ADOPTION OF ANIMAL TRACTION TECHNOLOGY IN THE BUILSA DISTRICT OF UPPER EAST REGION OF GHANA

BY

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DECLARATION

I, CHARLES AKANGOA AKPEINTUIK, do hereby declare that the materials covered in this thesis are the results of my own investigations, which was supervised by Dr. P. B. Atengdem. None of the materials contained herein, has been presented either in whole or in part for a degree of this University or elsewhere. Work by other authors, which served as sources of information have duly been acknowledged by references to them.

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DEDICATION

Behind every successful man is a woman. This work is dedicated to my beloved wife, Mrs. Amankai Akangoa, my children, Agollie, Abayamibanoapo, Asupagsalie and Aninakanmwailewai.

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ABSTRACT

The Builsa district is a peasant farming community. It had a problem of recurrent food shortage. The use of animal traction was one of the suggested solutions to this problem, hence its introduction in 1937. Reports suggested its low adoption. The study was to verify the veracity and the causes of the low adoption. A conceptual framework was developed. The concepts include: the farmers' sieve system, characteristics of animal traction technology and environmental influences.

Adoption was found to be high (91%). At 5% significant level, the Fisher exact two-tailed test showed no significant difference by ages, family size, ownership of donkeys, credit received, use of lecture method of training, demonstration/lectures and demonstration/group discussion categories and adoption. Those variables that showed significant difference include ownership of cattle, farm size, those who received training in AT, those who received training through demonstration alone and those who received training through group discussion alone.

It is recommended that when introducing a new technology into a peasant farming community like the Builsa District beneficiaries should express the need for the technology.

Traditional leaders should be involved. Financial institutions should get to the doorsteps of farmers and educate them, on how to access credit facilities.

Further research should look into the effects of the use of AT on the environment and schooling in the study area.

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ABBREVIATION

AEA	-	Agricultural Extension Agent
AIAEE	-	Association for International Agricultural and Extension Education
AT	-	Animal Traction
ATT	-	Animal Traction Technology
BDA	-	Builsa District Assembly
DCE	-	District Chief Executive
DDA	-	District Director of Agriculture
DDO	-	District Development Office
EA	-	Extension Agent
FASCOM	-	Farmers Services Company
FFS	-	Farmer Field School
FLS	-	Front Line staff
GDP	-	Gross Domestic Product
GGADP	-	Ghanaian German Agricultural Development Project
ILCA	-	International Livestock Centre for Africa
MoFA	-	Ministry of Food and Agriculture
MTADP	-	Medium Term Agricultural Development Programme
NA	-	Native Administration/Authority
NAEP	-	National Agricultural Extension Project
NGO	-	Non-Governmental Organisation
NOC	-	National Onchocerciasis Committee
NOCR	-	National Onchocerciasis Committee Report
NR	-	Northern Region

OA	-	Operational Area
PRA	-	Participatory Rural Appraisal
RAAKS	-	Rapid Appraisal of Agricultural Knowledge Systems
RAOA	-	Regional Administration Office Archives
SPSS	-	Statistical Package for the Social Sciences
TIF	-	Tamale Implement Factory
UER	-	Upper East Region
URADEP	-	Upper Regional Agricultural Development Programme

CHAPTER ONE

INTRODUCTION TO THE RESEARCH STUDY

1.0 Introduction

Chapter one presents background information of the research study. It also presents the problem statement, research questions, hypothesis, main objective of the study, specific objectives, key concepts, conceptual framework and the significance of the study.

1.1 Background Information

Agriculture remains the principal occupation of the majority of the people in Africa. An average of 32% of GDP is produced by agriculture and the sector constitutes the largest productive sector in Africa (Kevin, 1993). Kevin pointed out that economic growth of at least 4% per annum in each African country will require agricultural growth at the same level in most countries.

Without agricultural growth at 4% per annum the generally most competitive industrial sector (agro-industry) will not be supplied with the raw materials to permit it to grow by its target rate of 5-7% per annum. According to the report, agricultural growth is the most important contributor to the growth of manufacturing and services in Sub-Saharan Africa. However, most agricultural operations in Sub-Saharan Africa are done by hand, and seasonal labour shortage is one of the main factors contributing to low agricultural productivity in the region. This is because smallholders have too little capital to invest in tractors (International Livestock Centre for Africa, {ILCA}, 1994). Hence, the low level of growth in agricultural production is primarily due to the low level of investment and technological improvement in the sector. The Government's Medium Term Agricultural Development Plan (MTADP) has

set a target of 4% annual growth in agricultural production (MTADP: An agenda for Sustained Growth and Development, (MOFA 1991).

A strengthened national agricultural extension system is one key factor in achieving this growth through dissemination of agricultural technology, especially among the small-scale farmers (Kevin, 1993). However, Ghana's agriculture has relied on the small-scale farming sector to produce the bulk of the nation's food requirements. The investments being made lead to problems of logistics and lack of farm power. The use of human power in agriculture still predominates over other sources of farm power such as draft animal power and tractors (Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm): Dibbits and Bobobee (1997) noted that one important way in which agricultural output can be increased is by providing more efficient means of production that saves labour and reduce drudgery. With the government's unattained tractorisation programme in 1957 (Korang-Amoako, Donkor and Amoah, 1994; Munzinger, 1982), fresh approaches to the promotion of sustainable and appropriate agricultural technologies are required to reduce the drudgery of the smallholder farmers and increase productivity. Hence, the need to intensify the use of animal traction that can release farm labour for activities other than cultivation and provide opportunities for raising farm income. However, according to ILCA's programme (1994), if the use of animal traction is to persist, once introduced, a number of conditions must be met. These include:

- Investment costs for both animals and implements must be low.
- There must be opportunities for intensifying and diversifying the applications of animal traction
- Farmers will have to learn animal management skills in addition to cultivation techniques.
- Extension staff will have to be trained in the use of animal traction if they are to provide useful advice.

- Problem of animal nutrition will have to be addressed through low-cost inputs to increase the efficiency of animal traction and
- Appropriate animal health package will be needed to protect them against diseases.

Starkey (1988) also observed that constraints to animal traction may include

- Lack of appropriate implements.
- Limited credit
- Insufficient animals
- Animal health problems
- Inadequate animal nutrition
- Uncleared fields
- Farmer traditions
- Lack of technical knowledge
- Poor infrastructure and
- Limited marketing possibilities.

Therefore, the identification of a district specific farmer's needs is necessary to be able to propose policies and measures to the situation.

1.2 Problem Statement

In 1934, the Ministry of Agriculture of the colonial government of the Gold Coast conducted a survey in the then North Mamprusi District to investigate the causes of recurrent food shortages in the area, to suggest and implement better measures to arrest the situation. Among other suggestions, they recommended that the introduction of animal traction was an obvious answer (Lynn, 1937). Hence, in 1937, animal traction was introduced into the Builsa District (Lynn, 1937). The farmers embraced the technology since they would increase their

cultivated areas considerably by the use of bullock power; and at the same time improve the yields of their crops. The chiefs of Sandema and Nakon were among the first 19 influential converts (Department of Agriculture, Gold Coast, 1938 - 1939).

There were also interventions by the Catholic and Presbyterian churches in 1969 and 1974 respectively (Cliff Trowell, Personal communication, January 20, 2003) and Upper Region Agricultural Development Programme (URADEP) in 1976 (Korang-Amoakoh, Donkor and Amoah, 1994) to boost the technology.

The Ministry of Agriculture report of 1934 had indicated that five out of every six compounds in the Builsa district had cattle and that land was also in abundance (Lynn, 1937). A report on the socio-economic survey of the Builsa District indicated that the district has a total of 38,101 cattle with a total of 7,830 households (National Onchocerciasis Committee Report, 1992). This implied that each household had an average of five cattle. However, after several years of implementing animal traction technology with the district's high potential in it, there are suggestions of low adoption. What could be the cause?

Munzinger (1982) said the economic situation of the individual farmer was a decisive factor determining whether he wanted to use draught oxen or not. Bah (1988) said farmers attach great importance to the social division of labour, cultural identity and compatibility with traditional patterns of life. de Graaf (1992, pp 117) citing Ellis (1988) said farmers' decisions on adopting or enhancing the use of animals on their farms are not necessarily based on financial profitability. Those tangible social and cultural benefits also play a significant role in the adoption process.

The National Agricultural Extension Project (NAEP) Annual report (MOFA, 1997) had it that most of the Frontline Staff (FLS) have inadequate skills and confidence in training farmers and animals. Besides, animal traction extension materials are in limited supply.

Which of these factors mentioned may be the causes of a low adoption, if any, of animal traction in the Builsa District? The research questions and objectives are based on these.

1.3 Research Questions

The study therefore intends answering the following questions:

1. Have the socio-economic factors of farmers affected their adoption of animal traction?
2. Have socio-cultural factors of farmers affected their adoption of animal traction?
3. Have the extension methods used so far affected the adoption of animal traction?
4. What influence do the characteristics of animal traction technology have on farmers' adoption of the technology?

1.4 Hypothesis

1. Socio-economic factors of farmers have not affected their adoption of animal traction
2. Socio-cultural factors of farmers have not affected their adoption of animal traction
3. Extension methods used so far have not affected the adoption of animal traction
4. The characteristics of animal traction technology do not have influence on farmer's adoption of the technology.

1.5 Main Objective

To verify and substantiate the speculation of low adoption of animal traction in the Builsa District.

1.6 Specific Objectives

1. To find out the historical development of animal traction in the Builsa District.
2. To find out farmers' personal characteristics and their effects on the adoption of animal traction
3. To determine the socio-economic factors of farmers which influence the adoption of animal traction.
4. To examine how socio-cultural factors of farmers affect adoption of animal traction
5. To find out farmers opinions on the importance/usefulness of animal traction
6. To determine the compatibility of animal traction within the farming system of the Builsa District
7. To find out the various levels of adoption of animal traction.
8. To find out the effectiveness of the extension methods used in promoting animal traction.

1.7 Key Concepts of the Research Study

The key concepts, which determine the scope of the research study, include: technology, animal traction technology, adoption of technology, communication of information on a technology for adoption, extension and extension methods.

1.7.1 Technology

Technology is the combination of knowledge, inputs and management practices which are deployed together with productive resources to produce a desired output (Reijntjes, Haverkort and Waters-Bayer, 1992). A technology usually has two components:

1. Hardware: consisting of the tool that embodies the technology as material or physical objects

2. Software: consisting of the information base for the tool (Conroy, Gordon and Marter, 1995, Rogers, 1995).

1.7.2 Animal traction technology

Animal traction is the use of draught animals for tillage, seeding and other activities (Barret, Lassiter, Wilcock, Baker and Crawford, 1982). Munzinger (1982) also described animal traction as the employment of animals for draught activities. However, the first definition will suit the context of the study.

1.7.3 Adoption of Technology

Adoption is the decision to apply an innovation and continue to use it. Early studies in adoption found that in the process of adoption an individual goes through five stages. These are; awareness, interest, evaluation, trial and adoption (Maunder, 1972). Later studies re-stated that these stages correspond to knowledge, persuasion, decision, implementation and confirmation (Rogers, 1995). He argued that the latter stages are less inspired by normative decision-making theory, and supposedly reflect better what happens in actual practice.

Animal traction technology adoption has two main meanings:

1. Transfer of ideas, techniques or implements from an area, where they have worked effectively, to another.
2. The dissemination of knowledge or skills - transferring or communicating ideas and techniques to the intended clientele.

1.7.4 Communication of information of a technology for adoption

There are various definitions of communication. For example, Nnadi (1997) defined it as the process of establishing a commonness or oneness of thought between a sender and a receiver. Rolings and Leeuwis (2002) defined it as the process through which people exchange meanings.

For the purpose of this study, communication of information of a technology for adoption may be described as the process of transmitting or exchanging information through a medium between a sender and a receiver to reach a mutual understanding with the intent of receiving a response through a feedback, either rejecting or adopting the technology.

Communication can be in the form of written, oral or non-verbal. Communication has five elements:

Communication can be in the form of written, oral or non-verbal. Communication has five elements:

1. The sender/source
2. The message - the message may be oral, written, or non-verbal.
3. The medium - mechanism through which the message is transmitted to the intended audience
4. The receiver - this is the intended audience of the message.
5. Feedback - this indicates the two-way nature of effective communication (Nnadi, 1997; Rogers and Kincaid, 1981 and Swanson, 1984).

1.7.5 Extension

There is no simple definition of extension, which is universally accepted. It is a dynamic concept and its interpretation is always changing. Rolings and Leeuwis (2002) criticised

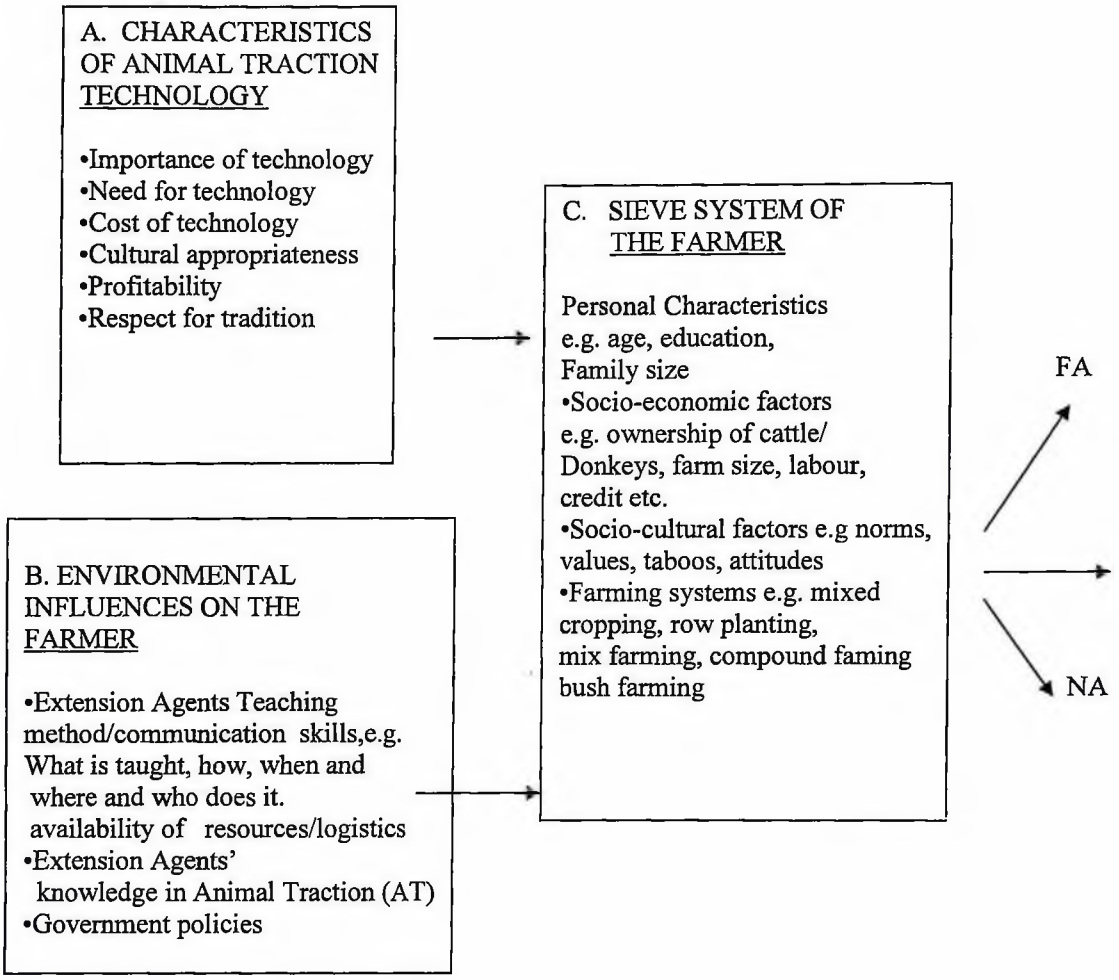
earlier definitions of extension as normative in that they prescribe what the authors would like extension to look like ideally. For this reason, they have defined extension as "a series of professional communicative interactions that is meant amongst others, to develop and/or induce novel patterns of co-ordination and adjustment between people, technical devices and natural phenomena, in a direction that supposedly helps to resolve problematic situations, which may be defined differently by different actors involved".

1.7.6 Extension methods

This refers to methods of communication, which can be used in extension for influencing the target groups (Maunder, 1972, Oakley and Garforth, 1985; van den Ban and Hawkins, 1996). Extension methods can be seen as a particular mode of using media and media combinations (Leeuwis and van den Ban, 2002)

1.8 Conceptual framework

Figure 1.1 A diagram showing the conceptual framework of animal traction technology adoption



Source: Adapted from Rogers, 1983, p 233

Key

FA = Full Animal Traction Adoption

AA= Average Animal Traction Adoption

NA= No Animal Traction Adoption

In this section, the conceptual framework of the study, the basis on which the study has been developed is discussed. The study is developed on the following concepts as shown in Figure 1.1. These are:

1. Characteristics of animal traction technology
2. Environmental influences
3. The sieve system of the farmer and
4. Adoption

Literature has various factors that influence farmers' adoption or rejection of technologies. Rogers (1995) has identified some of these factors as characteristics of the technology, age, education, socio-economic and social system of farmers and the Extension Agent.

From the diagram it can be seen that the decision of the farmer to adopt or not to adopt the technology is conditioned by the characteristics of the animal traction technology and the environmental influence acting on the farmer under his prevailing situation (age, education, socio-economic, socio-cultural and farming system). For example, if animal traction technology is costly, difficult to understand, has little or no respect for tradition and not appropriate to the farming system, no farmer is likely to adopt it. Even if adopted then it is likely to be the young, wealthy or educated farmers. van den Ban and Hawkins (1996) noted that innovators tend to be relatively young, better educated and "better off". Urasa (1994) also found that any new technology to be introduced into rural areas must be as simple and cheap as possible if it is to be widely adopted. He went further to say that a new technology will not be accepted to the target group if it is not compatible with existing farming principles and cultivation practices.

The Extension agents' knowledge in animal traction, his communication skills thus his behaviour, and attitude towards farmers, his respect for farmers norms, values and taboos can influence the farmers' decisions. When the farmer is convinced by the extension agent and combining this with his prevailing situation (age, education, family size, socio-economic status, socio-cultural an farming system) he/she can decide to adopt animal traction. Gibbons and Schroeder (1983) noted that the types of innovation-decisions made by farmers are all dependent on the extension agent's ability to influence them.

Government policies can also act on the farmers' system to result in adoption or rejection. For example, prices of implements, resource allocations for extension staff training in AT and government's attitudes towards AT itself. Bwalya (1988) noted that for animal draft power technology transfer programme to be effective, management and organisation of agricultural credit schemes, training of extension system, economic and political factors need serious consideration.

Omoding (1994) observed that chiefs and rulers sometimes use coercion to implement programmes in order to please their master, which probably accounted for unsustainable adoption of ox cultivation in some areas in Uganda. Hence, from the various literature cited and on Roger's (1983) attributes of innovation and their rate of adoption model, the adoption of animal traction technology (A) can be seen as a variable which is a function of:

1. The characteristics of animal traction technology itself (C_f) as perceived by the farmer under his prevailing conditions
2. The environmental influences (E_f) as perceived by the farmer under his prevailing conditions
3. The farmer sieve system (S_f).

Thus $A=f(C_f+ E_f+ S_f)$

1.9 Significance of the study

The Government of Ghana has over the years invested money and human resources towards promoting AT. However, evidence of low adoption still exists. There is very little understanding of why the low adoption. The government of Ghana and NGOs are still undertaking AT promotion without full understanding of why the low adoption of earlier efforts.

Therefore this study will provide:

1. Government and NGOs who provide extension services to farmers a feedback on the impact of the method of technology transfer they use.
2. It will also provide more in-depth understanding of rural circumstances so that any future interventions would be more effective.

CHAPTER TWO

BACKGROUND OF THE STUDY AREA

2.0 Introduction

This chapter gives an overview of the study area. These are: location, population, age distribution, distribution of household size, education and literacy levels. The others are topography, climate, soils and vegetation. The rest are economic activities, farming systems and agricultural extension in the Builsa District.

2.1 Location

The Builsa District is one of the six districts in the Upper East Region (UER) of Ghana. It falls between longitudes 10°.05'N and 10°.30'N and latitudes 10°.15'N and 10°.30'N. It is bounded on the north and east by the Kassena-Nankana district, on the west by the Sissala district and on the south by the West Mamprusi district. The district has an area of 2,220 sq. km. which is 25.1% of the total area of the UER (Builsa District Assembly, 2000).

2.2 Population

The Builsa district has a population of 75,375 which is 8.2% of the total population of the UER in 2000 as against 66,357 in 1984. This is an increase of 13.6% over 1984 which represents a growth rate of about 0.73% over the 16-year inter-censal period. It presently has a population density of about 34.0 persons per sq. km. (Ghana Statistical Service, 2002).

2.3 Age Distribution

The 0-14 age group constitutes 43.4 of the total population while those aged 65 and above make up only 6.4. The economically active population of 15-64 age cohort is about 50.2 (Ghana Statistical Service, 2002).

2.4 Distribution of Households by size.

According to the 2000 Ghana population census the Builisa District has about 4,700 households. With a population of 75,375, the average household size stands as 16.0 persons. On the whole $^{1}/_{3}$ of the population of the district live in household with more than 6 persons, while $^{2}/_{3}$ live in households with not more than 6 persons. (Ghana Statistical Service, 2002).

2.5 Topography

The topography is undulating. Slopes ranging from 200 to 300m are found in the northern part of the district. In the valleys of the Sissili, Kulpawn and the White Volta in the south, the slopes are more gentle and range from 150 to 200m. In general the low-lying nature of the land makes the greater part of it liable to flooding in years of copious rains. The district falls within the Volta Basin and is heavily dissected by the White Volta and its tributaries namely: Sissili, Kulpawn, Belipieni, Bukpegi and Asebelika. Most of these streams are seasonal and dry up during the extended dry season with an adverse effect on the supply of water for both agricultural and domestic use (Builsa District Assembly, 2000; National Onchocerciasis Committee Report, 1992).

