ADOPTION OF INNOVATIONS IN PARTICIPATORY AGRICULTURAL DEVELOPMENT AND EMPOWERMENT PROJECT (PADEP) IN TANZANIA: CASE STUDY HANDENI DISTRICT, TANGA

BY

GEORGE KAPINGA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2011

ABSTRACT

In developing countries like Tanzania, Draught Animal Power (DAP) technology could be appropriate technology which many farmers can afford as a first step from using a hand hoe before stepping forward for using tractor in agricultural activities. This study intended to determine factors hindering adoption of draught animal power innovation under Participatory Agricultural Development and Empowerment Project (PADEP) at Handeni district. Five villages were used to get a total of 120 respondents who were then interviewed using interview schedule. Data obtained were analyzed using SPSS computer programs where descriptive statistics, Likert scale and logit model of regression were used. It was found from this study that farmers had negative perception towards PADEP meanwhile having positive perception towards the use of DAP. It was also found that despite the project involving DAP use, most of farmers, including those who were involved in the project and those who were not involved in the project in the study area were still using a hand hoe. This was contributed in most cases by lack of capital which could be used to run other agricultural technologies having some kind of costs when compared to hand hoe. It was revealed further that there were some factors which statistically influenced positively to the adoption of DAP in the study area. These include household size, average income, costs, extension services and market. Others were relative advantage, compatibility to the past experience and complexity of the technology. These were statistically found to have $p < 0.05$ values. Those influenced negatively to the adoption of DAP include age, sex, marital status, farm size, land size owned by the farmer, trialability and observability of the technology. These had $p > 0.05$ values. From these findings I recommend that projects on the use of DAP should be established and continued by both government and private institution meanwhile putting emphasis on factors found to influence positively the adoption of DAP technology in the study area.

DECLARATION

I, GEORGE KAPINGA do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work, and has not been submitted for a degree award in any other University.

_____ _____

George Kapinga
(MA candidate)

Date

The above declaration was confirmed by:

_____ _____

Dr. Mbwambo, J. S.

Date

COPYRIGHT

AKNOWLEDGEMENT

I first thank my living God for giving me good health from the beginning to the end of my studies. This has helped me to carry out all schooling activities appropriately and at timely. I also acknowledge my wife Lydia T. Msophe and my children Silaki G. Kapinga, Prince G. Kapinga, Joel G. Kapinga and Catherine G. Kapinga for willingly provide cash for my studies which could otherwise supposed to be equally benefited by all family members. They further had tolerance and patience which encouraged and supported my studies in all two years period. I extend my sincere thanks to my supervisor Dr. Mbwambo, J. S. for his tireless supervision, guidance and encouragement without which it would have been difficult to get to the end of my study. The kind assistance I got broadened my mind and paved the way toward the completion of my thesis.

Thanks are also to academic and non academic staff members of the Development Studies Institute (DSI) for materials and non materials assistance during the whole study period. I thank staff members of Handeni District for giving me instruction which were important during the data collection at the field. Their cooperation eased my field work. Lastly, but not least, I thank village executive officers of Konje, Kwabaya, Suwa, Kwenjugo and Kibindu for their assistance at the field areas.

DEDICATION

To my late beloved mother, Veronica Mateso, who laid a foundation of my academic life.

May Almighty God lay her soul in eternal peace, AMEN.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND SYMBOLS

ASDP	Agricultural Sector Development Program
CACC	Central Agricultural Census Commission
CARMATECH	Centre for Agricultural Mechanization and Rural Technology
CDD	Community Driven Development
DAP	Draught Animal Power
DASIP	District Agricultural Sector Investment Program
DSI	Development Studies Institute
MOP	Mbeya Oxenization Project
ME	Monitoring and Evaluation
NAEP	National Agricultural Extension Program
NALEP	National Agricultural and Livestock Extension Program
PADEP	Participatory Agricultural and Empowerment Project
PANTIL	Program for Agricultural and Natural Resources Transformation for Improved Livelihood
PIDP	Participatory Irrigation Development Program
SIDO	Small Scale Industrial Development Organization
SNAL	Sokoine National Agricultural Library
Tsh.	Tanzanian shillings
UFI	Ubungo Farm Impliments
URT	United Republic of Tanzania
WB	World Bank
ZZK	Mbeya Farming Implements (*Zana Za Kilimo*)

CHAPTER ONE

INTRODUCTION

1.1 Background information

Agriculture is the foundation of the Tanzanian economy (URT 2003). It contends further that it accounts for about half of the national income, three quarters of merchandise exports and is source of food and provides employment opportunities to about 80 percent of Tanzanians. The expansion of smallholder farming can lead to a faster rate of poverty alleviation, by raising the incomes of rural cultivators and reducing food expenditure, and thus reduces income inequality (WB, 2008). Wetengere (2010) contends that farm production can be increased through putting more land into use or applying new technology. In fields that are difficult for tractors such as terraced or steep hillsides and on farms where the scale of the enterprise and incomes from it do not justify the purchase of the tractor, animal power is only alternative to laborious hand cultivation (Dijkman, 2006). NIAEM (2008) reports that the use of animals for draft purposes results in saving of fossil fuel and thus saving of precious foreign exchange.

Social benefit–cost analyses show that the estimated value of contribution of livestock through use of crop by-products, draft power and dung for manure and fuel far exceeds the value of livestock products. Vizards (2000) reports that animals still provide the draught power for about 28% of the world's arable land, or about half the total cropping area in developing countries, directly or indirectly serving about 2 billion people. Vizards (2000) continues further by saying draught animal power is one option in a spectrum of technologies, ranging from the use of hand power to the use of sophisticated motorized power, that are now available for use by farmers. Starkey, (1996) contends that the work

performed annually by these draught animals would require 20 million tones of petroleum, if it were performed by motorized vehicles. Starkey (1996) reports further that Ethiopia, together with a few neighbouring parts of the Horn of Africa, is exceptional in sub-Saharan Africa, since farmers have been using animal power for tillage for thousands of years.

In the year 2003 Tanzania introduced Participatory Agricultural Development and Empowerment Project (PADEP). The main objective of PADEP was to raise the production of food, income, and assets of participating households and groups in a sustainable manner (URT, 2008). WB (2003) reports that this objective will be achieved by, among others, empowering self-selected rural communities and farmers' groups to make decisions regarding choice of sustainable and remunerative productive technology. The project was introduced at Handeni District in 2005/2006. Technologies developed during the implementation were applied in chicken production, goat production, maize production, sunflower production, simsim production, gardening and the use of draught animals. This study will focus on adoption of draught animals because if the workload is reduced by removing the drudgery of the hand hoe, both men and women shall have more time for other socioeconomic activities and improve their living standards. The study is expected to improve the above situation by offering various solutions which will ensure increased food production and income so as to alleviate poverty as per Millennium Development Goal 1, among farmers and a nation at large.

1.2 Problem statement

The Participatory Agricultural Development and Empowerment Project (PADEP) is an integral part of the Agricultural Sector Development Program (ASDP), (WB, 2003) which

requires that farmers using an ox-plough reach 18% by 2012. This will be achieved through the implementation of small agricultural development sub-projects planned and managed by groups of community members and farmers (URT, 2003). Report shows that at Handeni district, farmers using draught animals as farming technology increased from 302 in the year 2005/2006 to 340 in the year 2007/2008. This is an average of 3% increase per year. In the same period there was increase of draught animals from 176 to 226 (URT, 2008). This is an average of 10% increase per year. According to the 2002 Tanzania National Census, the population of Handeni District was 249,572. URT, PMO (2008) reported that, 90 percent of Handeni citizens are farmers and depend on agriculture for food and generating income. After six years of PADEP project implementation, this gives 0.15% of farmers using draught animals in Handeni District. There is only one year remaining to reach the time planned to achieve 18% of the farmers using ox-plough which is very far from the achieved 0.15%. However the factors hindering adoption of DAP technology in Handeni District are not precisely known and hence a need for research. In Handeni District the study on Draught Animal Power (DAP) was done by Programme for Agricultural and Natural Resources Transformation for Improved Livelihood (PANTIL) and it assessed the profitability of DAP. This study will focus on adoption of DAP technology.