2.6 Climate

The climate of the Builsa district is similar to the climate generally experienced in the Upper regions of Ghana. Mean monthly temperatures range between 22°C and 35°C. The highest temperatures are recorded in March/April and can rise to 45°C, whereas the lowest temperature is recorded in January. The dry season is characterised by dry hammattan winds and wide diurnal temperature ranges. The critical factor in the climate is rainfall for farming. There is only one rainy season, which builds up gradually from little rain in April to a maximum in August-September. It then declines sharply to a complete halt in mid-October

when the dry season sets in. Rainfalls are very torrential and erratic and range between 85mm and 1150mm with irregular dry spells occurring in June or July (Builsa District Assembly, 2000; (National Onchocerciasis Committee Report, 1992).

2.7 Soils

The greater part of the soils in the district comprises of ground water laterite, developed over the granite formation. Soil textures vary within the district but coarse textured soils predominate with various amounts of loosely packed stones and concretions. These soils develop to depths, which make them cultivable. On upland, savannah ochrosols of various depths and inherent low fertility prevail. Alluvial soils with high caolinitic clays ranging from sandy clay loams to silty clay are found in most parts of the valley bottoms of the south. These alluvial soils are comparatively higher in fertility but are most difficult to work and subject to seasonal water logging and floods. In general, greater parts of the soils are poorly drained. Intense erosion overtime has contributed to serious reduction in soil depth and thereby to loss of arable land surface (Builsa District Assembly [BDA] 2000; National Onchocerciasis Committee Report [NOCR], 1992).

2.8 Vegetation

The vegetation is characterised by parkland savannah. This contains economic trees such as shea, baobab, acacia and dawadawa. This woodland savannah satisfies domestic requirements of fuel wood and timber for house construction, kraals, vegetable garden fences and materials for handicrafts. The grasses and shrubs provide pasture for the livestock population, mainly goats, sheep and cattle. In the dry season, however, annual bush fires decimate the grasses and shrubs and as a result pasture for livestock is largely destroyed (Builsa District Assembly, 2000, National Onchocerciasis Committee Report, 1992).

2.9 Economic Activities

The people of Builsa are predominantly farmers. Very few are engaged in the fields of manufacturing, industries, trade and hunting. Crops grown include millet, sorghum, groundnuts, beans, rice, maize, vegetables, sweet potatoes and fara-fara potatoes. According to the National Onchocerciasis Committee Report (1992), majority of farm households (87.9%) cultivate up to 20 acres, although the average acreage per household was 12 acres, and that 12% cultivated between 20 and 60 acres. Livestock and poultry are also kept. These include cattle, donkeys, sheep, goats, pigs, fowls, guinea fowls, turkeys and ducks.

The availability and proper use of credit is important for increased agricultural productivity. However, in the Builsa district, there is only one source of institutional credit - the Builsa Community Bank. The other nearest banks are at Navrongo (29 km) and Bolgatanga (58 km). Figure 2.1 shows credit acquisition in the Builsa District.

Table 2.1 Level of credit acquisition in the Builsa District

Item	No of Households	%
Yes	12	7.3
No	136	82.4
Not Stated	17	10.3
Total	165	100

Source: National Onchocerciasis Committee Report (1992)

2.10 Farming System

Mixed cropping is the main practice alongside sole cropping. Both distant and compound farming is practised. Livestock and poultry production forms an integral part of crop production system. It plays a central role in soil fertility restoration in addition to the immediate utility in the form of meat, milk, cash outlays and of household ceremonies.

2.11 Agricultural Extension

Agricultural extension is that vital link between agricultural research and farmers. They take research findings necessary for agricultural development to farmers. They also make known to agricultural research stations, problems encountered by farmers for investigation and solution.

The Builsa district is divided into 17 operational areas (OA) for extension activities. Each OA is headed by a District Development Officer (DDO). The District Director (DDA) of the Ministry of Food and Agriculture (MoFA) is the over all boss. Every AEA has at least forty (40) farmers with whom regular contact is maintained. In the Builsa district, like any other rural area, the AEAs operate far from ideal conditions. These include lack of transportation and logistics support, non-payment of transport claims, delays in promotion and low AEA-farmer ratio. This contributes to low extension-farmer contact (DDA, personal communication, 24th February 2002, NOC, 1992). Table 2.2 shows the number of households that had contacts with AEAs.

Table 2.2 Number of Households who had contacts with AEAs

Period of contact	No of Households	%
Never	70	42.4
Under 1 month	30	18.2
2-3 months	22	13.3
4-6 months	17	10.3
7-12 months	2	1.2
Over 1 year	22	13.3
Not stated	2	1.2
Total	165	100

Source: NOC, 1992

CHAPTER THREE

THE HISTORY OF ANIMAL TRACTION IN GHANA

3.0 Introduction

This chapter, reviews the history of AT in Ghana. These include its origin, genesis, current state and a historical development in the Builsa district.

3.1 Origin of Animal Traction

Animal traction was first started in Asia thousands of years ago. It was introduced into sub-Saharan Africa through European settler farmers, early development programmes and migration of workers within the region during the colonial period (Starkey, 1990).

3.2 The Genesis of AT in Ghana

The first pairs of working bullocks in Ghana were introduced at the Pong-Tamale Agricultural Station in 1922 (Seifert, 1992). However, the technology was first adopted by farmers in the early 1930's in the Upper East Region (Seifert, 1992). From 1934, the British colonial government made more systematic attempts to introduce the use of draught oxen with the purpose of increasing the area under cultivation. Demonstration farms were set up and the use of draft oxen was generally encouraged (Seifert, 1992).

In those days, interested farmers were trained at stations set up at places like Tamale, Zuarungu and Babile (Dibbits and Bobobee, 1997; Munzinger, 1982). Farmers in places like Nakpanduri and Langbensi have used the technology for quite a long time. The use of the technology was catching up well until the independence in 1957. At this time, due to the government's expansion programme in agriculture, tractors were imported on a large scale to the towns and surrounding areas where AT training centres had been set up. The relative

speed for doing work with tractors and the lower (subsidised) cost of tractor services in those days reduced interest considerably in the use of the AT technology. Since then AT technology had been supported and promoted mainly by church NGOs for many years with training and credit facilities to farmers to get animals and implements (Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm): Dibbits and Bobobee, 1997, Munzinger, 1982).

The promotion of AT continued in the 1970s when the Ghanaian-German Agricultural Development Project (GGADP) intervened to give it a new boost. This project, realising the existing tillage problems in the region, decided to encourage AT. In this regard, training stations were opened in places like Gushiegu, Nyankpala, Savelugu, Sawla, Damongo, Zabzugu, Bimbilla, Navrongo and Nakpanduri by GGADP (Dibbits and Bobobee, 1997; Munzinger, 1982). These GGADP stations were stocked with the necessary training materials and implements to train interested farmers. Trained farmers were given implements like bullock ploughs on very liberal terms of payments. Some stations e.g. Nyankpala, served also as bullock banks where bullocks were bred and later sold to farmers on similar soft terms. Interest in the technology rose again and the demand for the implements and tools became high. To address the rising demand for implements (which until then were wholly imported from Germany) the GGADP set up the Tamale Implement Factory (TIF) as a subsidiary to assemble animal traction implements (Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm): Dibbits and Bobobee, 1997, Munzinger, 1982).

3.3 Current state of AT in Ghana

Animal traction is widely used only in Northern, Upper East and Upper West Regions. In these regions, cattle are common and AT has been used for many years. In a few localities in Volta, Brong Ahafo, Ashanti and Greater Accra regions, AT is being introduced. Constraints in these localities include limited ownership of cattle, small number of bullocks, lack of knowledge of AT, extensive farming systems based on shifting cultivation and difficulty in clearing shrubs and difficult grasses. Here proper selection, training and guidance of motivated farmers and financial assistance seem necessary for quite some time before a momentum for continuous AT development can take place (Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm);)

Most work animals are bullocks, but in the UER, many farmers also use donkeys. Donkeys are mainly used for transport, but the interest to use donkeys also for ploughing and ridging is increasing especially in the Upper regions. Working cows have been observed in the Nakpanduri area. Bullocks are harnessed with very inefficient (cruel) double withers and donkeys pulling carts with a simple kind of collar harness and a simple saddle (Dibbits and Bobobee, 1997).

3.4 A historical development of AT in the Builsa District.

3.4.1 Pre-Independence

Recurrent food shortage in the then North Mamprusi district came to the notice of the Department of Agriculture in the late 1920s. In 1931, an Agricultural Superintendent was sent to Zuarungu the then capital of the district to investigate the causes of these food shortages and to make recommendations as to what should be done to alleviate the situation.

It was not until 1934 that the investigation actually started due to lack of staff (Lynn, 1937). The findings among others were:

1. Farming practices were not sufficiently intensive for these conditions. A system of "fixed" cropping was followed and manuring was quite inadequate.
2. The innate distaste of the people for consistent labour. That is, lack of effective cultural practises.
3. Years of living on the margin of subsistence had sapped the energy of the people and predisposed them to disease; many of them were physically incapable of hard work, which was necessary to bring an improvement in their conditions.
4. Land was in abundance
5. About five out of every six compounds had cattle.

Table 3.1 Livestock owned by six (6) compounds in Wiagah

Livestock	I	II	III	IV	V	VI	Total	Mean
Cattle	7	3	0	8	5	3	26	4.3
Donkey	1	1	0	1	0	1	4	0.7
Sheep	0	0	0	6	3	5	14	2.3
Goat	8	4	0	4	8	7	31	5.2
Total	16	8	0	19	16	16	75	12.5

Source: Adapted from Lynn, 1937, pp 72

Based on these findings some suggestions were made towards alleviating the recurrent food shortage and among them were:

1. Improving the existing system of farming
2. Cultivation of soil prior to planting
3. Growing crops on ridges instead of flats
4. Planting in lines
5. Contour ridging to check erosion

6. Rough cultivation after harvest
7. Controlled burning and
8. Increasing the area of land under cultivation.

Table 3.2 shows areas farmed (in acres), number of men farming and number of dependants to support this last point (8).

Table 3.2 Areas farmed (in acres), number of men farming and number of dependants.

Name of farmer	Area farmed (acres)				Number of men farming	Area per man (acres)	No of dependants	Area per person (acres)
	Compound farm	Separate not bush	Bush farm	Total				
Abasu	3.12	0.76						
		0.46		4.34	3	1.45	10	0.43
Akulbalmi	4.62	0.89	-					
		0.77	-					
		0.57	-	6.85	2	3.43	8	0.86
Anisedi	1.07	3.20	-	4.27	1	4.27	4	1.07
Amanyidi	3.99	2.03	-	6.02	4	1.51	9	0.67
Azurumi	2.86	1.01	-	3.87	2	1.94	12	0.32
Ansoadi	1.87	0.37	-	2.24	1	2.24	9	0.25
TOTAL	17.83	10.06	-	27.59	13	--	52	--
MEAN	--	--	-	4.59	2.1	2.21	3.6	0.53

Source: Lynn, 1937, pp 69

The introduction of AT was an obvious answer to these suggestions. Animal Traction was therefore introduced into the Builsa District in 1937. A demonstration was started by establishing mixed farming units attached to the Native Administration school, the then only primary school in the Builsa district (Old Primary). This farm consisted of 8 acre units ran by two paid labourers (Mr. Agazeri and Mr. Alung) working with the Native Administration using a pair of bullocks, a plough and a locally made cultivator. The purpose of the school farm was a dual one; firstly to produce food as economically as possible to reduce the school mess expenses and secondly as a practical demonstration of improved methods of farming (Lynn, 1937).

Sufficient interest was shown by the chiefs of Sandema and Nakon and their people in the work of the plough and the mixed farming methods practised in the demonstration station that they sent in bullocks and men including themselves (the chiefs) for training at Tono Farm Centre. The chiefs of Sandema and Nakon were therefore among the first 19 influential converts. The chief of Sandema - Chief Azantilow and the chief of Nakon were even quoted as saying, *"We will never return to the old and traditional methods"* (Department of Agriculture, Gold Coast, 1939-1940). Hence people began to realise that with the use of bullock power, they would increase their cultivated areas considerably and at the same time improve the yields of their crops.

In 1940 the Builsa Native Administration started a loan scheme referred to as the Agricultural Loan Scheme to provide farmers with bullocks and ploughs (Department of Agriculture, Gold Coast, 1939-1940). Farmers from the Builsa district continued to take their bullocks to Tono Farm Centre for training. The Tono Farm Centre was by then being financed by both Navrongo and Builsa Native Administration. However, in 1945, it was agreed to layout a new Native Authority Farm Centre between Sandema and Wiagah. Three hundred and twenty pounds (£320) was voted to cover initial capital expenditure. Four (4) bullocks and two (2) donkeys were purchased. An instructor's house, a large half-roofed cattle shed, a donkey shed, a labourer's quarters, an office and some stores were put up. Two wells were sunk by the Native Authority. Two acres each of sun hemp and groundnuts were planted to provide fodder. In all hundred acres of land was acquired. Also one Grade 1 instructor assisted by two Grade II instructors supervised the cultivation and building. Bullock and bullock men began training at the Builsa Farm Centre (Department of Agriculture, Gold Coast, 1945-1946).

3.4.2 Post Independence

Much attention was being paid to animal traction until Ghana's Independence in 1957. At this time, due to government's expansion programme in agriculture, tractors were imported on a large scale to the towns and areas where AT training centres had been set up. The relative speed for doing work with tractors and the lower (subsidised) cost of tractor services in those days reduced interest considerably in the use of AT (Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm): Dibbits and Bobobee, 1997; Munzinger, 1982). The few farmers who still used AT had difficulties in getting ploughs and spare parts. For example, in 1971, eighty-nine (89) farmers from the Builsa district applied for bullock and plough loans but were told that such a scheme was not in operation. Again on 8th March 1972, Chief Azantilow on behalf of thirty-six (36) farmers applied for ploughs but to no avail (Ministry of Agriculture, 1971).

Food shortage in the district continued to be a major problem, yet there was abundant land and almost every household had cattle. This prompted some churches to intervene by giving AT a new boost. Notable among them were the Roman Catholic and Presbyterian churches who started AT in 1969 and 1974 respectively. The Presbyterian church concentrated its activities within Sandema. The Catholic church covered areas like Wiaga, Kadema, Uwasi, Gbedema, Kanjarga, Siniensi, Doninga and Fumbisi. In 1973, twenty-one (21) pairs of bullocks were trained. The cost of housing and feeding became difficult because of increased number of farmers wanting to be trained. The training was therefore shifted to the community levels; hence the demand for AT implements continued increasing. Table 3.3 shows a comparison of input sales for 1974 and 1975.

Table 3.3 Comparison of AT input sales for 1974 and 1975

ITEM	1974	1975
Bullock ploughs	37	172
Donkey ploughs	4	7
Cultivators and carts	8	5

Source: Wiagah Agric Project, 1975.

The Catholic Church ended its project in the district in 1980 (Atekinla, personal communication, February 25, 2002; Trowel Cliff, personal communication, January 20, 2003)

CHAPTER FOUR

LITERATURE REVIEW

4.0 Introduction

Chapter four deals with literature on animal traction and adoption. Areas reviewed are meaning of AT, contribution of AT to agricultural development, adoption and the adoption process, meaning of communication, meaning of extension, the extension agent and technology transfer. Others are extension teaching methods and adoption, technology characteristics and adoption. The rest are socio-economic factors and adoption, socio-cultural factors and adoption and obstacles to the adoption of AT technology. These areas are reviewed because they influence adoption. Before a farmer adopts a technology he must know its characteristics. Panin and Ellis (1992) said farmers are likely to adopt a technology if they perceive the technology to be profitable. In the same vein the choice of extension teaching methods and the ability to communicate effectively taking into consideration the socio-economic and socio-culture of farmers play a significant role when introducing a technology for adoption (Leagons, 1960; Maunder 1972).

4.1 Meaning of Animal Traction

Animal traction is the use of draft animals for tillage, seeding and other draft activities (Barret, Lassister, Wilcock, Baker and Crawford, 1982). Munzinger (1982) described animal traction as the employment of animals for draft activities. A variety of animals are used in different parts of the world for animal traction. These include bullocks, cows, bulls, buffaloes, horse, mules, donkeys and camels. In Ghana, only bullocks, bulls and donkeys are mostly used for AT. In the Nakpanduri area of the Northern Region, the use of cows for AT is being practised. Implements used for AT include ploughs, harrows, ridgers, cultivators, planters, harvesters, millers, carts and water lifting equipment.

4.2 Contribution of AT to Agricultural Development

This section has the following sub-headings under it. These include AT and crop yields, AT and farming systems, AT and farmer preferences, AT and different ages and gender of farmers, AT and ownership of draft animals and lastly, AT and animal population.

4.2.1 Animal Traction and Crop Production and Yields

Animal traction may assist farmers to increase the total production of their crops. One of the clearest ways to achieve this is through increase in area cultivated (Starkey, 1988). According to him, there is very often a correlation between farm size and ownership of draft animals although this does not necessarily mean that the animals are the cause of the large area of cultivation. It may be that farmers who have big farms are the ones wealthy enough to use draft animals. He observed that records on farmed areas before and after the adoption of draft animals indicated that where land was available, farmers cultivated more land when they had draft animals so that total yield over farm increased. However, in some areas there were drops in yield per unit area as farmers tended to farm more extensively rather than intensively. Also, the use of AT can result in better timing due to faster and better land preparation, seeding and weeding which may give rise to higher yields and less crop failures (Seifert, 1992).

4.2.2 Animal Traction and Farming Systems of Farmers

Animal traction is associated with the tendency to move from bush fallow cultivation involving mixed cropping in partially cleared areas still containing stumps, to permanent systems, in which single crops are grown in cleared fields. Animal traction may lead to extensive farming with large areas being less intensively managed. One of the more notable ways AT affects farming system is through the integration of crop and livestock enterprises

(Starkey, 1988). Also, AT may lead to changes in the crop mix, and therefore may have differential effects on crop production. Starkey noted that AT has often been promoted in West Africa for mono cropping in areas where inter-cropping was traditional. It was earlier thought that AT led to increased production of cash crops to the detriment of food crops. However, according to him, surveys have not found marked differences in crop mix associated with AT.

4.2.3 Animal Traction and Farmer Preferences for Animals

In common with most aspects of life, AT both benefits and suffers from long standing preferences and the vagaries of more rapidly changing "fashions". Animals often have prestige status unrelated to their working abilities, so that one sickly horse may have higher social status than a pair of strong oxen. In some countries and communities the colours of animals and implements may be very important influencing decisions relating to adoption even though it is unlikely that these factors would influence performance. Such preferences that appear illogical may have a technical justification that is not immediately apparent to an outsider. Nevertheless, farmer prejudice can be as important as farmer judgement, when it comes to selecting animals, implements, harnesses or management regimes. In such circumstances any reduction in possible technical efficiency may have to be set against the pleasure associated with the choice, since "fashion' may sometimes be viewed as a social benefit of animal traction (Starkey, 1988).

4.2.4 Animal traction and Different Ages and Gender of Farmers.

The social costs and benefits of AT vary considerably between people of different ages and gender in farm households. Men and children usually train the animals, work with them and herd them. These people have the initial problems associated with first use of animals and

area expansion, but may later benefit from easier and more fulfilling work. In some communities, men consider it appropriate to cultivate land for the crops usually grown by women, in others, they do not. Women and children often have the tasks of weeding and harvesting and their work may be increased if cultivated areas are expanded. Children often tend draft animals and because of these their educational prospects can suffer, either due to limited school attendance or due to fatigue when school is combined with looking after animals. In some small survey in Sierra Leone, it was found that children of daft animal owners were less likely to attend primary school. On the other hand, the general correlation between draft animals and wealth might make it easier for animal owners to afford secondary school fees (Allagnat and Koroma, 1984; Gboku, 1988).

4.2.5 Animal Traction and Ownership of Draft Animals

In some parts of West Africa, AT has been introduced through communal ownership, often encouraged by governments and Aid agencies. While there have been examples of successful village associations for AT, many have experienced major social and organisational problems associated with conflicting interests for access during the animal working hours and responsibility for maintaining the animals at other times (Starkey, 1988). With individual ownership, it is clear who is responsible for both costs and the benefits of animal management. One of the costs is grazing supervision, and if this is not carried out with dedication, the animals may suffer from insufficient food, accident or theft. Alternatively, growing crops can be eaten, causing much social conflict and expense (Starkey, 1988). Corbel (1988) said in one survey in Sierra Leone a quarter of farmers reported that they had to pay out significant sums in compensation as a result of the alleged misbehaviour of their work oxen.

4.3.6 Animal Traction and Quality of life of Farmers

Animal Traction may well have a direct impact on the quality of life of farmers by reducing drudgery of personal transport. It also provides opportunities for social and economic benefits such as

- Enhanced possibilities for collecting and distributing harvest, water, building materials, timber, farm implements and other goods.
- Increased marketing opportunities for farm produce and
- Greater ease of utilising crop residues, compost and manure (Starkey, 1988).

4.3.7 Animal Traction and Animal Population

Starkey (1988) observed that castrated bulls remain the dominant draft animals in West Africa. However, in some areas such as Northern Nigeria, uncastrated males are used for work. In Sine Salourn in Senegal, cows are increasingly being worked. Reh and Horst (1982) reported that N'dama cows used for draft purposes actually had higher reproductive characteristics than similar cows kept in traditional herds. This was attributed to the fact that the better husbandry associated with draft animal, more than compensated for the stresses imposed by the work. In countries where work oxen come from small local herds, the "best" males that seem large and strong are selected for work and so are castrated and are therefore unable to breed. Thus the breeding bulls may be genetically inferior in terms of body size and conformation (Starkey, 1988).