1.3 Problem justification

Agricultural development in Tanzania has been associated with different programmes since independence. Despite all efforts taken by the government to improve the sector, the adoption of using draught animals has been found to be very low in some parts of the nation as seen earlier. The persistence of this situation implies that there are necessary measures to be taken so as to alleviate the problem. Research work in adoption of draught

animal power from agricultural projects could be, among other factors, one of the approaches towards achieving Millennium Development Goal 1. This study, upon its completion is meant to offer solutions on factors hindering adoption of draught animal power in various agricultural projects, particularly PADEP, so that policy makers will find it easy to push forward related agricultural programmes and projects and ensure high adoption rate. In addressing those findings farmer will be able to increase their farm size and hence production which in turn will raise their disposable income

1.4 Objectives

1.4.1 Overall objective

The main objective of this study was to determine factors hindering adoption of draught animal power innovation under Participatory Agricultural Development and Empowerment Project

1.4.2 Specific objectives

I. To determine the perception of farmers on Participatory Agricultural Development and Empowerment Project.
II. To determine the perception of farmers on the use of draught animals in agriculture.
III. To assess farming technologies used by farmers and reasons for the use of certain technology
IV. To determine factors hindering use of draught animals

1.5 Research questions

1. What are the perception of farmers on Participatory Agricultural Development and Empowerment Project

2. What are the perception of farmers on the use of draught animals in agriculture
3. what are the farming technologies used by farmers and what are the reasons for the use of certain technology
4. What are the factors hindering the use of draught animals

1.6 Conceptual framework

This starts from draught animal power as agricultural technology given to farmers before which extension services and training is carried out with the presence of capital for the intervention. These have an influence on factors which could lead to adoption of Draught Animal Power (DAP) technology. The factors include age, sex, marital status, education, household size, size of the farm, size of land owned, relative advantage, credit, cost, market, extension services, trialability, observability, complexity, and compatibility. The flows of these aspects from technology to adoption are dependent as summarized in Fig. 1.