4.3 Meaning of Communication

Communication has been defined in several ways by different authors. van den Ban and Hawkins (1996) defined communication as the process of sending and receiving messages through channels, which establish common meaning between a source and a receiver. Nnandi,

(1997) sees it as a process of establishing a commonness or oneness of thought between a sender and a receiver. Rölings and Leeuwis (2002) defined it as the process through which people exchange meanings.

According to Rölings and Leeuwis (2002), communication has the following ingredients and distinctions:

- Communication is about using symbolic signals
- Symbolic signals are transferred through channels and media.
- It can be through more or less verbal and intentional 'messages'.
- It takes place between people that are aware of each other
- Communication takes place in a historical and relational context - people that communicate with each other do so in the context of previous communications and experiences.
- Communication can be more or less interactive
- Communication can be synchronical, that is, when on telephone or a-synchronical, that is, when using letters, articles etc.
- Communication messages have different levels and layers - messages can be imbued with various more implicit meanings and connotations
- It goes along with selection processes because of people's culture, pre-existing knowledge, goals, aspirations and interest.

According to them, there are three models of communication. These are:

1. *The 'objective' or 'transmission model'*. In this model, there is a sender who composes a 'message' and sends through a 'channel' to a 'receiver'. In this process, information in the message has a fixed objective. The receiver provides the same information as intended by the sender unless something goes wrong in the channel. The weakness of

this model is that even if nothing is wrong with the channel, the sender and receiver (i.e. the Extension Agent and farmer) would not end up with the same meanings and information.

2. *The 'subjective' or 'receiver-oriented' model.* This is a refinement of the transmission model. In this model, the personal history and context of the sender e.g. (Extension Agent) and receiver (farmer) are seen as having a different 'lifeworld' or 'stock of knowledge'. When a sender encodes a message, there is a high probability that the receiver will use a different stock of knowledge to decode the message vis-à-vis if roles are changed. Thus because meanings and information are constructed by subjective individuals, effective communication can only occur if a sender makes an effort to anticipate the frame of reference of the receiver. This, an EA would for example, have carefully studied farmers' perspectives and modes of thinking in order to get their messages attuned and adapted to them. Hence, there is the need for intensive interaction between EAs and farmers in which both parties become both senders and receivers. Röling and Leeuwis (2002) also noted that despite EA's efforts to anticipate farmers' frame of reference and modes of thinking farmers would in a number of cases still refuse to accept the meanings proposed by EAs and /or would ignore their advice.

3. *The 'Social' or 'network-negotiation transaction' model.* This model focuses on the influence of communication in the wider social network of the sender (EA) and receiver (farmer) since the EAs are not the only ones communicating. Thus the meaning constructed by a farmer in interaction with an EA may be influenced directly or indirectly by others such as other farmers, religious leaders, family, local leaders, traders etc. Also the meanings constructed by farmers can be influenced by

politics, social relationship, struggle for resources, social interests and aspirations of various kinds. (Rolings and Leeuwis, 2002).

4.4 Adoption and the Adoption process.

Rogers (1995) defined adoption as a decision to make full use of an innovation as the best course of action available. Adoption process is the changes that take place within individuals with regard to an innovation from the moment that they first became aware of the innovation to the final decision to use it or not (Wilkenning, 1953). In Wilkenning's view, an individual's decision to adopt an innovation is a process, which comprised of learning, deciding and acting over a period. He further stated that the adoption of a specific practice is not the result of a single decision to act but a series of actions and decisions. Bohlen (1966) noted that the adoption of a new idea is not a single unit but a rather complex pattern of mental activities combined with "actions" before the individual fully accepts or adopts the idea.

In the adoption process, an individual goes through five stages (van den Ban and Hawkins, 1996, Leeuwis and van den Ban, 2002: Rogers, 1995). These stages are:

1. Awareness: the individual first hears about the innovation
2. Interest: the individual seeks further information about the innovation he has heard about.
3. Evaluation: the individual weighs up the advantages and disadvantages of using the innovation in his own circumstances.
4. Trial: the individual applies the innovation on a small scale.
5. Adoption: the individual applies the innovation on a large scale.

These stages were later elaborated by Rogers (1995), into knowledge, persuasion, decision, implementation and confirmation.

Knowledge: This occurs when an individual or other decision making unit is exposed to the innovation's existence and gains some understanding of how it functions. Knowing about an innovation is often quite different from using the ideas. Most individuals know about many innovations that they have not adopted because individuals may not regard it as relevant to his situation or as potentially useful.

Persuasion: occurs when an individual forms a favourable or unfavourable attitude towards the innovation. Here the individual becomes more psychologically involved with the innovation, and he or she actively seeks information about the new idea. Here the important behaviours are where he seeks information, what messages he receives and how he interprets the information that is received. Thus selective perception is important here in determining the individual behaviour. Relative advantage, compatibility and complexity are important at this stage.

Decision: occurs when an individual or other decision-making unit engages in activities that lead to a choice to adopt or reject the innovation. Innovations that can be divided for trial use are generally accepted more rapidly.

Implementation: Problems in exactly how to use the innovation may crop up at the stage of implementation. For example, unavailability of innovations. Questions to ask here include where to obtain the innovation, how to use it, how it works, operational problems likely to be encountered and how to solve them. Active information seeking takes place here. Implementation ends when innovations become a routine or is institutionalised.

Confirmation: During this stage the individual wants supportive messages that will prevent dissonance from occurring.

The elaboration of the adoption process to include knowledge, persuasion, decision, implementation and confirmation is to provide for the fact that the new idea can possibly be

rejected at any point of the adoption process. They further indicated the idea that a change in information is followed by a change in behaviour is no longer accepted as a pattern. Thus the normative-decision-making model is no longer considered to provide an adequate explanation of the way people make decisions.

4.5 Meaning of Extension

The term 'extension' has evolved over time, and has different connotations in different countries. Hence there is no simple definition of extension, which is universally accepted. It is a dynamic concept and its interpretation is always changing. According to Rölings and Leeuwis (2002), the term extension itself is more recent; it originates from the academia, and it's common use was first recorded in Britain in the 1840s in the context of 'university extension' or extension of the university. But now, it is applicable to other sectors such as industry, health, energy and education. In their view the various definitions of extension are in essence, normative definitions, in that they prescribe what the authors would like extension to look like ideally. They also noted that alternatively, when extension is defined more descriptively in terms of what Extensionists actually do, then its definition might not correspond with normative definitions. This is because when taking a closer look at what Extensionists do in actual practice, one might, for example, discover in some cases that their work has little to do with 'help' but rather with imposing technologies and/or enhancing state control over farmers. They went further to argue that extension in the 1980s could be problematically regarded as 'help' and being in the interest of the recipients. That extension is in many ways also an intervention that is undertaken and/or paid for by a party who is interested to influence people in a particular manner. This often created tension between the interest of the extension organisation (and/or its funding agency) and the interest of the recipients.

However, the situation where extension derives from (semi-state) institution that is concerned with the public interest or public policy is rapidly changing in view of the emergence of private and NGO-based extension. Thus, it can be assumed that the interests and policies that are pursued by extension are nowadays often more individual and/or localised than in the 1980s.

Röling and Leeuwis (2002), citing Ison and Russel (2000) feel the word 'extension' itself is already misleading and that it is practically impossible to stretch the meaning of the concept in the necessary fashion; that, some senior authors in the field of extension no longer use the concept in many of their writings. However, they maintained that if one is to use the concept for the meantime then one should among others"

- Shift away from a focus on individual behaviour change, which has characterised most of the definitions so far, and incorporate the idea that extension is about fostering new patterns of co-ordination.
- Move away from the idea that extension works mainly on the basis of pre-defined directions, policies and innovations and emphasise on generative dimensions.
- Indicate that changes usually have a dual (material-technical and social organisational) component.
- Transcend the idea that extension is mainly concerned with decision-making, and emphasise the importance of social learning and negotiation in extension process
- To define extension as a two-way (or multi-way) process, in which several parties can be expected to contribute relevant insight, and which may have action implications for all parties (not only farmers, but also researchers, Extensionists, policy makers, etc) involved in the process. They have thus defined extension as:

"A series of professional communicative interventions amidst related interactions that is meant - among others - to develop and/or induce novel patterns of co-ordination and adjustment between people, technical devices and natural phenomena, in a direction that supposedly helps to resolve problematic situations, which may be defined differently by different actors involved" (Leeuwis and van den Ban, 2002 p. 19).

Earlier studies by Axinn (1988) and Rivera, Seepersad and Pletsch (1989), citing Malassis (1976) categorised extension into three dimensions, namely

- Approach - different styles of action within an extension system
- Model - systems held to be worthy of transference to other situations e.g. Training and visit
- Type - similarity among certain systems e.g. similar purposes among different commodity specific extension systems.

However, later studies by Rölings and Leeuwis (2002) categorised extension into six different dimensions namely:

- Extension strategies/or services
- Extension functions
- Extension approaches
- Extension methodologies
- Extension methods
- Extension tools and techniques

Extension strategies/or services: This refers to a wider intervention purpose of the organisation (Extensionists), that is whether the organisation is problem solving, knowledge exchange, diffusion of innovation etc. The different extension strategies include

- Advisory communication

- Supporting horizontal knowledge exchange
- Generation of (policy and/or technical) innovations
- Facilitating conflict resolution
- Supporting organisational development and capacity building
- Persuasive transfer of (policy and /or technological) innovations

Extension functions: Functions relate to different communicative sub-goals that are deeme useful as part of the wider strategy. Four of such functions are

- Awareness raising/conscientisation
- Exploration of views and issues
- Information provision
- Training

Extension approaches: This refers to the basic planning philosophy that is being adopted by Extensionists e.g.

- commodity – focused approach
- training and visit approach
- the technical innovation – centered approach

Extension Methodologies: These are more or less pre-defined series of steps or procedures, whereby each step can involve the use of one of several methods e.g.

- Farmer Field School (FFS)
- Participatory Rural Appraisal (PRA)
- Rapid Appraisal of Agricultural Knowledge Systems (RAAKS)

Extension Methods: Methods can be seen as a particular mode of using media and media combinations. Examples of methods include

- Farm visits
- Workshops
- Group discussion
- Priority ranking

Tools and Techniques: Tools and techniques are particular ways of operating a method. However, whether something is considered a method or a tool is often debatable; thus no sharp boundaries exist between them.

4.6 Extension Agent and Technology Transfer

The role of the extension agent is to disseminate new ideas; practices and knowledge to farmers to enable them improve their productivity. Two main types of technology transfer have been in use; formal and informal. The national extension services have generally provided formal top-down training. This has effectively taught farmers to start to use work animals in areas where AT was not known. However, the availability of resources to allow frequent extension agent-farmer contact for technology being transferred and the agent's ability to diagnose the farmers felt needs have affected the adoption of technologies (Starkey, 1988). He observed that once AT has started in a region, much transfer has been informal, within families, from farmer to farmer or from regional immigrants to local farmers. Farmer-led innovation has often been much more significant than formal extension advice. He therefore concluded that formal extension is important for introduction of AT technology but thereafter it does not keep up with the evolution of farming systems.

Public sector researchers have developed "improved" AT technologies on research stations. These have then been promoted by the extension services, often to be rejected by farmers as technically or economically inappropriate to their farming systems (Starkey, 1990). Whale (1989) indicated that a technology is transferred if

a. The information is conveyed such that it fulfils a particular need of the client and
b. It can be effectively applied by the client to his own situation.

The farmers' decision to adopt or reject the technology depends to a large extent on the extension agent's ability to convince the farmer. van den Ban and Hawkins (1996) observed that the message has to be presented such that the client understands it and he is assisted to balance the advantages and disadvantages of the new practice. In most countries in the region, development programmes have tried to promote animal-drawn wheeled tool-carriers but the transfer process has not succeeded; the technology has been "perfected yet rejected" (Starkey, 1988). Successful farmer-to-farmer transfer appears to have been responsible for the increase in the use of donkeys and working cows in several countries in Southern Africa. This adoption has sometimes been against the advise of extension agents (Starkey, 1988).

4.7 Extension Teaching Methods and Adoption

Learning is an active process on the part of the learner. Unless he becomes interested to the point of putting forth mental and physical effort to learn, nothing is accomplished. Leagans (1960) observed that it is the task of the extension worker to:

a. provide farmers with an opportunity to learn
b. stimulate mental and physical activity that produces the desired learning

The choice of extension teaching method and the ability to communicate effectively therefore plays a significant role when trying to influence the adoption of technologies. Maunder

(1972) observed that each culture and sometimes a region or community within a culture, has its peculiar means of communication as well as those common to other cultures. It must not be taken for granted that the channels and techniques of one culture necessarily exist in another or that they would function effectively if they were introduced, for example, written literature is of little value among groups that are highly illiterate.

According to Kang and Song (1984), a good number of proven educational methods or techniques exist from which the extension agent may choose to set up learning situations and maximise the transfer of information and skills to farmers from a broad perspective. These methods are classified in terms of the target group into three main categories namely; individual methods, group methods and mass methods (Kwarteng and Zinnah, 1994, van den Ban and Hawkins, 1996).

According to Kang and Song (1984) and Kwarteng and Zinnah (1994) to create a conducive atmosphere for effective extension delivery, a number of factors need to be considered in deciding on the method to use. These include:

1. People learn best in different ways; some by listening, some by seeing, some by doing and some by discussions. A combination of methods may be required to bring about the desired learning in the target group. Studies have shown that the more different extension methods are used the more people change their practice (Kang and Song, 1984; Maunder, 1972).
2. A number of teaching methods can overlap in trying to attain an objective. In this regard special attention must be given to the stage of the adoption process at which the target group is. It has been indicated that mass methods are most effective at the awareness stage, while the individual and group methods may stimulate interest and play a major

role in farmer's opinion and decision-making (Bohlen, 1966; Maunder, 1972; Leeuwis and van den Ban, 2002, van den Ban and Hawkins, 1996).

3. It has also been established that no extension method is better than the other. The extension agent should choose the technique best suited to the situation (Kwarteng and Zinnah, 1994).
4. A good knowledge and understanding of the audience, especially their differences and similarities with respect to their age, level of education, available resources and their entire social environment helps the extension agent select the most suitable method or a combination of methods to suit the target group.
5. The characteristics of the message, the teaching and learning objectives and what the participants are expected to be able to do with the content of message should also be considered. For example, if the aim of the communication is to provide knowledge, the extension agent may use the lecture, if the aim is to teach a skill, demonstration method may be more appropriate.
6. Extension agents' ability to identify audience needs and involving them in the decision-making process may encourage the adoption of technologies. Conroy, Gordon and Marter (1995), observed that the limited effectiveness of technologies is often associated with an inadequate involvement of target beneficiaries, limits to multi-disciplinary technology development process and insufficient allowance for the adaptive fine tuning necessary to meet the end user's needs.

4.8 Technology Characteristics and Adoption

Various literature, Bohlen (1966) and Rogers (1983) have identified five main characteristics of an innovation from the point of view of farmers, which affect their rate of adoption. These are:

1. Relative advantage
2. Compatibility
3. Complexity
4. Trialability
5. Observability

4.8.1 Relative Advantage of the Technology

This is the degree to which a technology is perceived to be better than the ideas it supersedes in terms of economic, profitability, social prestige, physical convenience, low initial cost, lower perceived risk, decreasing discomfort, psychological satisfaction or saving time (Association for International Agricultural and Extension Education [AIAEE], 1998). Panin and Ellis (1992) said farmers are likely to adopt a technology if they perceive the technology to be profitable, by either reducing costs and increasing income without necessitating major changes in their farming systems.

4.8.2 Compatibility of Technology.

This refers to the degree to which technology is perceived to be consistent with the farmer's goals and aspiration, socio-cultural values, past experiences, needs and existing farm practices (Association for International Agriculture and Extension [AIAEE], 1998). An individual's perception is influenced by his beliefs, values, and attitudes and these can affect adoption. Innovations, which are compatible with previous experiences usually, catch on faster and are usually adopted more quickly than unusual ones (Adams, 1982).

4.8.3 Complexity of the Technology

This refers to the degree to which an innovation is perceived as relatively difficult to understand and use (AIAEE, 1998). Innovations, which are relatively simple usually, catch on faster and are usually adopted more quickly than the more complicated ones (Adams, 1982).

4.8.4 Trialability of the Technology

This is the degree to which an innovation may be experimented with on a limited basis (Kwarteng and Zinnah, 1994). If a farmer can try an innovation without committing much of his resources he will adopt it more readily, also if its performance meets his objectives.

4.8.5 Observability of the Technology

This refers to the degree to which the results of an innovation are visible to others. Some results are easily observed and communicated to others whereas others are difficult to describe to others. Farmers learn much from observing and discussing their colleagues' experiences, their observations often being a reason to start a discussion (van den Ban and Hawkins, 1996). Bohlen (1966) noted that people who have low ability to mentally handle abstract ideas tend to be more reluctant to adopt practices, which do not produce visible outcomes when used.

4.9 Socio-economic Factors and Adoption

When introducing a technology due consideration should be given to the availability and resource endowments of the potential adopter such as labour, land and capital. These can permit the rejection or adoption of the technology that is being introduced. A technology can be rejected due to the inadequacy of the farmer's resources, making him incapable of meeting

the requirements of the technology being promoted. Fliegel (1984) noted that some farmers may be inclined to be innovative that is, psychologically predisposed to accept innovations quickly but unable to act because of situational constraints such as insecure land tenure, lack of access to credit and lack of access to markets.

4.10 Socio-cultural Factors and Adoption

A farmer's willingness to adopt a technology is also largely influenced by socio-cultural factors such as beliefs, norms, values and taboos of the social system. Shaner, Philipp and Schmehl (1982), citing Beal and Sibley (1967) said characteristics such as knowledge, beliefs, attitudes, behaviour and goals of farmers are the most important factors to consider when introducing new technologies to farmers. Bah (1988) said farmers attach great importance to factors such as the social division of labour, cultural identity and compatibility with traditional pattern of life when adopting a technology.

4.11 Constraints to the Adoption of AT Technology

There are difficulties that make the spread and adoption of AT problematic. These are:

Lack of appropriate implements.

(Bobobee, 2003 www.fao.org/waicent/faoinfo/agricult/ags/agse/3ero/namibia/c7.htm); said, lack of appropriate implements could be an important constraint to the use of AT and farmers have sometimes found it difficult or impossible to obtain suitable equipment.

Harnessing. Several people had suggested that harnessing was a major constraint. Starkey (1988) named these people as Mucuta (1985), Smith (1988) and Vietmeyer (1982). They strongly advocated the use of head/horn yokes, withers/shoulder yokes, collars, breast bands single yokes or double yokes.

Human labour. Human labour can be a critical constraint in a family and AT may ease or exacerbate this. Farm households that do not have sufficient labour to manage draft animals throughout the year may be unable to adopt AT. Stumping fields to allow the use of animal drawn ploughs itself requires much labour, and in some areas, this may be a critical constraint to adoption (Seifert, 1992).

Lack of capital and/or credit. The adoption of AT can be highly dependent on the availability of these resources. The market cost of oxen, cultivation implements and carts in West Africa is high, relative to average farm incomes (Starkey, 1988). Seifert (1992) noted that it would be impossible for poor peasants to introduce AT due to lack of funds, or it would be inappropriate due to small acreage or family size.

Limited availability of animals. This can be a serious constraint to the employment of draft animal power in some areas. In the humid and sub-humid zones of West and Central Africa, there are very few cattle. Elsewhere, civil unrest or wars can restrict animal availability (Starkey, 1988).

Social traditions. Starkey (1988) observed that in areas where AT is still a highly innovative technology, it is common to hear someone argue that the technology is appropriate to one tribal group, but not to another. Theft of animals or fear of this can affect AT users. In Gambia, a reason given for using donkeys rather than oxen was the reduced risk of theft with donkeys. In some countries, draft animals give prestige to their owners but they may also cause jealousy and friction within communities (corbel, 1988).

National policies. National development policies can act as a major constraint to the adoption of AT. Interventions at national level can greatly influence decisions at farm-level. If AT is discouraged by governments as the case for Ghana in the late 1950's and early 1960's (Munzinger, 1982), the necessary implements may become unavailable to the farmers. There

will not be allocation of resources for the provision of national services such as credit, extension research and training.

CHAPTER FIVE

METHODOLOGY

5.0 Introduction

This chapter presents how the data for the study was collected, managed and processed. There are various types of methodologies used in research. According to Sarantakos (1993) the choice of any methodology depends on some factors. These factors are:

- The appropriateness of the method for the theoretical goals
- The adequacy of the method regarding the research objective
- The realisation of methodological rules which determine its structure, possibilities and limitations and
- The examination of the prerequisites and conditions, which must be considered for the performance of mathematical - statistical tests.

Survey was therefore found to be the most appropriate. Survey studies are studies that ask a sample of respondents questions (often about opinions but commonly about factual matters as well). Such survey generally interviews respondents in the field, mail questionnaires to the respondents, households, or pass out questionnaires to a group (Bailey, 1987).

The discussion in this chapter falls under the following headings:

1. Research design
2. Population of the study
3. Procedure and selection of sample
4. Instrument development
5. Data gathering
6. Data management
7. Analysis of data

5.1 Research design

Since the study is a fact-finding exercise as stated earlier, a survey of the descriptive type was used to collect the data. The design is cross-sectional. A cross-sectional study is one that studies a cross-section of the population at a single point in time. Hence, a broad sampling of persons of different ages, different educational and income levels, different races and different religions is done for study (Bailey, 1987).

According to Bailey (1987), the basic advantage of a cross-sectional study is that data can be gathered from a large number of people and these data are comparable since they are not affected by changes over time. This suggested that although the field data was collected within a short period of time, they were not significantly affected by the changes in time between collection of information from a respondent to another.

5.2 Population of the study

The target population was taken as all farmers and Agricultural Extension Agents (AEAs) in the Builsa traditional area. The target population is the unit for which the information is required (Sarantakos, 1993). The "Unit of analysis" is the individual respondents in the Builsa district. According to Bailey (1987) the unit of analysis refers to the different characteristics of an individual person in the target population being studied.

5.3 Procedure and selection of sample

The Builsa district was selected as a case study. This is because AT was introduced into the Builsa district around the same period with Navrongo, Bawku and Zuarungu which were all under then North Mamprusi District. The study should have therefore covered the whole of Upper East Region, but because of time, financial and language barriers, it restricted itself to

only the Builsa district and also because the researcher hails from Builsa District. Two-stage random sampling was carried out to get a sample size of one hundred (100) respondents. This sample size was chosen because of statistical analysis purpose. Bailey (1987) citing Champion (1970) said for statistical data analysis to be done a sample size should not be less than thirty (30) cases.

Firstly, four (4) villages were randomly selected from thirteen (13) villages. Only four villages were selected because of time and financial constraints and also for easy supervision. The selection was done by writing the names of villages on pieces of paper and rolling them thoroughly. The rolled pieces of paper were then spread on the floor. Four persons were asked to pick any of the rolled pieces of paper on the floor. The names of villages picked became the four selected villages.

Secondly, one hundred (100) respondents (house) were also randomly selected from one thousand and twenty-eight (1,028) houses using the same procedure for the selection of the villages. The only difference was, instead of names of villages, names of houses were written on the pieces of paper. House heads were interviewed.

Random sampling was done because the study population has the same cultural characteristics and this was to give each respondent in the study population an equal probability of being chosen for the sample. Sampling is the process of selecting a subset of some pre-determined size from a population. According to Bailey (1987), sampling has the following advantages:

1. Saves money
2. Saves time

3. Easy to supervise interviews

5.4 Agricultural Extension Agents (AEAs)

For the AEAs, the "complete survey" was used to collect data because they were only seventeen (17) of them. The questionnaires were given to them to fill and return them within two weeks.

5.5 Instrument development

A research instrument is "any type of written or physical device which is purported to measure variables" (Sproul, 1988, cited in Atengdem, 1997). The choice of specific instruments is influenced by some factors. According to Atengdem (1997) citing Sproul (1988), the instruments should:

- Measure the variable appropriately
- Be sufficiently valid and reliable
- Yield the appropriate level of measurement for each variable
- Require an appropriate amount of time
- Be easy to acquire a response
- Be easy to administer
- Be easy to interpret and
- Incur costs within the researcher's budget

The following instruments and methods were therefore identified as the most appropriate for the data collection:

1. Questionnaires
2. Informal interview and group discussions
3. Literature and documentary review formats

Data required and instrument used

MAIN CONCEPT	DATA REQUIRED	SOURCE OF DATA	INSTRUMENT USED
PERSONAL CHARACTERISTICS OF FARMERS	♦ Age of farmer ♦ Family size ♦ Educational level	♦ Farmers	♦ Questionnaires ♦ Interviews ♦ Group discussion
SOCIO-ECONOMIC FACTORS	♦ Ownership of cattle ♦ Ownership of donkeys ♦ Access to credit ♦ Source of labour ♦ Affordability of AT services ♦ Availability of AT services	♦ Farmers ♦ AEAs ♦ Office records	♦ Questionnaires ♦ Interviews ♦ Group discussion
SOCIO-CULTURAL FACTORS	♦ Values ♦ Norms ♦ Beliefs ♦ Attitudes ♦ Taboos	♦ Farmers ♦ AEAs ♦ Literature	♦ Questionnaires ♦ Interviews ♦ Group discussion
TECHNOLOGY CHARACTERISTICS	♦ Importance ♦ The need ♦ Costs ♦ Profitability ♦ Cultural appropriateness ♦ Appropriateness to some aspects of farming systems	♦ Farmers ♦ AEAs ♦ Literature and documents	♦ Questionnaires ♦ Interviews ♦ Group discussion
EXTENSION TEACHING METHODS	♦ What is done, e.g., weight pulling ♦ How it is done ♦ When it is done ♦ Where it is done ♦ Who does it ♦ Why it is done ♦ Frequency of visits	♦ Farmers ♦ AEAs ♦ Office records and reports	♦ Questionnaires ♦ Interviews ♦ Group discussion

5.6 Data gathering process

The questionnaires and interview schedules were constructed. In order to ensure the validity and reliability of the questionnaires, they were pre-tested.

Validity is the ability of an instrument to produce accurate results and to measure what is supposed to be measured (Sarantakos, 1993). Reliability is the ability of an instrument to produce consistent results (Sarantakos, 1993). Sarantakos (1993) noted that pre-testing helps the researcher assess whether the interviewers understand and can administer the instrument effectively and whether the target respondents find the interview schedule adequate for its purpose. Bailey (1987) said pre-testing is done to remove ambiguous or extraneous questions. The pre-testing was conducted in Sandema. Corrections were made by re-framing of questions, deletions and additions.

5.6.1 Initial Arrangements

On arrival the researcher first visited the District Chief Executive (DCE) of the area to seek permission from him to operate in the district. A similar visit was made to the DDA of MoFA to seek permission from him to operate in the district, and to use some of his staff as research assistants. It was also to collect documentary and literature materials, list of villages, names of households and if possible names of farmers for sampling. Permission was also obtained from NGOs operating in the communities where data was to be collected.

5.6.2 Interview Schedule

Lindzey and Aranson (1968) as cited in Kalton and Moser (1971) outlined three broad conditions for a successful interview. These are:

- The accessibility of the information to the respondents

- Cognition or understanding by the respondent of what is required and
- Motivation on the part of the respondent not just to answer the questions but give accurate answers.

The interview was conducted in the local dialect (Buli) since most of the respondents were illiterate. The researcher and his assistants also speak the same dialect hence no need for interpretation, which might distort information. The respondents were interviewed in their respective homes. This was meant to get the individual's views and opinions.

5.6.3 Group Discussion

There was no formal group discussion but occasionally the researcher had informal group discussions with the farmers. This was done to obtain a wide range of opinions as part of the research was historical. Sarantakos (1993) said group discussion is a way of gaining information in a short period of time about the breath or variation of opinions and of establishing a mechanism of opinion information.

5.7 Data Management

Completed questionnaires were received they were scanned through to ensure that information on the key concepts was collected. The responses for closed and open-ended questions were coded appropriately. Coding is a process in which statements and answers are translated into numbers (Sarantakos, 1993). Unlike the closed questions, the open-ended questions were put into pattern of categories after studying the responses. These categories are mutually exclusive and exhaustive and allow some degree of quantification if a quantitative framework is employed (Sarantakos, 1993). Research assistants were trained on how to administer the questionnaires.

5.8 Storage and Handling of Data

In order to establish uniformity with the closed responses for the purpose of analysis, the open-ended responses were post-coded. The responses on the individual questionnaires were coded following the listing and categorisation of the responses. Data was then transferred to a sheet of paper for easy handling before entering it on to the computer. The data collected from the group discussions, documents and literature were compiled into notes to be used to support data during analysis, interpretation and discussion of results.

5.9 Data Analysis

The data was entered onto the computer using the Statistical Package for the Social Sciences (SPSS). Frequencies and cross tabulations were ran, analysed and the results interpreted.

Non-parametric statistical tests were used to test the level of significance of the hypothesis. Non-parametric tests are used when data is ordinal, nominal or when subjects are allocated to categories (Greene and d'Oliveira, 1988).

To determine whether the hypotheses stated earlier were true, the degrees of freedom was taken to be one (1) and the level of significance (critical value) as 0.05. The level of significance is a statistical test value whose associated probability of occurrence under the null hypothesis H_0 is equal to or less than some small probability, usually denoted $\propto$. The purpose of setting a significance level is to define a rare event under (H_0) when the null hypothesis(H_0) is true. Thus, if (H_0) were true, and if the result of the statistical test on the set of observed data has a probability less than or equal to $\propto$, it is the occurrence of a rare event that would lead us, on a probabilistic basis, to reject (H_0) (Siegel and Castellan Jr., 1988).

According to Bailey (1987) the chi-square (χ^2) and Fisher's Exact Tests are used to test the level of significance, but that unless all expected values are at least 5, one cannot assume the distribution to be χ^2, hence the chi-square can not be used in this case. For this reason, the Fisher's Exact Test was found more appropriate and was used. For the use of Fisher's Exact Test, all tables were re-grouped into 2 x 2 tables (Siegel and Castellan Jr., 1988). The Fisher's Exact Test Score was then compared with the level of significance, (0.05). If the Fisher's Exact Test Score was found to be less or equal to the level of significance, the null hypothesis (H_0) was accepted. If it was found to be more than the level of significance, the null hypothesis (H_0) was rejected. Hence, symbolically, it can be represented as $p \leq 0.05$ = significant and $p > 0.05$ = not significant where p is the Fisher's Exact Test Score.

CHAPTER SIX

CHARACTERISTICS OF THE STUDY POPULATION

6.0 Introduction

This chapter presents the findings, presentation and discussion on the characteristics of the study population. For ease of presentation the chapters is divided into two sections namely:

1. Characteristics of farmers
2. Characteristics of Agricultural Extension Agents.

SECTION ONE

6.1 Characteristics of Farmers

This section presents the findings, presentations and discussions on the personal, socio-economic and socio-cultural characteristics of farmers. The section tries to find out whether the characteristics mentioned affect the adoption of AT as stated in Objectives 2, 3 and 4.

6.1.1 Personal Characteristics

Under this, only results of personal characteristics of respondents, which are relevant to the objectives of the research, are presented. These include

- ages of respondents
- their family size
- educational levels.

Age of respondents

The ages of most of the respondents, especially those who were forty years or above were estimated using important events in their years of birth. The percentage and age distribution of respondents is presented in Table 6.1.

Table 6.1: Distribution of respondents by age

Age category (years)	Frequency	%
30 - 47 (Youth)	44	44.0
48 - 65 (middle age)	36	36.0
66+ (old age)	20	20.0
Total	100	100.0

Source: Field Survey 2002

The ages of respondents were classified into three categories, namely; the youth, (30-47) years, the middle age (48-65) years and the old age (66 or above) years. The mean age was 50.8 years whilst the minimum and maximum ages were 30 and 95 years respectively.

Majority of respondents (44%) were in the youth category, followed by the middle age category (36%) and the old age category (20%). The economically active group in a nation is between 15-64 years (Ghana Statistical Service 2002; Barrett et al 1982). As indicated in Table 6.1, majority of the respondents fall within this range. Age can influence the adoption or rejection of a technology. For example a technology that looks complex or needs more labour and energy for an old person may be easy for a young person. van den Ban and Hawkins (1996) and Swanson (1984) noted that innovators tend to be relatively young. Atengdem (1997) also observed that age is an important factor in determining the working ability of any person.

Family size of respondents

On the size of family, children who were four years or below were not included because at those ages, children can neither farm nor tend livestock. The distribution of respondents by family size is presented in Table 6.2.

Table 6.2: Distribution of respondents by family size

Family size (No. Of persons)	Frequency	%
1 - 5	9	9.0
6 - 10	50	50.0
11 - 15	27	27.0
16 - 20	8	8.0
21+	6	6.0
Total	100	100.0

Source: Field Survey 2002

The minimum number of persons per family was four (4) with twenty-six (26) as the maximum. The mean family size was ten (10). The average household size for the various electoral areas in the Builsa District for 2000 population and housing census ranged from 3.9 to 6.9 persons (Ghana Statistical Service 2002). The mean for the study being more than the mean for the population and housing census could be that the study was conducted in areas with large compound houses.

Table 6.2 indicates that majority of respondents (59%) had family size between one and ten (1 - 10). These are respondents from the big towns who practice the nucleus family system due to pressure on land and other social amenities. The remaining respondents (41%) are from the villages (outskirts) who still believe in the extended family system and that the social status of a person is determined by the size of the family hence the need for large families Lynn (1937) noted that in North Mamprusi (of which Builsa district was then part) wealth and position are associated not with money but with the number of wives and children and livestock that a man has. The large number of persons per family can affect the adoption of a technology. A small family size is not likely to adopt a technology, which needs either division of labour or larger work force, whilst a larger family size may adopt. Barrett,

Lassiter, Wilcock, Baker and Crawford (1982) observed that both oxen and donkey farmers have larger families and larger work force than their hoe-farmer counter-parts. Stumping fields to allow the use of animal-drawn ploughs itself requires much labour, and in some areas this may be a critical constraint to adoption (Reynolds, 1988). Farm households that do not have sufficient labour to manage draft animals throughout the year may be unable to adopt animal traction (Starkey, 1988).

Educational Level of respondents

The distribution of respondents by educational level is presented in Table 6.3. As shown in Table 6.3 majority of respondents (72%) had no formal education 25% had basic education whilst 3% had secondary/tertiary education. The majority of respondents had no formal education.

Table 6.3: Distribution of respondents by educational level

Educational Level	Frequency	%
No formal Education	72	72.0
Basic Education	25	25.0
Secondary/Tertiary Education	3	3.0
Total	100	100.0

Source: Field Survey 2002

Probably those who had formal education were in government work or migrated to the towns and cities to look for "white collar jobs" or greener pastures. Education plays an important role in the adoption process. An educated and literate person is likely to adopt an innovation faster than an illiterate person if literacy is required. He has access to a lot of information

about the technology through reading. Urasa, (1994) said most smallholder farmers have had only very limited education and so any new technology to be introduced should be simple enough to be understood by the farmers. Swanson (1984) citing Rogers (1983) shows that innovators tend to be relatively young, better educated and "better of".

6.1.2 Socio-economic characteristics

This section presents the findings, presentations and discussions on the socio-economic characteristics of the study population. These include

- Ownership of cattle and donkeys
- Affordability and availability of Animal traction (A.T) services
- Source of A.T. services
- Availability of credit facilities
- Form and use of credit
- Adequacy and timeliness of credit
- Size of farms and
- Source of farm labour.

Munzinger (1982) observed that the economic situation of the individual farmer is the decisive factor in determining whether he goes over to the use of draught oxen.

Ownership of Cattle

The percentage of ownership of cattle by respondents is presented in Table 6.4.

Table 6.4: Distribution of respondents by type of Ownership of Cattle

Type of Ownership	Frequency	%
Individual	21	21.0
Family	56	56.0
Both family and Individual	4	4.0
No Cattle	19	19.0
Total	100	100.0

Source: Field Survey 2002

Livestock, especially cattle play a vital role in terms of wealth of a person in the Builsa District. Lynn (1937) noted that in North Mamprusi (Builsa District inclusive), wealth and position are associated not with money, but with the number of wives and children and livestock that a man has. The study showed that (56%) majority of respondents had family cattle. This situation may reduce adoption of animal traction. This is because before some animals are trained all family members must agree. Even when animals are trained there may be conflicting interests for access during the crucial working hours and responsibility for maintaining the animals at other times. The study noted that access to work animals during the season was done according to seniority. The one maintaining the work animals may not get access to the bullock services early, if he is not a senior. Even if he gets, it could be too late. In this case even though there may be cattle, the individual prefers getting animal traction services from outside or using the hoe.

Ownership of Donkeys

The distribution of respondents by type of ownership of donkeys is presented in Table 6.5.

Table 6.5: Distribution of respondents by type of ownership of donkeys

Type of Ownership	Frequency	%
Individual	7	7.0
Family	13	13.0
No donkeys	80	80.0

Source: Field Survey 2002

As shown in Table 6.5, majority of respondents (80%) did not have donkeys. The low ownership of donkeys could be attributed to the fact that donkeys are not used for payment of bride wealth and religious sacrifices hence their ownership is not prestigious.

The low ownership of donkeys can affect adoption because bullocks are very expensive and those who do not have cannot afford. As Fischer (1994) puts it, farmers must be able to use the new technology immediately after training, that is, they must have their own animals and implements and that training is ideally done with the farmers' own animals and implements and on their own fields.

Affordability of Animal Traction Services

Affordability of AT services here refers to the ability of a farmer to play for the service of AT at any point in time. On affordability of animal traction services, 46% of respondents said few farmers could afford, 34% of respondents said most farmers could afford, whilst 20% said some farmers could afford.

The 46% respondents who said few farmers could afford animal traction services were bullock owners. Some bullock owners complained that whenever they plough for people they refuse to pay them, an indication that they cannot afford the cost of the services. The other 34% were bullock owners who have been paid for their services. This finding is consistent with Galjart (1971), cited by Fliegel (1984), who observed that in addition to unwillingness to adopt innovations one should raise questions about inability to adopt. Hawens and Flinn (1975) cited by Fliegel (1984) in support said laggards are not necessarily unwilling to adopt innovations, but are unable to implement their adoption decision.

Availability of Animal Traction Services

Availability of AT service is a situation where a farmer gets AT services any time he/she wants without difficulty. The study showed that 65% of respondents said animal traction services were not readily available, 22% said somewhat available whilst 13% said animal traction services were readily available.

The 65% who said animal traction services were not readily available are those who do not own bullocks or donkeys at all or those who have family ownership. In the case of the family ownership, one would have to wait until his turn since they would be ploughing according to seniority. In the case of those who do not own bullocks at all they will have to wait until the owners finish ploughing. Even that, it will depend on how close he is to the owner or the number of requests made before him. This can affect adoption since he might not see the benefits or advantages of animal traction over the use of hoe because of the late ploughing. Johnson and Kellogg's (1984) observed that farmers will accept new cultivated more land when they had draft animals so that total yield over farm increased.

Source of Animal Traction Services

The study indicated that majority of respondents (69%) had their own animal traction services, 22% hired animal traction services whilst 9% had no source of animal traction services, hence they used the hoe. Of the nine (9) respondents who did not enjoy animal traction services, four (4) of them said they could not afford the cost of ploughing, two (2) said they feared disappointments, whilst three (3) said they had enough family labour and did not need animal traction services.

This finding confirms Galjart (1971), as cited by Fliegel (1984), observations from his studies of smallholder farmers that in addition to unwillingness to adopt innovations one should raise questions about inability to adopt. Hawens and Flinn (1975) as cited by Fliegel (1984), also observed that laggards are not necessarily unwilling to adopt innovations, but are unable to implement their adoption decision. Beal and Sibley (1967) as cited by Shaner, Philipp and Schmehl (1982) said beliefs might influence the farmer's attitudes, behaviour and goals. For example even though farmers may be treated fairly when seeking credit, the anticipation of being treated unfairly may keep them from seeking credit as in the case of those respondents who said they feared disappointments. Those who said they had enough family labour also confirms Brown's (1966) citing Mead (1955) observation that the introduction of mechanisation of agriculture has either fallen through or encountered difficulties because the local population has considered it not only uneconomical (since human labour is considered cheaper) but also that it would leave the farmer "with even less of the creative work of which he now has too little".

Respondents who had access to credit facilities

The study conducted revealed that only (16) sixteen out of the hundred (100) respondents interviewed had credit facilities for AT from financial institutions either in cash or in kind. The remaining eighty-four (84) respondents did not get any credit facilities from any source (formal and informal). Reasons given for not getting the credit facilities included the following:

1) The procedures of getting credit is cumbersome.
2) They did not belong to any group or association, one of the criteria used in giving credit.
3) They feared getting government loans because of prosecution and disappointments.
4) They applied but were denied because they did not belong to the party of the ruling government.
5) The amount of loans approved were usually inadequate.
6) Could not use loan for its purpose because of late disbursement.
7) Others said they were self-sufficient and did not need any loan.

Credit can be a critical constraint to the adoption of animal traction. Some of the findings above confirm the observations made by Munzinger (1982) that National development policies can represent either an impetus to animal traction, or they can act as a major constraint. Interventions at national level can greatly influence decisions at farm-level.

Out of the sixteen (16) respondents who had the credit facilities, seven (7) used the credit to buy foodstuffs, whilst the remaining nine (9) used it for either funerals or payment of bride wealth. The inability of respondents to use credit for its purpose, that is purchase of draught animals or hiring of animal traction services was attributed to the inadequacy of the credit.

This is because fourteen (14) out of the sixteen (16) who had the loan said the loan was not adequate. Another reason for using the credit for other purposes other than animal traction was the time they received the credit. This is because out of the hundred (100) respondents interviewed, ninety-five (95) of them said credit facilities were mostly late.

Availability of Credit Facilities

On the availability of credit facilities, the study showed that out of the hundred (100) respondents interviewed ninety five (95) said credit facilities were not readily available, five (5) said credit facilities were somewhat available. However, no respondent indicated that credit facilities were readily available. But from the reasons given earlier in the forgone paragraph for not getting the credit facilities, one is tempted to conclude that the problem of respondents was not availability of credit, but rather accessibility of credit facilities. For example reasons like procedure is cumbersome, do not belong to any group indicated that the credit was available but how to access it could be the problem.

The Farm Size of Respondents

Farm sizes of respondents were put into three categories for easy analysis. The farm size of each respondent was estimated using the then existing charges for ploughing one acre of land in the community and the number of man days used in weeding each plot of land. The distribution of respondents by size of farm is presented in Table 6.6.

Table 6.6: Distribution of respondents by the size of farms

Size of farm Category (acres)	Frequency	%
1 - 5 (small scale farmers)	24	24.0
6 - 10 (Medium scale farmers)	42	42.0
11+ (Large scale farmers)	34	34.0
Total	100	100.0

Source: Field Survey 2002

The minimum farm size was two (2) acres with twenty-nine (29) acres as the maximum. The mean farm size was nine (9) acres. From Table 6.6 the medium scale farmers were the majority (42%) followed by the large scale farmers (34%) and the small-scale farmers were the least (24%).

When interviewed the small-scale farmers complained of either lack of land or no money to hire animal traction to increase their acreage. However, the medium and large scale farmers said apart from the large number of dependents they had to feed, land was not a problem. They also had their own bullocks or could afford the cost of ploughing. This confirms the findings of Gboku (1988). He noted that animal traction might assist farmers to increase the total production of their crops. One of the clearest ways in which this is achieved is through increase in area cultivated. He said there is very often a correlation between farm size and the ownership of draft animals, although this does not necessarily mean that the animals are the cause of the large area of cultivation; it may be that the farmers that have big farms are the ones wealthy enough to use draft animals, so that draft animals may be the result of large farms. Recorded farm areas before and after the adoption of draft animals tend to indicate that where land is available, farmers will cultivate more land when they have draft animals, so that total yield per farm increases (Barrett et al, 1982; Panin, 1986.