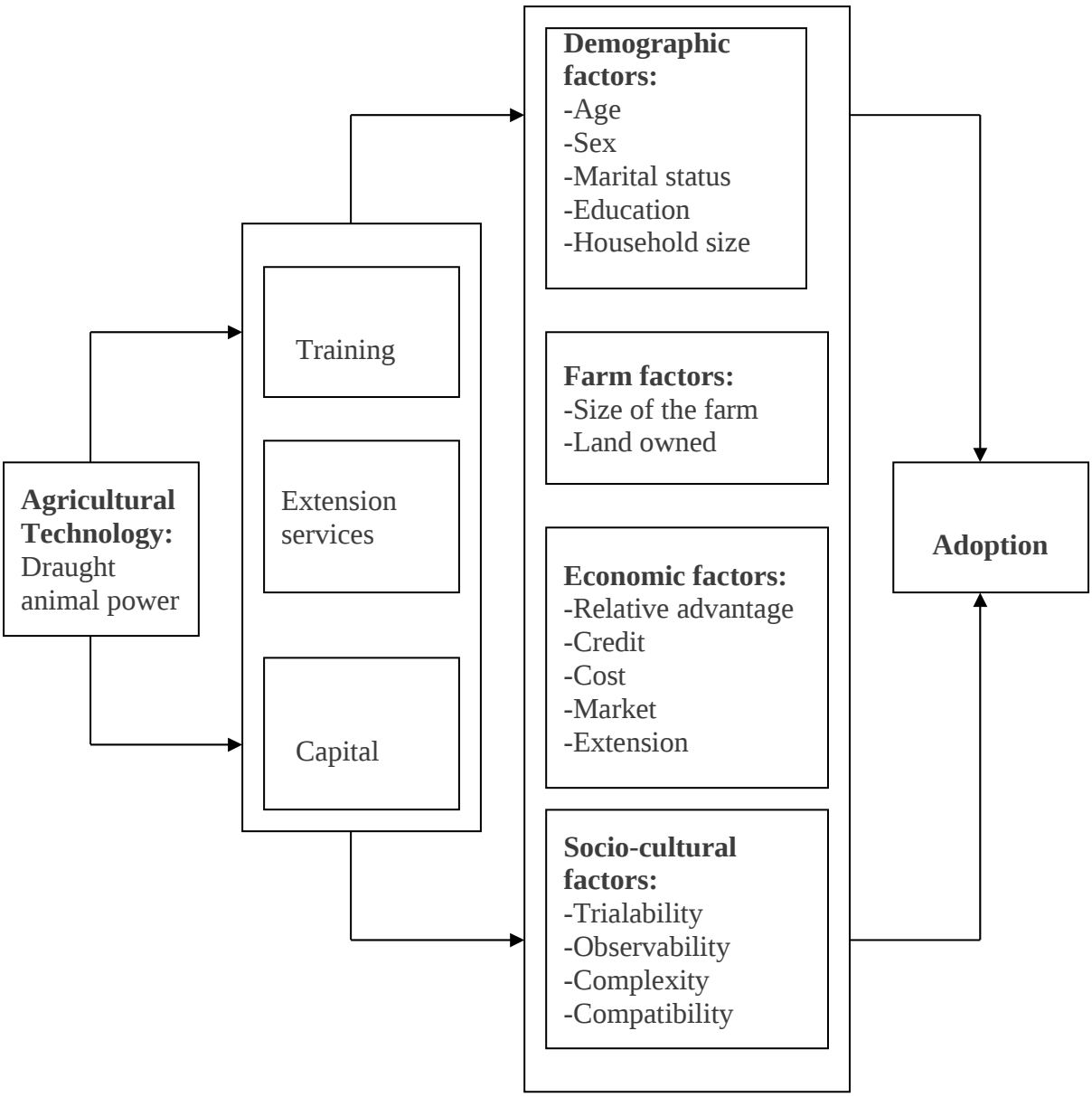

Fig. 1: Conceptual framework summary
Operational definition: Refer appendix I

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of key concepts

2.1.1 Adoption

Adoption can be defined as a degree of use of new technology in long run equilibrium when farmer has full information about the new technology (Grepperud 2003). According to David and Place (2003), adoption is the process of spread of the technology generated and passed to the farmer by extension agent. In most case the farmer who adopts an innovation is considered rational and otherwise is for none adopter. The decision whether or not to adopt an innovation and how, is therefore based on the farmers evaluation of how the technology suits the farmer's own strategies depending on some major factors (Abrol and Oman, 2004). Ajayi, (2003) argued that it is the realization of the farmer's decision to apply the new technology in his/her production process.

2.1.2 Innovation

Innovation is a practice, object or an idea that is perceived as new by an individual or other unit of adoption" (Rogers, 2003). This definition reflects the notion that the individual or social system's perception in question determines whether an idea is deemed new or not new. To be called an innovation, an idea does not have to be necessarily newly invented, Rogers (1995). It is also important to note that "newness" in an innovation may not be a factor in the diffusion and adoption of innovations as an individual may have already heard about the innovation, but did not get persuaded enough to adopt it (Rogers, 2003).

2.1.3 Draught animal

Draught animals are animals e.g. bulls, oxen and cow (cattle), donkeys, mules, horses, goats, camels, water buffaloes, etc which assist farmers in carrying out agriculture activities e.g. ploughing, harrowing, planting, ridging, weeding, mowing and harvesting, transport, irrigation, building industry, and provide power.

2.1.4 Participation

According to Rahman, (1991), participation means involvement by a local population and, at times, additional stakeholders in the creation, content and conduct of a program or policy designed to change their lives. Built on a belief that citizens can be trusted to shape their own future, participatory development uses local decision making and capacities to steer and define the nature of an intervention. Participation requires recognition and use of local capacities and avoids the imposition of priorities from the outside. Kremmis, (1992) reports that the participation of stakeholders in selecting appropriate technologies at local level promotes their adoption and adaptation in a more efficient way than when external organizations alone are involved.

2.2 Theoretical background of adoption

2.2.0 Adoption model's and theories

For many years, there were separate adoption theories in education, sociology, anthropology, medicine, rural sociology, marketing, and industry. Much of it was based on "contagion" theory, which associated the probability of adoption with the proximity of a prior adopter.

2.2.1 Optional adoption decision models

Based on over 3,000 studies Rogers developed several diffusion process models. This includes optional adoption decision models. It describes the adoption decision of people who are free to adopt or reject an innovation. The optional adoption decision model includes five stages; knowledge, persuasion, decision, implementation, and confirmation. In the knowledge stage a person becomes aware of an innovation. In the persuasion stage a person seeks information about the innovation and forms an initial impression. In the decision stage a person either adopts or rejects the innovation. In the implementation and confirmation stages a person uses the innovation and seeks confirming data. The model also proposes how communication channels, information sources, and innovation attributes affects the decision process for early and later adopters. People seek or receive information about the technology from two different communication channels. These are mass media which are more effective in communicating awareness during the knowledge stage and interpersonal channel which is more effective persuasion because they allow for feedback. People seek or receive information from either local or cosmopolitan sources.

2.2.2 Technology adoption models

Economists have developed models of technology adoption that focus on uncertainty, information and learning (Abadi and Pannell 1999, Marra *et al.*, 2005). In these economic models, following the discovery that an innovation exists, the potential adopter has high uncertainty about its relative advantage. Information is acquired and processed, contributing to the learning process through which farmers adjust their perceptions. This is likely to include a reduction in uncertainty about the “relative advantage” of adopting the particular innovation. This information acquisition and processing involves a cost to the

decision maker (e.g. time and money) that is part of the cost of making a practice change. The cost may be so high as to inhibit the learning and adoption process.