6.1.3 Socio-cultural characteristics

Under this section, the results, presentations and discussions on the socio-cultural characteristics of the study population are presented. These are:

- The cultural acceptability of animal traction technology,
- The level of respect given to cattle owners, donkey owners,
- The category of people who manage work animals.

Cultural Acceptability

All the hundred (100) respondents interviewed said animal traction technology was acceptable in the community. However, the only reason why some cattle owners do not have working animals is to avoid jealousy and hatred. That because animal traction owners normally increase the total production of their crops through increases in area cultivated, people tend to hate them and can kill them through spiritual means. This observation is in line with Starkey (1988) who noted that the adoption of animal traction tends to increase income differences between farmers within villages.

The traditional beliefs and attitudes of the people can also make the introduction of technologies difficult in certain areas as the reasons given by some cattle owners for not having work animals. Brown (1966) citing, Edwin (1939) noted that in India the Baiya refused to use an iron plough because they believe that the iron plough would repay with harshness the generosity of the land.

Level of respect given to cattle (bullock) owners

The distribution of respondents by their perception of the level of respect given to cattle owners is presented in Table 6.7.

Table 6.7: Distribution of respondents by their perception of the level of respect given to cattle (bullock) owners

Level of respect	Frequency	%
Very high	34	34.0
High	56	56.0
Average	10	10.0
Low	0	0.0
Very low	0	0.0
Total	100	100.0

Source: Field Survey 2002

From Table 6.7 majority of respondents (56%) ranked level of respect given to cattle owners as being high, 34% ranked them as very high and 10% ranked them average. No respondent ranked them low or very low.

This shows the importance respondents attach to ownership of cattle. This is even shown in Table 6.4 where only nineteen (19) out of the hundred (100) respondents did not own cattle. This level of respect could be attributed to the fact that cattle is used for funerals, sacrifices bride wealth and for security purposes. Lynn (1937) noted that in North Mamprusi (Builsa District inclusive) wealth and position are associated not with money, but with the number of wives, children, and livestock that a man has. However, the eleven who ranked cattle owners as being average said the respect given to a cattle owner depends on the respect he gives to others. A cattle owner who does not respect people is not respected.

Level of respect given to donkey owners

The distribution of respondents by their perception of the level of respect given to donkey owners is presented in Table 6.8. It can be seen from Table 6.8 that majority of respondents (54%) ranked the level of respect for donkeys as being high, followed by those who ranked them average (35%), very high 7% and low 4%. Nobody ranked them very low. Those who ranked respect given to donkey owners as being high or very high are likely to be those who own donkeys or have enjoyed the services of donkeys in one way or the other. Those who ranked donkey owners as average or low are likely to be those who do not own donkeys or have not enjoyed their services. And also for the mere fact that they are not used for sacrifices and payment of bride wealth, they are of low status.

Table 6.8: Distribution of respondents by their perception of level of respect given to donkey owners

Level of Respect	Frequency	%
Very high	7	7.0
High	54	54.0
Average	35	35.0
Low	4	4.0
Very low	0	0.0
Total	100	100.0

Source: Field Survey 2002

As compared to the level of respect given to cattle in Table 6.7, more respect is given to cattle owners than donkey owners, probably due to the multiple functions it plays or because cattle is naturally preferred. As noted by Starkey (1988) that animal traction both benefits from, and suffers from long standing traditional preferences and the vagaries of more rapidly

changing "fashions". That animals often have prestige status unrelated to their working abilities, so that one sickly horse may have higher social status than a pair of strong oxen. In some countries and communities the colours of animals and implements may be very important influencing decisions relating to adoption, even though it is unlikely that these factors would influence performance.

Category of people who manage work animals

Table 6.9 presents the distribution of respondents by the category of people who manage work animals

Table 6. 9: Distribution of respondents by the category of people who manage work animals

Category of people who manage work animals	Frequency	% (N=100)
Boys	100	100.0
Girls	56	56.0
Men	95	95.0
Women	14	14.0

Multiple response.
Source: Field Survey 2002

Table 6.9 indicates that all the respondents (100%) said boys manage work animals, 95% said men manage work animals whilst 56% and 14% said girls and women respectively.

The study indicated that there was no custom which prevents any gender from managing work animals. That in a family where there are no children or the children are attending school, then the men and women would manage the work animals. The reason why it is not common to see women managing work animals may be just out of fear and also because of the numerous roles women play in the household.

Starkey (1988) observed that men and children usually train the animals, work with them and herd them. He said children often tend draft animals and because of this their educational prospects can suffer, either due to limited school attendance or due to fatigue when school is combined with looking after animals.

6.1.4 Summary: Characteristics of Farmers

In summary, it was found under the social characteristics of the respondents that most of them (44%) were the youth, 36% the middle age and 20% the old age. The study also revealed that most respondents (50%) had family size between 6–10 person, whilst those with 21 or more persons were the least (6%). Out of the hundred (100) respondents interviewed seventy two (72) had no formal education.

On the socio-economic characteristics of the respondents, the study indicated only 19% of respondents did not own cattle. Also 80% of respondents did not own donkeys. Out of the hundred (100) respondents interviewed on the affordability of animal traction services, majority of them said few farmers could afford On availability, a majority of 65% said animal traction services were not readily available, 22% said it was somewhat available. The study again indicated that 69% of respondents used their own draft animals, and 22% hired. However, 9% did not use draft animals, either because they could not afford the cost of ploughing or had enough family labour. From the interview it was shown that 84% of respondents did not receive any credit facility, only sixteen (16) of the respondents had credit. Of the sixteen (16) seven (7) of them use the credit to buy foodstuff, whilst nine (9) used the credit for funerals, payment of marriage dowries with the reasons that either credit was inadequate or it was received very late and could not be used for the intended purpose. On availability of credit facilities 95 out of the 100 respondents said credit was not readily

available. The study also revealed that medium scale farmers were 42; large-scale farmers 34 and small-scale farmers were 24.

On the socio-cultural characteristics of respondents, all the hundred (100) respondents said animal traction technology was culturally accepted in the community. Jealousy and hatred might prevent people from owning draft animals. On respect given to bullock owners 56% of respondents rated high, 34% rated very high and 10% rated average. No body rated them low or very low. On the respect given to donkey owners those who rated them high was 54%, average 35%, very high 7%, and low 4%. The study also indicated that 100% of the respondents said boys manage work animals, 95% said men manage work animals, 56% said girls manage work animals and 14% said women manage work animals. All the respondents did indicate that there was no custom preventing women or girls from managing work animals.

6.2 Characteristics of Extension Agents

This section presents findings, presentations and discussions on the characteristics of the extension agents. This may help answer the research question whether the extension methods used so far affected the adoption of AT and to find out its effectiveness in promoting AT as demanded by Objective 8. Areas to look at therefore include:

- Number of in-service trainings
- Duration of the in-service training
- Source of in-service training
- Methods used in training AEAs
- Frequency of visits made by AEAs
- Reasons for inability to make visits to farmers

- Problems farmers face in adoption of AT and
- Summary

6.2.1 Number of In-service Trainings

The distribution of respondents by number of in-service training received by AEAs is presented in Table 6.10

Table 6.10: Distribution of respondents by number of in-service trainings received by AEAs

Number of In-service trainings	Frequency	%
0	2	11.8
1	6	35.3
2	3	17.6
3	1	5.9
4	2	11.8
5	3	17.6

Source: Field Survey 2002

From Table 6.10 it is shown that majority of respondents had zero to two (0-2) trainings (11) whilst only six had three to five (3-5) trainings. This is because MoFA places less importance on AT as compared to other sectors of the ministry. Munzinger (1982) and Starkey (1988) said animal traction has sometimes been neglected in allocation of resources for the provision of national services such as credit, extension, research and training.

6.2.2 Duration of In-service Training

Of the seventeen (17) respondents nine (9) said they had 1-2 days training, three (3) said 3-4 days and the other three (3) respondents said 5-6 days. The nine respondents who had 1-2 days of training still emphasises the less importance given to animal traction by MoFA.

Those who had 3-6 days of training were those old staff who were in the ministry during the time animal traction was being promoted.

6.2.3 Source of In-service Training

The distribution of respondents by source of in-service training is presented in Table 6.11.

Table 6.11: Distribution of respondents by source of in-service training

Source of training	Frequency	%
MoFA	15	88.2
NGOs	4	23.6
Farmers	5	29.5

Multiple Response N = 17

Source: Field Survey 2002

Table 6.11 shows that majority of respondents (88.2%) had their training from MoFA. Notwithstanding this, the 29.5% respondents who had their training from farmers indicates that AEAs can equally learn from farmers and that extension is a two way affair and not one way.

6.2.4 Methods used in training AEAs

The distribution of respondents by the methods used in training them is presented in Table 6.12. As indicated in Table 6.12, majority of respondents (64.7%) had their training by demonstration, followed by lectures 41.2% and group discussion 23.5% respectively.

Table 6.12. Distribution of respondents by the methods used in training them

Method used	Frequency	%
Demonstration	11	64.7
Lectures	7	41.2
Group discussion	4	23.5

Multiple Response N = 17

Source: Field Survey 2002

6.2.5 Reasons for inability of AEAs to make follow-up visits to Farmers

The study conducted showed that majority of AEAs (47%) sometimes made visits, 23.5% always made visits whilst 24.4% never made visits. The distribution of respondents by reasons for their inability to make visits to farmers is presented in Table 6.13

Table 6.13 Distribution of respondents by reasons for their inability to make follow-up visits to farmers

Reasons	Frequency	%
Lack of means of transport	9	52.9
No fuel	5	29.4
Large operational area	8	47.1
Lack of knowledge of AT	4	23.5
Farmers did not have training materials	5	29.4

Multiple response N=17
Source: Field Survey, 2002

6.2.6 Farmers Perception of Problems facing the adoption of animal traction

The distribution of respondents by problems farmers face in adoption of animal traction is presented in Table 6.14

Table 6.14 Distribution of respondents by problems farmers face in adoption of animal traction

Problem	Frequency	%
Lack of spare parts/Implements	14	82.4
Lack of capital	16	94.1
Lack of bullocks	9	52.9
High cost of drugs	8	47.1
Illiteracy	9	52.9
High cost of implements	2	11.8

Multiple Response N = 17
Source: Field survey 2002

Table 6.14 shows that majority of respondents (94.1%) say lack of capital is the problem facing farmers in the adoption of animal traction, followed by lack of spare parts 82.4%, lack of bullocks 52.9%, illiteracy 52.9%, high cost of drugs 47.1% and high cost of implements 11.8% respectively.

6.2.7 Summary: Characteristics of Extension Agents

In summary, majority of respondents (11 out of 17) had zero to two (0-2) trainings. The study also showed that nine (9) out of seventeen (17) respondents had 1-2 days of training. Respondents said there were no funds to keep them more than two days. On the source of training, fifteen out of seventeen had their training from MoFA, five from farmers and four from NGOs respectively. The five who had their training from farmers shows that AEAs can equally learn from farmers. The study conducted also revealed that majority of AEAs (47.0%) sometimes made visits to farmers, (23.5%) always made visits whilst (24.4%) never made visits. Reasons for their inability to make visits were: lack of means of transport (52.9%), large operational area (47.1%), no fuels (29.4%), farmers did not have training

materials (29.4%) and lack of knowledge in AT (23.5%). The study again indicated majority of AEAs (64.7%) were trained using demonstration, followed by lectures (41.2%) and group discussion (23.5%) respectively.

CHAPTER SEVEN

EXTENSION METHODS USED IN PROMOTING ANIMAL TRACTION

7.0 Introduction

The findings, presentations and discussions on extension methods used in promoting AT are presented in this chapter. Here, attempts are made to answer the research question thus: Have the extension methods used so far affected the adoption of AT? The objective to find out the effectiveness of the extension methods used in promoting AT is also discussed here. Areas looked at in the chapter therefore include:

- Awareness of AT
- Source of awareness
- Methods used in training
- Duration of training
- Adequacy of training
- Whether respondents were trained in groups
- Number in a group
- Respondents' participation in bullock handling during the training
- Level of respondents participation in yoking and nose-ringing
- Follow-up visits made by trainers
- Frequency of visits made by AEAs
- Effectiveness of extension methods
- Factors hindering the adoption of AT and
- Summary of the chapter.

7.1 Awareness of Animal Traction (AT)

Awareness occurs when an individual or other decision-making unit is exposed to an innovation's existence. Being aware of an innovation is often quite different from using the ideas. Most individuals know about many innovations that they have not adopted because individuals may not regard it as relevant to his situation as potentially useful. (Rogers, 1995).

The study revealed that all the hundred (100) respondents interviewed were aware of animal traction. This could be attributed to the fact that AT had been introduced into the study area since 1937. Some of them could have grown up to meet it.

7.2 Source of Awareness

The distribution of respondents by their source of awareness of animal traction is presented in Table 7.1

Table 7.1: Distribution of respondents by their source of awareness about A.T.

Source of Awareness	Frequency	%
MoFA	80	80.0
NGOs	26	26.0
Friends	55	55.0
Family	46	46.0

Multiple Response N = 100
Source: Field Survey 2002

As shown in Table 7.1, majority of respondents (80%) had their source of awareness from MoFA. Those who had their source of awareness from NGOs were the least (26%). This could be as a result of the late involvement of NGOs in animal traction activities in the study area. For example whilst MoFA introduced animal traction into the study area in 1937, it was

not until 1969 and 1974 that the Roman Catholic and Presbyterian churches respectively got involved in animal traction activities.

7.3 Source of training

Training farmers and rural people often seeks to make available knowledge, skills and attitudes required for more productive and efficient farming (Atengdem, 2001). Of the hundred respondents interviewed eighty-four (84) of them had training in AT. Sixteen (16) did not get training. Table 7.2 presents the distribution of respondents by their source of training.

Table 7.2: Distribution of respondents by their source of training in A.T.

Source of training	Frequency	%
MoFA	18	21.4
NGO	22	26.2
Friends	29	34.5
Family	82	97.6

Multiple Response N = 100

Source: Field Survey 2002

Table 7.2 indicates that majority of respondents (82%) had their training in AT from their families. Those who had their training from MoFA were the least (18%). This could be attributed to the level of importance MoFA gives to A.T. as compared to other sectors of MoFA. This finding supports the National Agricultural Extension Project (NAEP) animal

traction report (1997) that except few extension staff who in the past were involved in training farmers and bullocks and often supported by NGOs most of the frontline staff had inadequate skills and confidence in training farmers and animals. Besides that animal traction extension materials are limited. Majority of respondents had their training from their families because, probably they grew up to meet their parents practicing AT As noted by Helsloot and Kriut (1992) in Panin and Ellis (1992) that most transfer of technology relating to AT had taken place through the family, neighbours and migrants. That there were very few examples of knowledge or skills being obtained from the extension services which were judged as rather irrelevant, unavailable or poor. Starkey (1988) observed that once AT has started in a region, much transfer has been informal, within families from farmer to farmer or from regional immigrants to local farmers. Thus formal extension is not important for diffusion of animal traction. Successful farmer-to-farmer transfer appears to have been responsible for the increase in the use of donkeys and working cows in several countries in Southern Africa. This adoption has sometimes been against the advice of extension agents (Starkey, 1994).

7.4 Methods Used in Training

Learning is an active process on the part of the learner. Unless he becomes interested to the point of putting forth mental and physical effort to learn, nothing is accomplished. It is the task of the extension worker to: (a) provide farmers with an opportunity to learn and (b) stimulate mental and physical activity that produces the desired learning (Leagans, 1960). The choice of extension teaching method and the ability to communicate effectively therefore plays a significant role when trying to influence the adoption of technologies. Hence Table 7.3 presents the distribution of respondents by the methods used in training them.

Table 7.3: Distribution of respondents by the methods used in training them

Method Used	Frequency	%
Demonstration only	43	51.2
Group discussion only	8	9.5
Two or more methods	33	39.3

Source: Field Survey 2002

From Table 7.3 it is established that majority of respondents (51.2%) had their training by demonstration followed by two or more methods 39.3% and group discussion 9.5%. The reason for majority of respondents getting their training by demonstration could be that the aim was to teach a skill. Also as indicated earlier most of them were trained by family members and friends. Some of the respondents said they had lectures and group discussions with MoFA staff who promised coming back to hold demonstration with them but never turned up.

7.5 Duration of training

The distribution of respondents by duration of training is presented in Table 7.4. From Table 7.4, it is shown that majority of respondents sixty-seven (67) out of the eighty-four (84) who had training had 1-2 days of training. This could be attributed to the fact that most of them had their training from families or friends and also the period training took place. If training was done during the cropping season both trainers and trainees might not have enough time for the training since they will have other farming activities to carry out.

Table 7.4: Distribution of respondents by duration of training

Duration (days)	Frequency	%
1 - 2	67	79.8
3 - 4	8	9.5
5 - 6	6	7.1
7+	3	3.6
Total	84	100.0

Source: Field Survey 2002

7.6 Adequacy of training

The distribution of respondents by adequacy of training is presented in Table 7.5

Table 7.5: Distribution of respondents by adequacy of training

Adequacy of training	Frequency	%
Highly inadequate	0	0.0
Inadequate	24	28.6
Somewhat adequate	10	11.9
Adequate	50	59.5
Highly adequate	0	0.0
Total	84	100.0

Source: Field Survey, 2002

Table 7.5 indicates that majority of respondents 59.5% said training was adequate even though majority of them said they had 1-2 days of training as indicated in Table 7.4. This could be because of the need respondents had for animal traction and also most of the training was done by demonstration. It has earlier been indicated that respondents ranked demonstration as the most effective among all the teaching methods. One of the respondents

said "I watched my friend training his animal, I also went and cut sticks made yokes, nose ringed my bullocks, harnessed them and started training them on my own. As noted by Kwarteng and Zinnah (1994) a good knowledge and understanding of the audience, especially their differences and similarities with respect to their age, level of education, available resources and their entire social environment helps the extension agent select the most suitable method. That the characteristics of the message, the teaching and learning objectives and what the participants are expected to be able to do should also be considered. For example if the aim is to provide knowledge, the extension agent may use lecture, if the aim is to teach a skill, demonstration method may be more appropriate.

7.7 Whether respondents were trained in groups

On whether respondents were trained in groups fifty-five (55) of them said they were trained in groups, whilst twenty-nine (29) of them said they were trained individually. On the number of participants in a group fifty-five (55) of them said they were between 2-6 in a group.

7.8 Level of respondent's participation in bullock handling during the training

Majority of respondents said their level of participation in bullock handling was very high whilst 27 said it was high. This could be as a result of the small number in the group thus making it possible for every one to have a try. It could also be because most of them had their training from families and friends, which was mostly by demonstration.

7.9 Level of respondent's participation in yoking and nose ringing

Out of the eighty-four (84) respondents who had training sixty-one (61) of them said their level of participation in yoking and nose ringing was high, sixteen (16) ranked participation

as very high whilst six ranked participation as being average. Again the high level of participation could be attributed to the training being done by family members and friends.

7.10 Follow-up visits by trainers

Seventy-seven (77) out of the eighty-four (84) said they never had follow-up visits, whilst seven (7) said they had follow-up visits. This could be because most of the training was done by fellow farmers; they did not have time to make such follow-up visits. The extension staff might not also have the necessary logistics to enable them make follow-up visits.

7.11 Frequency of visits by AEAs

Ninety-three (93) out of the hundred (100) respondents said they never had visits from AEAs. The remaining seven (7) who had visits from AEAs said it was quarterly. This could be lack of logistics for the AEAs to make visits.

7.12 Effectiveness of Extension Methods

Farmers described effectiveness of extension methods as:

(1) Ability to explain to farmers the advantages and disadvantages of a technology

(2) Ability to convince farmers to adopt a technology

(3) The number of farmers adopting the technology

The distribution of respondents on their perception of effectiveness of Extension Methods is presented in table 7.6.

Table 7.6: Distribution of respondents on their perception of effectiveness of Extension Methods

Extension methods	Highly ineffective		Ineffective		Some what effective		Effective		Highly effective	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Demonstration	0	0	0	0	0	0	64	64	36	36
Group Discussion	0	0	28	28	62	62	10	10	0	0
Lectures	3	3	75	75	22	22	0	0	0	0
Audio visuals	25	25	68	68	7	7	0	0	0	0

Source: Field Survey, 2002

On the effectiveness of the extension methods used, the study showed that 36% of respondents said demonstration was highly effective whilst 64% said it was effective. Nobody ranked it as highly ineffective, ineffective or somewhat effective.

On group discussion 10% said it was effective, 62% somewhat effective, 28% ineffective. Nobody ranked it as highly effective. Three percent (3%) rated lecture method as highly ineffective, 75% ineffective and 22% somewhat effective. Nobody ranked it as highly effective or effective. Audiovisuals had 25% rating it as highly ineffective, 68% ineffective and 7% as somewhat effective. Nobody rated it as being highly effective or effective. In order of effectiveness therefore demonstration ranks first, followed by group discussion, lectures and audiovisuals respectively.

Respondents argued that with demonstration, you are always active and there is maximum concentration. You do not easily forget. But with the other methods especially the lectures and audiovisuals you can easily fall asleep. Moreover some of them because of old age they have very poor retentive memory and also find it difficult to understand abstract things. That

some of them will not have the patience to sit and listen to lectures. It can be boring. Therefore as noted by Kwarteng and Zinnah (1994), a good knowledge and understanding of the audience, especially their differences and similarities with respect to their age, level of education, available resources and their entire social environment helps the extension agent select the most suitable method. The farmer's decision to adopt or reject the technology depends to a large extent on the extension agent's ability to convince the farmer. van den Ban and Hawkins (1996) noted that the message has to be presented such that the client understands it. Also each culture and sometimes a region or community within a culture has its peculiar means of communication as well as those common to other cultures. It must not be taken for granted that the channels and techniques of one culture necessarily exist in another or that they would function effectively if they were introduced, for example written literature is of little value among group's that are highly illiterate (Maunder 1972). Starkey (1988) said in most countries in the region, development programmes have tried to promote animal-drawn wheel tool-carriers but the transfer process has not succeeded; the technology has been "perfect yet rejected".

7.13 Factors hindering the adoption of animal traction

Distribution of respondents by factors hindering the adoption of animal traction is presented in Table 7.6. It is shown that 83% of respondents said lack of capital hinders the adoption of animal traction followed by high cost of bullock implements 44%, high cost of spare parts 34%, theft of cattle 32%, lack of bullocks 20% and illiteracy 13%. During the survey respondents complained they did not have funds to purchase implements, spare parts and bullocks. They did not also have funds to hire animal traction services. This problem is captured in Chapter six (6) on affordability of animal traction services, where 46% of respondents said few farmers could afford animal traction services. Barrett et al (1982)

observed that lack of capital or credit can be a critical constraint to agricultural development, and the adoption of animal traction can be highly dependent on the availability of these resources.

Table 7.6 Distribution of respondents by factors hindering the adoption of animal traction

Factor	Frequency	%
Lack of Capital	83	83.0
High cost of implements	44	44.0
High cost of spare parts	34	34.0
Lack of Bullocks	20	20.0
Theft of cattle	32	32.0
Feed	13	13.0

Multiple Response N= 100
Source: Field Survey 2002

Respondents also complained of high cost and lack of bullock implements and spare parts. This finding supports observations made by Starkey (1988) that lack of spare parts can also be a constraint although it is seldom a critical one. Gifford, (1988) found that lack of implements could be an important constraint to the use of animal traction.

The survey also revealed lack of bullocks and theft of cattle. Bullocks have either died or been sold to purchase food stuff but could not be replaced because of their high cost. Theft of cattle was also reported in Doninga where a respondent had all his cattle driven away. The risk of animal mortality is particularly important for farmers who were not animal owners,

and who therefore purchased animals using savings or credit (Bangura, 1988). Havard and Faye, (1988), as cited by Starkey (1990) also observed that the market cost of oxen, cultivation implements and carts in West Africa is high relative to average farm incomes. In some countries draft animals give prestige to their owners, but they may also cause jealousy and friction within communities. In extreme cases this may lead to the loss of animals through theft, poison or "witchcraft" (Corbel, 1988).

Respondents also complained that in the dry season all the grasses are burnt leaving nothing for cattle to feed on. Cattle therefore travel long distances in search of feed and water and never return. What they get is not sufficient and therefore animals are not strong enough to do ploughing. This finding confirms observation made by Abiye Astatke, Reed and Butterworth (1986), as cited by Starkey (1988) that large numbers of animals may die of starvation especially in drought years. Furthermore it has been observed that farmers may know how to improve the condition of their animals but choose not to. For example, farmers in Ethiopia may sell hay for money, even when their own animals are in poor condition.

7.14 Summary: Extension methods used in promoting AT

Summarising the chapter, all the hundred respondents interviewed said they were aware of animal traction. This could be attributed to the many years of its introduction into the study area. On the source of awareness of animal traction, 80% of respondents had their source of awareness from MoFA whilst those who had their source of awareness from NGOs were the least (26%). This was also attributed to the late involvement of NGOs in animal traction activities in the study area. The study also indicated that 84 of respondents had training and that 97.6% of this number had their training from their families. Those who had their training

from MoFA were the least (21.4%). This was attributed to extension staff lacking skills to train or did not have the materials necessary for training.

The study revealed that majority of respondents (51.2%) had their training by demonstration, (39.3%) two or more methods and group discussion the least (9.5%). This was also because most of them had their training from their family members. On the effectiveness of the methods used, respondents ranked demonstration as the most effective, followed by group discussion, lectures and audiovisuals respectively. Seventy-nine percent (79.8%) had 1-2 days of training. Those who had 7 or more days of training were the least (3.6%). This again was because farmers did most of training. The study also showed that 59.5% of respondents trained said the duration was adequate, 28.6% said training duration was inadequate. Fifty-five (55) of respondents trained said they were trained in groups of between 2-6 people. Twenty-nine (29) respondents said they were trained individually. On the level of participation in handling bullocks, more than 60% of respondents ranked yoking and nose ringing, as very high. This could be due to the small size of the group and also farmers did most of training. Seventy-seven respondents never had follow-up visits from trainers whilst seven had follow-up visits. The study indicated 93 of the hundred (100) respondents never had visits from AEAs. This could be attributed to lack of logistics for AEAs or lack of skills in training. Respondents listed the following as factors hindering the adoption of animal traction; lack of capital, high cost of implements and spare parts, lack of bullocks, theft of cattle and inadequate feed for animals during the dry season.

CHAPTER EIGHT

USES, PERCEPTIONS AND EFFECTS OF ADOPTION OF ANIMAL TRACTION (AT) ON SELECTED ASPECTS OF THE FARMING SYSTEMS

8.0 Introduction

Chapter seven presents the findings, presentations and discussions on the uses, perceptions and the effects of adoption of animal traction on selected aspects of the farming systems. The Chapter tries to find out the influence the characteristics of animal traction technology have on farmers adoption of the technology. It will find out the usefulness/importance of AT and its compatibility within the farming system of the Builsa District.

8.1 Awareness of the Usefulness of AT

Variables under this are haulage and traction activities that bullocks are used for. For eventual adoption to occur both the need for the technology and awareness of the potential benefits of the technology must be present (Abdulai, 1994).

8.1.1 Haulage activities that bullocks are used for

Of the hundred (100) respondents interviewed all of them said they knew that bullocks were used for carrying wood, gravel and farm produce. Eighty-five (85) of them said they knew that bullocks were used in carrying water whilst only twenty-three (23) of them said bullocks were used for transporting goods.

The reasons why only few of respondents knew that bullocks were used for transportation could be that bullocks are normally not very docile to permit their usage for transporting goods, and therefore using them to transport goods is not common in the study area. It also depends on the way bullocks were trained and handled. If bullocks are well trained and

handled properly they can be used for any haulage activity. Bangura, (1988); Allagnat and Koroma (1984) said farmers in Guinea argue that after working together for several seasons their animals had become their friends.

8.1.2 Traction activities that bullocks are used for

On traction activities all the hundred (100) respondents said they knew that bullocks were used for ploughing, ridging, harrowing and weeding. However, only three (3) of them said they knew that bullocks were used for planting. This is because the introducers of animal traction technology were more concerned with land preparation and haulage activities. Planting implements in AT were not introduced to farmers early.

8.1.3 Haulage activities that donkey are used for

All the hundred (100) respondents said they knew that donkeys were used for carrying water, wood, gravel, farm produce and transporting goods. This could be attributed to the fact that donkeys were used since time immemorial as means of transport. Even today, donkeys are still used as means of transport for people in the rural areas of the study area.

8.1.4 Traction activities that donkey are used for

The study indicated that all the hundred respondents (100%) knew that donkeys were used for ploughing, and ridging. Ninety-two (92) knew that donkeys were used for weeding, whilst eighty-five (85) knew of donkeys being used for harrowing. However nobody knew that donkeys could be used for planting. This could be as a result of the late introduction of the technology.

8.2 Perceptions about animal traction technology characteristics

Under this section, variables considered include: the relative economic advantage of animal traction technology, the ease with which technology was understood and used, the ease with which technology could be experimented and whether results of technology are visible for others to observe.

8.2.1 Relative Economic Advantage

The study revealed that out of the 100 respondents interviewed, 96 said the use of animal traction helps reduce drudgery, there is faster and better seed bed preparation, timely land preparation, recommended spacing resulting in optimum plant population and increased farm size resulting in increases in total production.

Johnson and Kellogg (1984) noted that farmers would accept new practices or technologies when they perceive that the benefits are greater enough to outweigh the costs. Swanson (1984) observed that small farmers would adopt a technology if it is economically and technically superior to their farming systems. Conroy, et al (1995) citing Appleton (1993) also noted that if farmers are to benefit, new technologies must either reduce their workload significantly or be capable of being incorporated into the work without adding to the overall burden.

8.2.2 Compatibility of animal traction technology

On the compatibility of animal traction technology, the study found that eighty-nine (89) of the hundred (100) respondents said it was compatible with the culture of the study area. As one respondent put it "These days we are looking for technologies which will make you better and not necessarily what pleases your friend or the so- called gods". This trend could

be attributed to respondent's interaction with outside life. Because it was noticed that more than 90% of respondents were returned migrants. Hence this observation is in line with Adams, (1982) and Leagans (1960) who observed that an individual's perception is influenced by his beliefs, values, attitudes and can affect adoption or practice of an innovation. Farmers have rejected new methods because they were incompatible with their values (Abdulai, 1994). The responsiveness of farmers to practise an innovation is greatly enhanced when the proposed or introduced technology has the potential to solve a perceived problem in particular localities. Hence both the need for the technology and the awareness of the potential benefits of the technology must be present for eventual adoption to occur.

8.2.3 Ease with which technology was understood and used

When the study was conducted it was found that ninety-one (91) out of the hundred respondents said the technology was easy to understand and use. One respondent said he watched a neighbour train his bullocks. After that he went home cut sticks, made his yokes, harnessed his animals and started training his bullocks. Some respondents remarked that no technology is complex provided it has relative economic advantage and is profitable. "After all, is it not a human being who invented that technology?" was what a farmer said. "If it were complex how did he do it"? Adams (1982) said innovations, which are relatively simple, usually catch on faster and are adopted more quickly than more complicated ones. Kivlin (1960); and Singh and Petrini (1966), cited by Rogers (1983) found that the complexity of farm innovations was more highly related in a negative direction to their rate of adoption than any other characteristic of the innovation except relative advantage.

8.2.4 Ease with which technology can be experimented

Here the study indicated that sixty-eight (68) out of hundred (100) respondents said it was not easy to experiment the technology on a limited basis. This, respondents indicated was due to lack of draft animals, high cost of draft animals and high cost of implements which some farmers could not afford. If a farmer can try an innovation without committing much of his resources, he will adopt it more readily, or if its performance meets his objectives (Fliegel and Kivlin, (1966a') Singh, (1966); and Fliegel et al, (1968), as cited by Rogers, (1983).

8.2.5 Whether results of technology are visible for others to observe

Some results are easily observed and communicated to others whereas others are difficult to describe to others. According to Rogers (1983), for technology to be readily acceptable and invite participation it must have advantage, be compatible with local customs, not too complicated and easy to test and observe. Farmers learn much from observing and discussing their colleagues' experiences, their observations often being a reason to start discussion (van den Ban and Hawkins, 1996). Bohlen (1966) noted that people who have low ability to mentally handle abstract ideas tend to be more reluctant to adopt practices, which do not produce visible outcomes when used.

The study has revealed that eighty-five (85) out of the hundred respondents said results of animal traction technology were visible. They gave examples as fast and timely land preparation, reduced fatigue, increased farm size etc.

8.3 Effects of adoption of AT on selected aspects of the farming systems

The selected aspects of the farming systems include; type of crops grown, land preparation, selection of farm sites, mixed cropping, planting pattern, farm size, crop yields and cost of

production. These are selected because they are, some of the factors, which have direct effect on crop production, the purpose for which animal traction technology was introduced into the Builsa district. If farmers perceive a technology to be profitable, by either reducing costs or increasing income, without necessitating major changes in farming systems, they are likely to adopt that technology. (Panin and Ellis, 1992).

The distribution of respondents by the effects of adoption of A.T. on selected aspects of farming system is presented in Table 8.1.

From the survey conducted as indicated in Table 8.1, the adoption of animal traction has affected all the seven selected aspects of the farming system in one way or the other except mixture of crops grown. Animal traction does not prevent them from growing mixture of crops, that is putting more than one crop seed in one container, mix them and planting them at stake. AT reduces labour, helps in cultivation of large acreage. With the large acreage land is apportioned to different kinds of crops which will serve as security against total crop failure. Urasa, (1994) noted that for new technologies to be widely accepted they have to offer solutions to existing problems within traditional farming practices. Farmers who use traditional methods of seedbed preparation, planting, weeding and even harvesting, threshing and winnowing need to be convinced that alternative methods are cheaper, more effective and easier to operate, and/or that they lead to a higher work output.

Table 8.1 Distribution of respondents by the effects of adoption of AT on selected aspects of farming system

Aspect of Farming System	Effects	
	Yes	No
Types of crop grown	✓	
Land preparation	✓	
Site selection	✓	
Mixture of crops		✓
Planting pattern	✓	
Size of farms	✓	
Crops yields	✓	
Cost of production	✓	

Source: Field Survey 2002

8.3.1 Type of Crops grown

On type of crops grown, respondents said many different types of crops could be grown within a season with the introduction of AT. They also observed that, with AT, crops that need ploughing with AT could be done faster thus leaving enough time to crops that need ploughing with hoe, for example fara-fara potatoes and sweet potatoes. Respondents also indicated that acreage of food crops were reduced in favour of cash crops. For example acreage of staple crops like sorghum and millet were reduced in favour of groundnuts and rice. However, Deveze and Levaray (1988) as cited by Starkey (1988) noted that increased production of cash crops does not necessarily imply lower production of food crops. They said in the cotton zones in West Africa, where animal traction has been successfully promoted by cotton companies, food grain production has increased.

8.3.2 Land Preparation

According to the respondents AT has made seed bed preparation faster, easier, better and timely. Timeliness of ploughing, seeding and weeding may well improve with animal

traction, and lead to yield increases (Starkey, 1988). Respondents also noted that because they use the ridges, there is good drainage. Mathews and Pullen (1974) as cited by Starkey (1988) said crop yields may be affected by special techniques such as tied ridging. That joining ridges to form a grid of mounds and hollows can assist in soil and water conservation particularly in those semi-arid regions that have 400-700mm of annual rainfall.

8.3.3 Selection of farm sites

The study revealed that rocky, stumpy and muddy lands with very heavy soils might be avoided with the fear that implements might get damaged. Also the animals may not be strong enough to pull the implements when such conditions exist. Starkey (1988) reported that animal traction is associated with the tendency to move from bush fallow cultivation involving mixed cropping in partially-cleared areas still containing stumps, to permanent systems in which single crops are grown in cleared fields. The study also revealed that with the introduction of AT distant farming is encouraged. This is because they need more area to cultivate which they can not get within the compounds. Also farm produce can easily be conveyed home using carts. This observation is in line with Starkey (1988) who noted that AT may lead to intensification, with larger farm areas being less intensively managed. He said AT may well have a direct impact on the quality of life, by reducing drudgery.

8.3.4 Mixture of crops

Animal traction may lead to changes in the crop mix, and therefore may have differential effects on crop production. However, the study indicated that all the respondents (100) said AT has not affected their mixture of crops. Farmers still practice this system to avert total crop failure, reduce labour and make maximum use of land. According to Barrett et al (1982); and Panin, (1986); some surveys have not found marked differences in crop mix

associated with AT. They found that should a major change in crop mix be associated with AT, this could well affect food production and the local economy, with significantly different effects on the various members of farm households.

8.3.5 Planting Pattern

All respondents said the adoption of AT has affected their planting pattern. Apart from the timely planting, planting is done in rows and on ridges thus maintaining recommended spacing and optimum plant population. Others were of the view that AT wastes land especially when planting groundnuts. The furrows between ridges are left which results in low plant population and yield per unit area. However, all respondents indicated that with AT cultural practices are easier because of the ridges and row planting. When one plants on the ridges plants establish faster resulting in better yields. Lekezime (1988), cited by Starkey (1988), observed that line planting followed by early or regular inter-row weeding with draft animals may improve yield per unit of labour and unit of area.

8.3.6 Size of farms

Out of the hundred respondents interviewed ninety-eight of them said AT increases their farm size. Even those of them who do not practice AT agreed that AT increases farm size. The other two who said it decreases farm size argued on the basis that most of the land is not utilized - reference the spaces between the ridges. This results in low output per unit area. These findings support the observations made by Barrett et al (1982); Allagnat and Koroma, (1984); Panin, (1986); and Francis, (1988) that farmers will cultivate more land when they have draft animals. Gboku (1988), had the same observation when he said *"there is very often a correlation between farm size and the ownership of draft animals, although this does not necessarily mean that the animals are the cause of the large area of cultivation; it may be*

that the farmers that have big farms are the ones wealthy enough to use draft animals, so that draft animals may be the result of large farms".

8.3.7 Crop yields

Animal traction may assist farmers to increase the total production of their crops. From the study conducted 99% of the respondents said AT assist them to increase their crop yield. This they attributed to the timely ploughing, planting and weed control. The remaining 1% said it decreases crop yield. This, they argued that with AT one is tempted to plough a large area and may not be able to maintain the farms effectively thus the output per unit area will be low. Also with the ridging only half the area will be planted, for example in the case of groundnuts.

These diverse views were also noted by Sargent, Lichte, Matlan and Bloom (1981) as cited by Starkey (1988). They said AT is often associated with higher crops yields than those obtained by hoe-farming. However, this may not necessarily be a direct effect of the tillage, for the yield increase may be due to factors associated with, but not caused by the working animals. Panin (1986) found that a significant increase in total crop yield of maize, millet, groundnuts and beans was associated with ridge formation using oxen. Starkey (1988) also noted that timeliness of ploughing, seeding and weeding may well improve with AT, and lead to yield increases. Even though AT may assist farmers to increase the total production of their crops, Francis (1988), argued that in some cases there may be a drop in yields per unit area, as farmers tend to farm more extensively rather than intensively as indicated by the 1% of the respondents.

8.3.8 Cost of production

On the question whether AT has any effect on cost of production, 97% of respondents said it decreases cost of production, whilst 3% of them said it increases cost of production.

The 97% respondents argued that the amount spent to plough one acre of land using AT is far less than using hoe to clear the same piece of land. They went further to give examples like buying of drinks, cigarettes and food as the expenses. After spending so much, it is not a guarantee that they will finish clearing that plot of land and there is nothing binding them to come back the following day to complete. With draft animals, however there is a fixed amount, and he will have to finish ploughing before he is paid. In addition to the less amount spent on the cost of ploughing other cultural practices, such as planting and weeding are made easier and on time because of the ridges, which results to good establishment of the crop thus leading to higher yields. This agrees with the findings of Starkey (1988) who said when crops are planted in lines, weeding becomes easier and faster AT.

However, the other 3% were of the opinion that draft animal owners cultivate more land and because planting is done by hand, greater human labour is needed. More human labour is also needed to weed, harvest and process. They argue that even though total output may be more the total profit may be less compared to the hoe-farmer. This finding is in line with Francis (1988), who observed that in some cases there may be a drop in yields per unit area, as farmers tend to farm more extensively rather than intensively.

8.4 Summary: Uses, Perceptions and Effects of Adoption of AT on Selected Aspects of the Farming Systems

In summary all respondents said bullocks were used in carrying wood, gravel and farm produce. Eighty-five percent (85%) said bullocks were used in carrying water whilst 23%

said they knew that bullocks were used for transporting goods. All respondents knew that bullocks could be used for ploughing, ridging, harrowing and weeding. Only 3% said they knew that bullocks could be used for planting. On the use of donkeys, all respondents indicated that they knew donkeys were used for carrying water, wood, gravel, farm produce and transporting goods. All respondents also said they knew donkeys were being used for ploughing and ridging, Ninety-two percent (92%) said donkeys were used for weeding, whilst 85% said they were used for harrowing. Nobody knew that donkeys could be used for planting.

The study also revealed that AT has helped to reduce drudgery of farmers. There is faster, better and timely land preparation, recommended spacing resulting in optimum plant population and increased farm size leading to increases in total crop production. It was also noted that 89% of respondents said AT was consistent with their socio-cultural values, norms and beliefs, needs and existing farming practices. Ninety-one percent (91%) of respondents said AT technology was easy to understand, whilst 85% said results of AT could easily be seen and observed by others. However, 68% of respondents indicated that it was not easy experimenting with AT on small-scale basis because of the high cost and scarcity of draft animals and implements.

The above paragraph therefore answers objective (5) of the specific objectives which states "To find out respondents perception about the importance/usefulness of animal traction technology"

On the effects of adoption of AT on selected aspects of the farming system it was found that the adoption of AT has some effects on all of them, either positively or negatively with the

exception of the mixture of crops grown. However, it was found that there were more the advantages of AT within the farming system such as, easy and better timely land preparation and reduced drudgery. Animal traction also allows the practice of mixture of crops, which is common in the study area. As noted by Panin and Ellis (1992) noted that if farmers perceive a technology to be profitable, by either reducing costs or increasing income, without necessitating major changes in farm systems, they are likely to adopt that technology. This confirms that AT is compatible with the farming system within the study area.

CHAPTER NINE

ADOPTION OF ANIMAL TRACTION TECHNOLOGY

9.0 Introduction

Chapter nine presents the findings, presentations and discussions on categories of adoption and testing of the hypothesis to find out whether the independent variables stated earlier actually had effect on the adoption of AT technology. These independent variables include:

- Personal characteristics of farmers
- Socio-economic factors of farmers
- Socio-cultural factors of farmers and
- Extension methods used in promoting AT

9.1 Categories of adoption

The study came out with two categories of adoption namely:

- Those who adopted - those farmers who have decided to apply and continue to use AT
- Those who never adopted - those farmers who have decided not to apply and use AT

Out of the hundred (100) respondents, ninety-one adopted whilst only nine (9) never adopted. Of the nine (9) who did not adopt, four (4) could not afford the cost. Two (2) feared disappointment whilst three (3) had enough family labour.