2.2.3 Social Impact theory

Dees, (2004), posits a Social Impact theory which describes the path from what you do to the ultimate impact you intend to create. It starts from the organization, program and principles, then activities, intermediate outcomes, and lastly intended impact. The likelihood that a person will respond to social influence will increase with:

- Strength: how important the influencing groups of people are to you.
- Immediacy: how close the groups are to you (in space and time) at the time of the influence attempt.
- Number: How many people there are in the group.

Increasing the numbers has a decreasing incremental effect (going from 2 to 3 has more effect than going from 66 to 67). In fact beyond four or five, the effect tails off rapidly. The effect is most powerful when everyone in the group (apart from the person being persuaded) clearly agrees.

2.2.4 Perceived attributes theory

There are five attributes upon which an innovation is judged: that it can be tried out (trialability), that results can be observed (observability), that it has an advantage over other innovations or the present circumstance (relative advantage), that it is not overly complex to learn or use (complexity), that it fits in or is compatible with the circumstances into which it will be adopted (compatibility).If the technology is perceived as difficult to learn and or too time consuming to prepare and use, or it is in some way perceived as threatening, it probably will not be used. No amount of administrative force would likely

be effective reversing a negative trend. This study will adopt perceived attributes theory to see the part it played in the adoption of PADEP innovations. It also fits to this study as far as it is based on judging the innovation when compared to the first two theories

2.2.5 Economic theory of adoption

The economic theory of adoption is based on the assumption that the potential adopter makes a choice based on the maximization of expected utility subject to prices, policies, personal characteristics, and natural resource assets. A discrete choice of technology is made that leads to a level of input use and profit. If the benefits associated with the use of a conservation technology accrue primarily beyond the farm, producers would not be expected to include those benefits in their decision to adopt the technology. Many of the recommended practices are designed to reduce off-site environmental impacts rather than to increase on-site productivity. The total benefits of switching to these technologies may outweigh the costs by a large margin, but if those gains are not realized by the farmer who bears the costs, the voluntary adoption of preferred technologies may not occur.

2.3 PADEP Background information and project area

2.3.1 Objectives

The main objective of the project is to raise the production of food, incomes, and assets of participating households and groups in at least 840 villages in a sustainable manner through the implementation of small agricultural development sub-projects planned and managed by groups of community members and farmers. This objective will be achieved by: (i) empowering self-selected rural communities and farmers' groups to make decisions regarding choice of sustainable and remunerative productive technology; (ii) sharing of costs by the public sector and participants, and hence sharing the risk of adoption of

improved technologies, again for self-selected participants; (iii) enhancing demand for products and services provided by the private sector in rural areas by increasing the purchasing power of participating groups and encouraging the growth of savings; (iv) promoting improved land and crop husbandry practices by participants; (v) supporting the ongoing decentralization process at the district level; and (vi) partially financing maintenance and/or construction of roads, bridges, and other small sub-projects to improve access to markets.

2.3.2 Achievements

Ratings for the Participatory Agricultural Development and Empowerment Project for Tanzania were as follows: the risk to development outcome was moderate; the Bank's performance was moderately satisfactory; and the Borrower's performance was also moderately satisfactory.

2.3.3 Challenges and lessons learnt

Some lessons learned in PADEP included: empowerment is an important output for Community Driven Development (CDD). One of the primary purposes of the CDD approach is to empower local communities to affect change by improving the process by which local development decisions are made. In case of challenges the project attempted to use participatory Monitoring and Evaluation (M&E) system which did not work well. The rationale for using a participatory M&E is that the beneficiaries, by monitoring their own performance, will learn and adjust accordingly. Adaptive management and learning is an important ingredient for success. This project demonstrated that, given a menu of choices that included both community infrastructure and livelihood investments; there was a strong demand for livelihood investments.