These findings confirm the observations made by Galjart (1971) and Havens and Flinn (1975) as cited by Fliegel, (1984) that laggards are not necessarily unwilling to adopt innovations, but are unable to implement their adoption decision. Beal and Sibley (1967) cited by Shaner *et al* (1982) noted that even though farmers may be treated fairly, the anticipation of being treated unfairly may keep them away. Brown (1966) citing Mead (1955)

said local population might consider an innovation not only uneconomical (since human labour is considered cheaper) but also that it would leave the farmer "with even less of the creative work of which he now has too little".

9.2 Personal characteristics of respondents on adoption

This section presents discussions on the relationship between adoption and some personal characteristics of respondents. These are age of respondents, family size of respondents and educational level of respondents.

Ages of respondents on adoption

Table 9.1 Distribution of respondents on adoption by age

Adoption	Ages (years)				Total	
	30-52		53+			
Yes	50	54.9%	41	45.1%	91	100%
No	8	88.9%	1	11.1%	9	100%
Total	58		42		100	

Source: Field Survey 2002 df=1 N=100
Fisher Exact Two-tailed test (p)
0.08>p>0.07
*p>0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test shows no significant difference in distribution of respondents by age category and adoption.

Respondents by Family Size

Table 9.2 Distribution of respondents on adoption by family size

Adoption	Family Size				Total	
	1-13		14+			
Yes	71	78.0%	20	22.0%	91	100%
No	9	100%	0	0.0%	9	100%
Total	80		20		100	

Source: Field Survey 2002 df=1 N=100
Fisher Exact Two-tailed test (*p)
*p= 0.1978
*p>0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test shows no significant difference in distribution of respondents by family size category and adoption.

Educational level of Respondents

Table 9.3 Distribution of respondents on adoption by educational level

Adoption	Educational level				Total	
	No Formal		Formal			
Yes	67	73.6%	24	26.4%	91	100%
No	5	55.6%	4	44.4%	9	100%
Total	72		42		100	

Source: Field Survey 2002 df=1 N=100
Fisher Exact Two-tailed test (p)
*p= 0.2620
*p>0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test indicates no significant difference in distribution of respondents by educational level and adoption.

9.3 Socio-economic factors of respondents on adoption

Under this section, discussions are made on the relationship between adoption and socio-economic factors. These include ownership of cattle, ownership of donkeys, farm size and credit.

Ownership of Cattle

Table 9.4 Distribution of respondents on adoption by ownership of cattle

Adoption	Ownership of cattle				Total	
	Yes		No			
Yes	77	84.6%	14	15.4%	91	100%
No	4	44.4%	5	55.6%	9	100%
Total	81		19		100	

Source: Field Survey 2002 df=1 N=100
Fisher Exact Two-tailed test (p)
*p= 0.0114
*p<0.05 Significant

At 5% significant level, the Fisher exact two-tailed test shows significant difference in distribution of respondents by ownership of cattle category and adoption. There is a much higher percentage of those who adopted and own cattle, that is, 84.6% as against only 44.4% of those who did not adopt who own cattle. This finding confirms Fischer (1994) observation that for farmers to be able to use a new technology immediately after training, they must have their own animals and implements.

Ownership of Donkeys

Table 9.5: Distribution of respondents on adoption by ownership of donkeys

Adoption	Ownership of donkeys				Total	
	Yes		No			
Yes	17	18.7%	74	81.3%	91	100.0%
No	3	33.3%	6	66.7%	9	100.0%
Total	20		80		100	

Source: Field Survey, 2002 df = 1 N = 100
*p = 0.3779
*p> 0.05 Not significant

At 5% significant level, the Fishers exact two-tailed test shows no significant difference in the distribution of respondents by ownership of donkeys category and adoption.

Respondent's farm size

Table 9.6: Distribution of respondents on adoption by size of farms.

Adoption	Size of farms (acres)				Total	
	1-7		8+			
Yes	36	39.6%	55	60.4%	91	100.0%
No	9	100.0%	0	0.0%	9	100.0%
Total	45		55		100	

Source: Field Survey, 2002 df = 1 N = 100
*p = 0.00046
*p < 0.05 significant

At 5% significant level, the Fisher exact two-tailed test indicates significant difference in the distribution of respondents by farm size category and adoption. There is much less percentage of those who adopted, who had 1–7 acres that is, 39.6% as against 100% of those who did not adopt who had 1 – 7 acres. This finding confirms Starkey's (1988) citing Barret *et al* (1982),

Allagnat and Koroma (1984); Panin (1986). Francis (1988); Westneat, Klutse and Amegbeto (1988) observation that farmers will cultivate more land when they have draft animals.

Respondents who received credit

Table 9.7: Distribution of respondents on adoption by those who received credit

Adoption	Did you receive credit?				Total	
	Yes		No			
Yes	14	15.4%	77	84.6%	91	100.0%
No	2	22.2%	7	77.8%	9	100.0%
Total	16		84		100	

Source: Field Survey 2002 df = 1 N=100
*p = 0.6333
*p > 0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test shows no significant difference in the distribution of respondents by those who received credit category and adoption. Credit is therefore not an influencing factor on AT adoption.

9.4 Extension methods used in promoting animal traction on adoption

This section looks at the relationship between adoption and extension methods used in promoting animal traction. These are; training, demonstration method, lecture method and group discussion method. Others are demonstration and lecture against other methods and demonstration and group discussion against other methods.

Training

Table 9.8: Distribution of respondents on adoption by those who received training

Adoption	Did you receive training?				Total	
	Yes		No			
Yes	77	84.6%	14	15.4%	91	100.0%
No	4	44.4%	5	55.6%	9	100.0%
Total	81		19		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 0.0114
*p < 0.05 Significant

At 5% significant level, the Fisher exact two-tailed test indicates significant difference in the distribution of respondents by training category and adoption. This is because there is much higher percentage of those who adopted who received training that is 84.6% as against only 44.4% of those who did not adopt who received training. Training is therefore an influencing factor on adoption.

Demonstration method

Table 9.9 Distribution of respondents on adoption by demonstration method

Adoption	Demonstration				Total	
	Yes		No			
Yes	77	84.6%	14	15.4%	91	100.0%
No	4	44.4%	5	55.6%	9	100.0%
Total	81		19		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 0.0114
*p < 0.05 Significant

At 5% significant level, the Fisher exact two-tailed test indicates significant difference in the distribution of respondents by demonstration method and adoption. This is because there is

much higher percentage of those who adopted that had demonstration (84.6%) as against only 44.4% of those who had demonstration method of training and did not adopt. Hence demonstration method has influence on adoption.

Lecture method

Table 9.10: Distribution of respondents who received lecture method

Adoption	Lecture method				Total	
	Yes		No			
Yes	4	84.6%	87	15.4%	91	100.0%
No	0	44.4%	9	55.6%	9	100.0%
Total	4		96		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 1.0000
*p > 0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test indicates no significant difference in the distribution of respondents by lecture method category and adoption. Thus, lecture method has no influence in adoption.

Group discussion method

At 5% significant level, the Fisher exact two-tailed test shows significant difference in the distribution of respondents by group discussion. This is because there is a lower percentage of those who had group discussion method adopted (38.5%) as against 77.8% of those who had group discussion method and yet did not adopt. Group discussions therefore has influence on adoption.

Table 9.11: Distribution of respondents on adoption by group discussion

Adoption	Group discussion				Total	
	Yes		No			
Yes	35	35.5%	56	61.5%	91	100.0%
No	7	77.8%	2	22.2%	9	100.0%
Total	42		58		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 0.03287
*p < 0.05 Significant

Both demonstration and lectures

At 5% significance level, the Fisher exact two-tailed test shows difference in the distribution of respondents by both demonstration and lecture method category and adoption. This is because only 4.4% those who had demonstration and lectures adopted, whilst 95.6% of those who did not receive that training adopted. Hence demonstration and lectures have no influence on adoption.

Table 9.12: Distribution of respondents on adoption by those who received training in demonstration/lecture methods

Adoption	Demonstration and lecture method				Total	
	Yes		Other methods			
Yes	4	4.4%	87	95.6%	91	100.0%
No	0	0.0%	9	100.0%	9	100.0%
Total	4		96		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 1.00000
*p > 0.05 Not significant

Respondents who received both demonstration and group discussion methods

Table 9.13: Distribution of respondents on adoption by demonstration and group discussion method

Adoption	Demonstration and group discussion				Total	
	Demonstration & group discussion		Other methods			
Yes	27	84.6%	62	68.1%	91	100.0%
No	5	44.4%	4	44.4%	9	100.0%
Total	34		66		100	

Source: Field Survey 2002 df = 1 N = 100
*p = 0.26662
*p > 0.05 Not significant

At 5% significant level, the Fisher exact two-tailed test indicates no significant difference in the distribution of respondents by those who received both demonstration and group methods category and adoption. This is because those who did not receive demonstration and group discussion training and adopted (68.1%) are more than those who received demonstration and group discussion and did not adopt (44.4%).

Summary of Fisher exact tests results

Independent Variable	Fisher Exact Two-Tailed Value at 0.05	Level of Significance
• Ages of respondents	P = 0.08 > p > 0.07	Not Significant
• Respondents family size	P = 0.1978	Not significant
• Educational level of respondents	P = 0.2620	Not significant
• Ownership of cattle	P = 0.0114	Significant
• Ownership of donkeys	P = 0.3779	Not significant
• Respondents farm size	p = 0.00046	Significant
• Respondents who received credit	p = 0.6333	Not significant
• Respondents who received training	p = 0.0114	Significant
• Respondents who received training by demonstration alone	p = 0.0114	Significant
• Respondent who received training by lecturers alone	p = 1.0000	Not significant
• Respondents who received training by group discussion alone	p = 0.03287	Significant
• Respondents who received both demonstration and lecture methods	p = 1.0000	Not significant
• Respondents who received both demonstration and group discussion methods	p = 0.26662	Not significant

CHAPTER TEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

10.0 Introduction

The study was set out to verify and substantiate the speculation of low adoption of AT in the Builsa district. This final chapter summarizes the activities that were undertaken during the course of the study and the findings thereof. It also presents the implications of the findings with regards to the research objectives and gives relevant recommendations.

10.1 Summary

In chapter one, mention is made that agriculture contributes a substantial proportion of the foreign exchange earnings, provides employment to between 60-70% of the country's population. However the use of human power in agriculture still predominates over other sources of farm power. This had led to low level of growth in agricultural production. To increase agriculture output therefore Dibbits (1997) suggested the provision of more efficient means of production that save labour and reduce drudgery, hence the use of draft animals. But in doing so, it is necessary to identify district specific farmer needs to be able to propose policies and measures. History has it that animal traction was introduced into the Builsa district since 1937. Since farmers' needs are location specific, the study came out to find the causes of the low adoption of AT in the Builsa District. In an attempt to find these causes the study came out with research questions, hypotheses and specific objectives.

Chapter two gave an overview of the study area with regard to location, population, age distribution, distribution of household by size, topography, climate soils, vegetation, economic activities, farming systems and agricultural extension in the Builsa District.

The history of animal traction in Ghana was examined in Chapter Three under the following headings; origin of AT, the genesis of AT in Ghana, the current state of AT in Ghana and a historical development of animal traction in the Builsa District.

In Chapter four, literature made mention of factors which can affect adoption. These include; personal characteristics, socio-economic factors, socio-cultural factors external factors such as the Extension Agents' knowledge in animal traction and his communication skills.

Chapter five describes the methodology of the study. Descriptive survey was used to collect the data. The study area was purposively selected. The population of the study was all farmers and Agricultural Extension Agents (AEAs) in the district. A two stage random sampling was used to select farmers to get a total of 100 respondents. Complete survey was used for the AEAs. The following instruments were used to collect the data;

- Interview scheduled questionnaires
- Questionnaires
- Informal interviews with farmers
- Literature and office records

The data was edited, coded and entered into the Computer. Data was analysed using SPSS and results interpreted and discussed.

In Chapter six, seven, eight and nine present the empirical findings of the study interlaced with discussions of such findings. Section one of chapter six presents findings on personal characteristics. Here it was found that 40% of farmers were between the ages of 30-45 years (youth). Majority of respondents had family size of 1-9 members (44%). Those who had no formal education formed 72%. On socio-economic factors 81% of respondents had cattle,

whilst 80% did not have donkeys. Majority of respondents (46%) said few farmers could afford animal traction services and 65% of respondents said animal traction services were not readily available. It was also indicated that 84% of respondents did not receive credit. Forty-two percent of respondents were medium scale farmers. The small scale farmers were the least (24%).

On socio-cultural factors, 100% of respondents said the use of animal traction was culturally acceptable in the community; 56% of respondents rated status given to bullock owners as high, 34% very high and 10% average, 54% rated status given to donkey owners as high, 35% average, 7% very high and 4% low. On average more status is given to bullock owners than donkey owners. The study revealed that any category of people be they female or male, could manage work animals.

In Chapter six section two, majority of AEAs (35%) had only one in-service training in animal traction. Majority of respondents (88.2%) had their training from MoFA, followed by farmers (29.5%) and NGOs (23.6%) respectively. Forty-seven percent sometimes made visits to farmers. Only 23.5% always made visits whilst 24.4% never made visits to farmers. Reasons for AEAs inability to make visits were; lack of means of transport (52.9%) large operational areas (47.1%), no fuel (29.4%), farmers did not have training materials (29.4%) and lack of knowledge in animal traction (23.5%). The study also found that majority of AEAs (64.7%) was trained using demonstration method.

Chapter seven focused on findings in extension methods used in promoting AT. All respondents were aware of animal traction. Majority of respondents (80%) had their source of information from MoFA. The study also found that 84 out of 100 respondents had training.

Ninety-seven percent of this number had training from their families. The study also found that majority of respondents (43%) had training through demonstration and 60% of respondents ranked their level of participation in handling bullocks, yoking and nose ringing as very high. Also 93% of respondents never had visits from AEAs. Respondent listed the following as factors hindering the adoption of animal traction; lack of capital, high cost of implements and spare parts, lack bullocks, theft of cattle and feed for animals during the dry season.

In Chapter eight, uses, perception and effects of adoption of AT on selected aspects of the farming system were discussed. Over 80% of respondents were aware that bullocks and donkeys were used for traction and haulage activities. All respondents agreed that animal traction reduces drudgery. Over 80% said animal traction was consistent with socio-cultural values, norms, beliefs, needs and existing farming practices. Similarly, over 80% of respondents also indicated that animal traction technology was easy to understand, see and observe by others. However, 68% of respondents indicated that it was not easy experimenting animal traction technology on small scale because of high cost and scarcity of draft animals and implements.

In Chapter nine, adoption was found to be 91%. Personal characteristics and adoption, ages of respondents, family size and educational level showed no significant difference. Under socio-economic factors ownership of donkeys and credit also showed no significant difference whilst ownership of cattle and farm size indicated significant difference. Under extension methods used in promoting AT and adoption, training, demonstration method alone, and group discussion alone showed significant difference whilst lectures alone, both

demonstration and lectures and both demonstration and group discussion indicated no significant difference.

10.2 Conclusion and Implications

This section concludes the study with regards to whether the research objectives spelt out have been met. It also highlights the implications of the findings of the study. Three of the research questions were answered in chapter nine whilst the fourth one was answered in chapter eight. Hence the conclusions and implications shall be based on these answers.

Objective 1: To find out the historical development of animal traction in the Builsa district

Animal traction was introduced into Builsa District in 1937 to address the problem of recurrent food shortage in the area. The paramount chief of the area was among the first 19 converts in the then Mamprusi district. The paramount chief met his sub-chiefs and told them to inform their subjects of the existence of the animal traction programme and that interested farmers should come along with their bullocks for training. Farmers were sent to Tono Farm Centre for training. In 1940, under the initiative of the paramount chief, the Builsa Native Administration started a loan scheme to provide farmers with bullocks and ploughs. In 1945 because of long distance from Tono Farm Centre, a new Native Authority Farm Centre was opened in the district, under the influence of the paramount chief.

However, in the early years of Ghana's Independence, the use of animal traction declined because of large importation of tractors. Attention was again paid to animal traction in the early 1970s when tractors were no longer available. The Roman Catholic and Presbyterian Churches intervened in 1969 and 1974 respectively to give animal traction a new boost.

This suggests that before introducing a technology into a peasant-farming community, the people must first of all express the need for the technology. This was shown when the people said they can only improve their farms and be self-supporting if they practice animal traction. Some of them were quoted as saying that they will never return to the old and traditional methods. This means they saw the importance of the technology. Also the introduction of a new technology into a peasant-farming community should be gradual and optional, thus no force should be applied. This was shown by the paramount chief when he asked interested farmers to come down with their bullocks. Omoding (1994), observed that chiefs and rulers sometimes use coercion to implement programmes in order to please their masters, which probably accounted for unsustainable adoption of ox cultivation is some areas in Uganda. It is worth noting that farmers respect their traditional rulers. Hence in an attempt to introduce a technology stakeholders (AEAs, NGOs) should first meet traditional rulers to solicit their support. Some of them can be made contact farmers. This is because people will more readily follow their chief's example than they will for that of a private individual, however, successful he may be.

Objective 2: To find out farmers' personal characteristics and their effects on adoption of animal traction

Majority of respondents (44%) were the youth whilst the aged were the least, (20%). Respondents with family size of 1-9 persons were the majority (47%) with those having 20+ persons as the least (9%). The study also indicated that 72% of respondents had no formal education. On personal characteristic and their effects on adoption, ages of respondents, family size and level of education showed no significant difference, between the respondents who had adopted AT and those who had not. This indicates that any body is capable of adopting a technology irrespective of his age, educational level or the size of his family. It is therefore suggested that AEAs and NGOs should not discriminate on the basis of age, education or the size of the clients family when delivering their extension messages.

Objective 3: To determine the socio-economic factors of farmers which affect adoption of animal tradition

On the socio-economic factors of farmers that affect adoption of animal traction, ownership of cattle and farm size were found to be significant, whilst credit and ownership of donkeys showed no significant difference between respondents who had adopted AT and those who had not. From this it is shown that ownership of cattle and farm size has influence on AT adoption. To make sure that farmers own their own cattle/bullocks it is suggested that AEAs and NGOs should encourage farmers to form Associations and open bank accounts with the Banks. This will enable individual farmers to be able to access loans to buy their own bullocks. Bullock banks can also be established by MOFA and NGOs and sold to farmers on soft terms. On the part of farm size AEAs should educate farmers on the need to have manageable farms to derive maximum benefits from them.

Objective 4: To examine the socio-cultural factors of farmers which affect adoption of animal traction

The study found that all the 100 respondents said the use of animal traction was culturally acceptable. About 90% rated status given to draft animal owners as high. All respondents also indicated that there was no taboo restraining any category of people from managing draft animals, be they male or female. Thus a farmer's willingness to adopt a technology is largely influenced by socio-cultural factors such as beliefs, norms, values and taboos of the social system in which he finds himself (Shaner, Philipp and Schemehl, 1982; de Graaf, 1992 and Panin and Ellis, 1992). From the study it is shown that cultural acceptability of AT has contributed to its high adoption (91%). It is therefore suggested that before a technology is introduced into a community, AEAs and NGOs in agricultural extension should study the socio-cultural factors of the area. It is also advised that MOFA should employ AEAs who can empathise with farmers. These days people seek admission into agricultural colleges because

of job security and not for the love of it. It is also suggested that when MOFA is admitting students into agricultural institutions, priority be given to students with farming background.

Objective 5: To find out farmers' opinions on the importance/usefulness of animal traction

More than 90% of respondents said draft animals could be used for traction and haulage activities. All the respondents indicated that the use of draft animals reduces drudgery. This implies that when introducing a technology, farmers must see it as useful. Conroy *et al* (1995) citing Appleton (1993) said farmers will adopt new technologies if technologies either reduce their workload significantly or is capable of being incorporated into the work without adding to the overall burden. Even though more than 90% of respondents agreed to the importance of AT, yet majority of them do not make use of them because they can not afford. It is suggested the NGOs and MOFA establish implement stores in the district. These implements can then be sold to farmers on hire purchase basis. Farmers Services Company (FASCOM) is already in that business but farmers can not pay the cash demanded by FASCOM.

Objective 6: To determine the compatibility of animal traction within the farming system of the Builsa district.

All the respondents indicated that animal traction did not interfere with their mixed cropping system, which is commonly practised to avoid total crop failure and also to make sure they get a bit of their traditional crops. It also makes land preparation planting, weeding etc. easy. This suggests that a new technology will be accepted to the target group if it is compatible with existing farming principles and cultivation practices (Urasa, 1994). From the study it is shown that AT is compatible within the farming system. This has contributed to the high adoption of AT (19%). It is suggested that the farming system of an area be studied before

introducing an intended technology. AEAs and NGOs should meet traditional leaders and farmers to brief them on the intended technology. Use should also be made of available reports and documents on agriculture in the area.

Objective 7: To find out the various categories of adoption of animal traction

There were two categories of adoption

- Those who adopted (91%)
- Those who never adopted (9%)

This disproves Starkey's (1988) result of 10-20% adoption. However, this increase in adoption could be due to the time lapse between 1988 and 2002. Also Starkey's results covered the whole North and not as specific as this study.

Objective 8: To find out the effectiveness of the extension methods used in promoting animal traction

Farmers described effectiveness of extension methods as

(1) Ability of extension officer to explain to the understanding of farmers the advantages and disadvantages of a technology.

(2) Ability to convince farmers that advantages out weigh the disadvantages and

(3). The number of farmers who will adopt the technology

From the description of effectiveness of extension methods from farmers view point, one can say extension methods were effective with adoption of 91%. The findings also showed that training, demonstration alone and group discussion alone were significant, whilst lectures, demonstration/lectures and demonstration/group discussions were found to have no significance on adoption of animal traction. The findings imply that even though most of the

training was done by families (refer to Table 7.2) the farmers needed the training (skills) and the right methods were used in the right situations. Hence before using a method, the characteristic of the message, the teaching and learning objectives and what the participants are expected to be able to do with the content of the message should also be considered (Kwarteng and Zinnah, 1994). Majority of farmers being trained by families implies that transfer of technologies is not only done by extension staff (formal) but can also be done by farmers themselves (informal) depending on the need they have for that particular technology. Starkey (1990) found that once animal traction has started in a region, much transfer has been informal, within families, from farmer to farmer or from regional immigrants to local farmers.

Training is vital for the adoption of AT especially with the demonstration and group discussion methods. But government (MOFA) has done very little with regards to the study conducted. For example 11.8% of AEAs had AT training (Table 6.10). In table 7.2 only 21.4% of farmers had training from MOFA. To promote and maintain AT in the Builsa district, it is suggested the MOFA in collaboration with NGOs interested in AT establish AT training station in the district where practical training workshops will be organised for farmers and AEAs periodically. This will create an atmosphere for demonstrations and group discussions among participant.

10.4 RECOMMENDATIONS

This section gives recommendations based on the conclusions and implications of the findings. However, these recommendations are limited to the Builsa district only since the research was a purposive one.

In introducing a technology into a peasant farming community like the Builsa Community the study has the following recommendations to make.

(1) The farmers must first of all express the need for the technology as indicated in Chapter ten section 10.3 under Objective 1. Urasa (1994) found that for new technologies to be widely accepted they have to offer solutions to existing problems within traditional farming practices.

(2) The technology must fit into the existing farming system. One of the reasons for the high adoption was that animal traction did not interfere with farmers' mixed farming practice, a practice they do to avoid total crop failure. Bwalya (1988), observed that for many small-scale farmers the bottom line of their activities is survival. This means that their decisions on cropping patterns, implement choice, etc are essentially based on risk avoidance.

(3) That traditional leaders/rulers should be involved when introducing a technology into the Builsa community. This is because people will more readily follow their chief's example than they will a private individual however, successful he may be.

(4) From the study credit was identified by both farmers and AEAs as a major factor hindering the adoption of AT yet credit facilities exist in the district. The problems of farmers have been accessibility to these credit facilities. During the study farmers enumerated reasons for not getting credit. Refer to Chapter six, section 6.2.2. This is due to lack of education. It is recommended that financial institutions should get to the doorsteps of the communities and educate farmers rather than sitting in offices expecting farmers to come. In case these institutions lack personnel /staff, they can collaborate with Ministry of Food and Agricultural to use some of their staff.

Further research:

(1). The study has only concentrated on animal traction and crop production. However, crop production cannot go on without a favourable environment. The study therefore suggests research into the impact of use of animal traction on the environment in the Builsa District.

(2). From the study also, it was noted that 72% had no formal education as against 28% with formal education. Comparing with the level of AT adoption (91%) one is tempted to infer that AT may have affected the number of children who go to school, hence the low level of literacy in the district. The study suggests a research into the effect of AT adoption on schooling.

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LIST OF APPEDICES

APPENDIX 1

ADOPTION OF ANIMAL TRACTION TECHNOLOGY IN THE BUILSA DISTRICT OF UPPER EAST REGION OF GHANA

QUESTIONNAIRE FOR FARMERS OF VILLAGES WHERE ANIMAL TRACTION TECHNOLOGY HAS BEEN INTRODUCED IN THE BUILSA DISTRICT

PART ONE

INTERNAL FACORS OF FARMERS INFLUENCING ADOPTION OF ANIMAL TRACTION TECHNOLOGY

A. BACKGROUND INFORMATION:

1. Name of Village:.....
2. Name of section:.....
3. Name of house:.....
4. Name of Farmer:.....
5. Sex: Male [ ] Female [ ]
6. Marital Status
   1. Married [ ]
   2. Single [ ]
   3. If a man, number of wives:.....
7. Family size
   1. No. of adults [ ] Male [ ] Female [ ]
   2. No. of children Boys [ ] Girls [ ]
8. Age of farmer:..... Years
9. Farming experience:..... Year
10. Educational background
    1. No formal education [ ]
    2. Primary School [ ]
    3. Middle/J.S.S [ ]
    4. Secondary/vocational [ ]
    5. Tertiary [ ]
    6. Other (specify) [ ]

B. SOCIO-ECONOMIC CHARACTERISTICS OF FARMER

11. Ownership of draft animals. Tick all that apply

Type of ownership

ANIMAL	FAMILY	INDIVIDUAL	OTHER SPECIFY
1. Cattle			
2. Working bullocks			
3. Donkeys			
4. Working donkeys			

In question 12 and 13 indicate the activities you use draft animals for.

12. Use of Cattle. Tick all that apply.

Type of Haulage		Type of traction	
1. Carrying water	[ ]	1. Ploughing	[ ]
2. Carrying wood	[ ]	2. Ridging	[ ]
3. Carrying gravel	[ ]	3. Harrowing	[ ]
4. Carrying farm produce	[ ]	4. Planting	[ ]
5. Transporting goods to market	[ ]	5. Weeding	[ ]
6. Other specify	[ ]	6. Other specify	[ ]

13. Use of donkeys. Tick all that apply.

Type of Haulage		Type of traction	
1. Carrying water	[ ]	1. Ploughing	[ ]
2. Carrying wood	[ ]	2. Ridging	[ ]
3. Carrying gravel	[ ]	3. Harrowing	[ ]
4. Carrying farm produce	[ ]	4. Planting	[ ]
5. Transporting goods and people to market	[ ]	5. Weeding	[ ]
6. Other specify	[ ]	6. Other specify	[ ]

14. Why don't you use animal traction for the mentioned farm practices? Cattle

Farm Practice	Use	Not use	Reasons
1. Ploughing			
2. Ridging			
3. Harvesting			
4. Weeding			
5. Planting			
6. Haulage			
7. Other specify			

15. Donkeys

Farm Practice	Use	Not use	Reasons
1. Ploughing			
2. Ridging			
3. Harvesting			
4. Weeding			
5. Planting			
6. Haulage			
7. Other specify			

16. What is your opinion about the level of affordability of animal traction services by farmers in your community

1. All farmers can afford [ ]
2. Most farmers can afford [ ]
3. Some farmers can afford [ ]
4. Few farmers can afford [ ]
5. Most farmers can not afford [ ]

17. How would you rate the availability of animals traction services in your community?

1. Readily available [ ]
2. Somewhat available [ ]
3. Not readily available [ ]

18. Do you get any credit facility for farming? If yes, tick all that is applicable.

Source	Type of credit			Use of Credit				Adequacy of Credit		
	Cash	Inputs	Equip-ment	To buy animals	To buy equip-ment	To buy food	Other specify	Not adequate	Some what adequate	Very adequate
1. Banks										
2. NGOs										
3. MoFA										
4. Money lenders										
5. Friends										
6. Family										
7. Other specify										

19. How would you rate the availability of credit facilities in your community?
    1. Readily available [ ]
    2. Some what available [ ]
    3. Not readily available [ ]

20. How would you rate the timeliness of credit?
    1. Always timely [ ]
    2. Sometimes on time [ ]
    3. Mostly late [ ]

21. How many farm sites do you have?.....
22. What is your total farm size?.....
23. What is your source of farm labour? .....
    1. Family [ ]
    2. Hired [ ]
    3. Communal [ ]
    4. Other specify [ ]

24. Apart from farming, what is your other source of income? Tick all applicable.
    1. Trading [ ]
    2. Blacksmith [ ]
    3. Crafts [ ]
    4. Government employment [ ]
    5. Other (specify) [ ]

25. How do these sources of income influence your use of animal traction?
    .....
    .....
    .....
    .....
    .....

26. How does the use of animal traction influence the following aspects in your farming activities?

Activity	Increase	Decrease	No Influence
1. Crop yield			
2. Cost of production			
3. Use of farm labour			

PART TWO

EXTERNAL FACTORS INFLUENCING ADOPTION OF ANIMAL TRACTION TECHNOLOGY

C. SOCIO-CULTURAL FACTORS

27. Is it culturally acceptable to use animals to farm?

1. Yes [ ]
2. No [ ]

28. What level of respect/status is accorded for using animal traction in your community?

Animal	1	2	3	4	5
	Very high status	Higher status	Average status	Low status	Very low status
Donkeys					
Cattle					

29. Who manages the work animals in your household? Tick all applicable

1. Boys [ ]
2. Girls [ ]
3. Women [ ]
4. Men [ ]

30. How many people are required to manage work animals in your household?

1. Donkeys.....
2. Cattle.....

31. How does the use of animal traction influence the following aspects of your farming?

a. Crops cultivation.....
b. Land reparation.....
c. Site of farm.....
d. Cropping system (mixed cropping.).....
e. Planting pattern .....
f. Size of farm .....

32. Rank in order of importance how the following influence the adoption of animal traction with 1st being the most important influencing factor .....5th least important influencing factor.

a. Reducing Cost. [ ]
b. Increase in income [ ]
c. Yield increase [ ]
d. Use of labour [ ]
e. Farm size [ ]

33. Rank the following in order of importance to consider when adopting a technology?
1st 2nd 3rd 4th

a. Compatibility [ ]
b. Complexity [ ]

c. Trialability [ ]
d. Relative economic advantage [ ]
e. Observability [ ]

D. EXTENSION DELIVERY METHODS

34. Have you heard of animal traction before?
1. Yes [ ]
2. No [ ]

35. If yes to question, 34 indicate your source of information. Tick all applicable
1. MOFA (FLS) [ ]
2. NGOs [ ]
3. Friends [ ]
4. Family [ ]
5. Other specify [ ]

36. Did you get any training on animal traction?
1. Yes [ ]
2. No [ ]

37. If yes to question 36 provide the following information

Organisation which trained you	Adequacy of duration					
	Duration of training	Highly Inadequate	Inadequate	Some what adequate	Adequate	Highly adequate
MOFA [ ]						
NGOs [ ]						
Friends [ ]						
Other specify [ ]						

38. Indicate the time of the year you had the training and its suitability. Give reasons

Time of year	Suitability		Reasons
	Suitable	Not suitable	
1. Cropping season [ ]			
2. Off season [ ]			
3. Other specify [ ]			

39. Which of the following methods were used during the training. Tick all applicable

1. Demonstration [ ]
2. Lectures [ ]
4. Group discussion [ ]
8. Individual [ ]
16. Audio visuals [ ]

40. How would you judge the effectiveness of these methods? Give reasons

Method	1. Highly ineffective	2. Ineffective	3. Some what effective	4. Effective	5. Highly effective	Reasons
Demonstrations						
Lecture						
Group						
Discussions						
Individual						
(Home/Farm visit)						
Audio visuals						

41. If you got trained in a group, how many were you? .....

42. How would you rate your level of participation in the following activities?

Activity	Level of Participation				
	Very high (1)	High (2)	Average (3)	Low (4)	Very low (5)
Selecting of farmers					
Selecting of site					
Handling of bullocks					
Yoking of bullocks					
Nose ringing					
Selecting of animals					

43. Did the trainer allow you to ask questions?
1. Yes [ ]
2. No [ ]

44. Did the trainer respect your views?
1. Yes. [ ]
2. No [ ]

45. How would you rate the level of competence (knowledge, skills) of trainers during training?
1. Very competent [ ]
2. Some what competent [ ]

3. Not competent [ ]

46. How would you rate the level of confidence of trainers during training?
1. Very confident [ ]
2. Somewhat confident [ ]
3. Not confident [ ]

47. Have the trainers visited you after training?
1. Yes [ ]
2. No [ ]

48. If yes to question 47, how often did they visit you?
1. Fortnightly [ ]
2. Monthly [ ]
3. Quarterly [ ]
4. Yearly [ ]

PART THREE

ADOPTION OF ANIMAL TRACTION TECHNOLOGY

E. FARMERS PERCEPTION OF ANIMAL TRACTION TECHNOLOGY

49. Indicate what you have learnt to do with animal traction, what you are doing and how you do it. Give reasons.

What you learnt	What you do	How you do it	Reasons
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

50. What factors influence the adoption of animal traction technology?

APPENDIX 2

ADOPTION OF ANIMAL TRACTION TECHNOLOGY IN THE BUILSA DISTRICT OF UPPER EAST REGION OF GHANA.

QUESTIONNAIRE FOR AGRICULTURAL EXTENSION AGENTS WORKING IN BUILSA DISTRICT.

A. BACKGROUND INFORMATION

1.Name of Officer .....

2. Operational Area .....

3. Sex: 1. Male [ ] 2. Female [ ]

4.Age.....

5.Marital status: 1. Married [ ] 2. Single [ ]

6.Number of years in service .....

7.Languages spoken: 1. English [ ] 2. Buli [ ] 3. Other specify [ ]

8.Highest formal educational level:

1. Agricultural College Certificate [ ]
2. University Diploma [ ]
3. University degree [ ]
4. Other specify [ ]

9.List other courses attended

Course	Place	Year	Duration	Sponsors/organisation

B. EXTENSION AGENT'S LEVEL OF KNOWLEDGE IN ANIMALS TRACTION

10. Indicate the institution in which you got animal traction knowledge. Tick all applicable.

Institution	Form of Tuition		
	Theory only	Practical only	Practical and Theory
1. Secondary School [ ]			
2. Agricultural College [ ]			
3. University [ ]			
4. Other specify [ ]			

11. Indicate the adequacy of the time allotted for the tuition.

Form of Tuition	Adequacy of time allotted		
	Not adequate	Somewhat adequate	Adequate
1. Theory			
2. Practicals			

12. Indicate the relevance of animal traction to you at the various institution levels. Give reasons.

Institutional level	Relevance					
	Highly irrelevant	Irrelevant	Somewhat relevant	Relevant	Highly relevant	Reasons
1. Secondary School						
2. Agric College						
3. University						
4. Other Specify						

13. Animal traction trainings after joining service. Tick all applicable

Organisation	No. of trainings	Duration	Adequacy of Duration			Reasons
			Very adequate	Somewhat adequate	Not adequate	
1. MOFA [ ]						
2. NGOs [ ]						
3. Farmers [ ]						
4. Other specify [ ]						

14. Indicate the time of the year trainings are usually done and its suitability. Give reasons

Time of year	Suitability		Reasons
Training done	Suitability	Not suitably	
1.			
2.			
3.			

15. Which of the following methods were used during any of the animals traction training? Tick all applicable.

1. Demonstrations [ ]
2. Lectures [ ]
3. Groups discussions [ ]
4. Audio visuals [ ]
5. Role plays [ ]

16. Rank in order of effectiveness the following methods which were used in helping you acquire knowledge in animals traction. 1st most – 5 least.

a. Demonstrations [ ]
b. Lectures [ ]
c. Groups discussions [ ]
d. Audio visuals [ ]
e. Role plays [ ]

17. Indicate the level of competence and confidence of resource persons during trainings.

Competence Knowledge/skills			Confidence		
Very competent	Somewhat competent	Not competent	Very confident	Somewhat confident	Not confident

18. Rank in order the following with regards to the frequency of training. 1st most –8th least.

a. Crop Production [ ]
b. Animals [ ]
c. Fish Production [ ]
d. WIAD activities [ ]
e. Animal traction [ ]
f. Extension methods [ ]
g. Record keeping [ ]
h. Post-harvest losses [ ]

C. EXTENSION AGENT'S DELVERY METHODS

19. Do you train farmers in animal traction? Yes [ ] No [ ]

20. If yes to question 19, indicate the source of your knowledge/skills in training farmers in animal traction and the methods you used in training them. Tick all applicable.

Source	Methods Used					
	Demonstration	Lecturers	Individuals	Group discussion	Audio visuals	Role play
MoFA [ ]						
NGOs [ ]						
Friends [ ]						
Farmers [ ]						
Other specify [ ]						

21. How would you rate farmers interest in animal traction before and after the training? Give reasons.

Period	Farmers	Interest				Reason
a. Before training	1. Every high	2. High	3. Average	4. Low	5. Very low	
b. During training						
c. After training						

22. How many farmers have you trained in animal traction in the last 10 years?
.....

23 By your estimation, how many of that number have adopted animal traction?
.....

24. Indicate the following and give reasons **Reasons**
    a. Number adopted [ ]:.....
    b. Number tried and dropped [ ]:.....
    c. Number never tried [ ]:.....

25. Do you usually make follow-ups after the training?
    1. Always
    2. Sometimes
    3. Never

26. If not always what prevents you from making the follow ups?
    1. :.....
    2. :.....

27. What problems do your farmers face with regards to animal traction? List them.
    1.
    2.
    3.
    4.

5.

28. Are you able to solve the farmers' problems with regards to animal traction adoption?
    1. Always
    2. Sometimes
    3. Never

APPENDIX 3

SOME IMPORTANT EVENTS USED IN ESTIMATING THE AGES OF SOME OF THE RESPONDENTS.

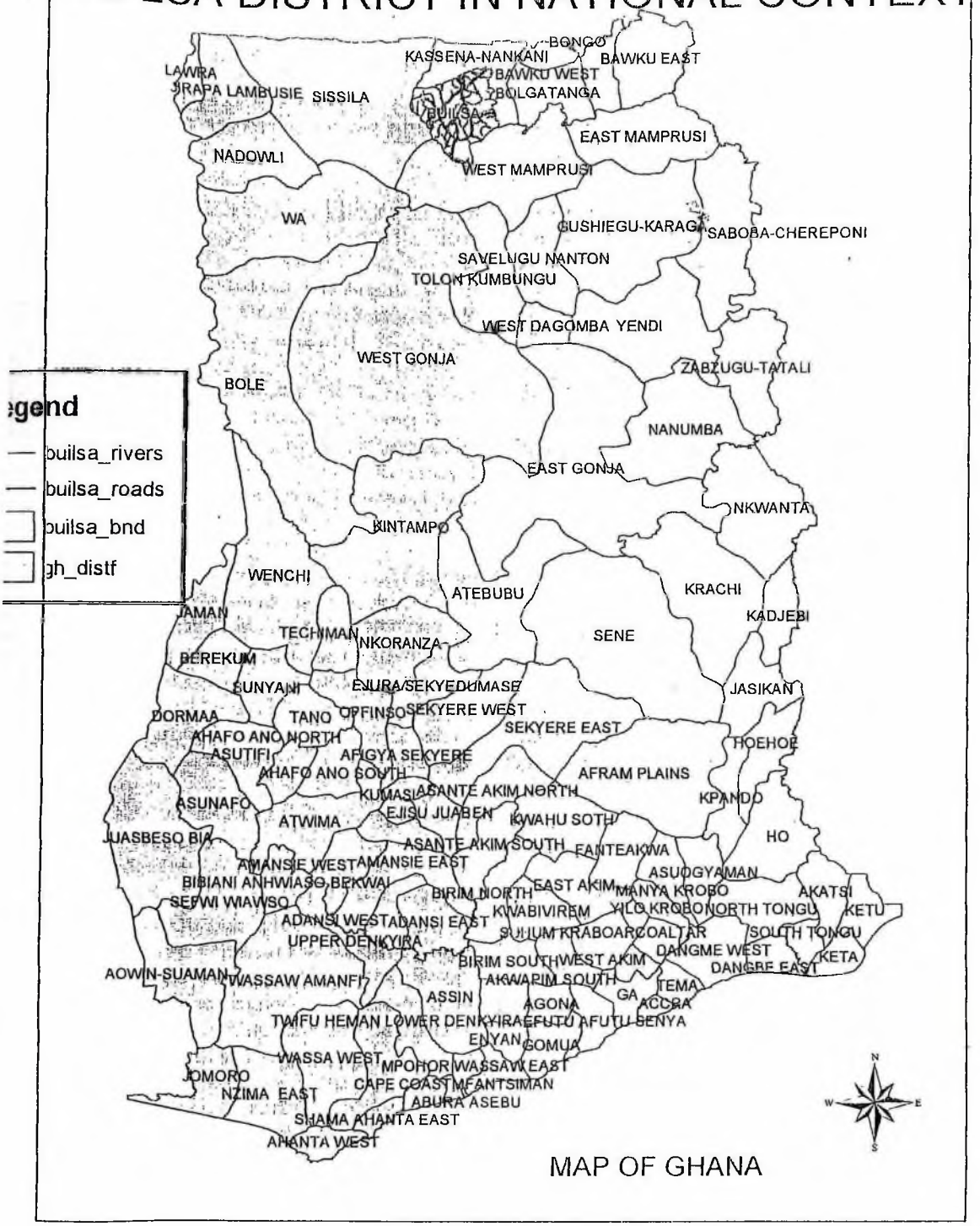
DATE	EVENT
1928	White Fathers settled in Wiagah
1936	Old Primary School (Sandema) opened.
1939-1945	Second World War
1951	Wiagah Land Planning started
1954	Sandema Middle Boarding School opened
6th Mar 1957	Ghana attained independence
1957	St. Matins' Middle School (Wiagah) opened
1960	Presbyterian Church started in Sandema
1961	Police Station opened in Sandema
24th Nov 1965	Sandema Health Centre opened.
24th Feb 1966	Dr. Kwame Nkrumah Overthrown in a coup d'etat
1969	Dr. K. A. Busia became the Prime Minister of the 2nd Republic of Ghana
1969	Aliens compliance order passed
13th Jan 1972	Dr. K. A. Busia overthrown in coup d'etat

APPENDIX 4

ENSTOOLMENT OF SOME CHIEFS WITHIN THE STUDY AREA

DATE	NAME OF CHIEF	VILLAGE	STOOL NAME
1919	Anisonyaansa	Siniensi	Akpiok
1926	Adangabe	Kadema	Akaasanab
1927	Asangalisa	Chuchuliga	Azung
1927	Ayarik	Gbedema	Annab
1931	Azantilow	Sandema	Sandema-Nab
1938	Atong	Doninga	Anaah
1940	Abuntori	Wiesi	Anyaani
1948	Asuik	Wiagah	Anigiak
1949	Akanko	Fumbisi	Anyiab
1958	Atiamoah	Bachonsa	Afiok
1958	Atirikperi	Gbedembilisi	Agberikum
1959	Agaankoba	Uwasi	Anaab
1959	Akanfella	Kanjarga	Azundiok

BUILSA DISTRICT IN NATIONAL CONTEXT



MAP OF BUILSA DISTICT