2.4 A review of adoption studies on draught power

2.4.1 The Global trend

Animal power has been used for thousands of years in Asia, Europe and North Africa. In areas of the world where draught animals are part of the traditional way of cultivating the land for instance in India, Nepal, Indonesia and in most of Latin America, people are accustomed of keeping, training and managing their draught animals (Pearson and Vall, 1993). Because of high oil prices, the weak rand and tractor scheme failures, animal traction has begun to be reconsidered as a source of power that could complement tractor power (Simalenga, 1997). In many parts of the world, animal traction is an appropriate, affordable and sustainable technology, complementing both human labour and tractor power (Starkey, 1996). Starkey (1991), reports that it has been estimated that in India draught animals provide more power than the hydroelectric and fossil fuel stations in that country. During the last 50 years, the industrialized nations have seen revolutionary changes and restructuring of animal agriculture, with profound effects on animal welfare, on the ownership of agricultural resources, on the lives of animal producers, and on food availability, human diet, and the environment; and many less-developed nations are also embarking on a similar intensification of animal production (Hursey, 1997).

2.4.2 In Africa

The recorded history of animal power in Africa starts about 6,500 BC in Egypt with the first drawings of oxen and plough occurring in the 111 Dynasty Starkey (1997) In Africa, particularly in the eastern and southern parts, the use of animal traction is currently on the increase (Starkey, 1996). The majority of these animals are found in Ethiopia (6 million), where animal traction has been used for centuries; elsewhere in the continent, the

distribution is uneven (Preece, 1999). More than 85% of the 1–1.2 million communal farming households in Zimbabwe use animal draft power (Francis, 2004). In Lesotho, the majority of farmers produce only at subsistence levels, and animal traction is one of the dominant technologies used for both agricultural and non-agricultural purposes (Mbata, 2009). Vizard (2000) contends that the use of draught power is slowly increasing in Africa, where 80% of cultivated land is currently prepared by hand power, but is declining in importance in eastern Asia as mechanization takes place.

2.4.3 In Tanzania

The traditional oxen farming in Tanzania can be traced back during the time when working animals were used in islands of Pemba and Zanzibar for generations (Starkey *et al.* 1994). On the mainland, Maasai pastoralists have a very long history of employing pack donkey for transport. However, animal power was not used in other traditional farming system. Efforts to promote utilization of animal power mainly oxen in Tanzania for the purpose of increasing agricultural production, started in 1920s when missionaries and settlers introduced ox-plough in different places like Tarime, Shinyanga , Mwanza and Handeni (Tanga) (Kiligwa *et al.,* 1992). Between the 1930s and 1940s the use of ox-plough spread to Mbozi and Kyela (Mbeya region), Isimani and Mufindi (Iringa region) and Mbulu (Arusha). By 1945, ox-ploughing was already common in many areas where rice, maize and cotton were grown for commercial purposes.

According to Shetto and Mkomwa (1996), ox-plough spread from Mbozi to Sumbawanga district in the 1950s. The period between 1961 and mid 1970s was characterized by low level of dissemination and utilization of DAP in Tanzania. This was due to fact that after independence the spread of ox-cultivation was interrupted by the government by putting more emphasis on the use of tractors, especially after subsidized tractor hire services

schemes were introduced. Sosovele (1993) contends that this shift of interest from the use of DAP technology to tractor mechanization slowed the process of technology dissemination and utilization to many smallholders. Nearly all of these schemes failed miserably, largely because of high costs of running and maintaining these tractors. Moreover, lack of elaborative institutional mechanism and policy framework to guide systematic development and utilization of animal power technology, led to less adoption of oxen for ploughing purposes. No attention was paid to the use of oxen for other far operations. According to Mothander *et al.* (1989), such failures renewed interest by the government of Tanzania in animal power technology. Oxen training centres (OTCs), which were also supported by mobile ox-training units for extensive ox-training services in villages, were established. Other efforts regarding the promotion of the utilization of animal power technology as pointed out by Kwiligwa *et al.* (1992) was though industrial mass production of ox-implements (ploughs) and spare parts at Ubungo Farm Implements (UFI) and Mbeya Farm Implements (ZZK) companies. Some institutions like the Centre for Agricultural Mechanization and Rural Technology (CARMARTEC) Arusha, Mbeya-Uyole Agriculture Centre, DAP-Mlingano and Small Scale Industrial Development Organization (SIDO) were consolidated to undertake research, testing demonstrations and even fabrication of ox-implements whether imported or locally made. During the 1980s and 1990s animal traction received more attention as several external donor funded DAP projects were initiated in several regions. Among the prominent one were the Iringa oxenizaton project, Mbeya Oxenization Project (MOP) and Tanga Animal Draught Technology. Other projects were supported by Sasakawa Global 2000. However Mensah (1996) criticizes the sustainability of externally donor funded programmes and argues that political commitment is vital if sustainable agricultural development is to be achieved.

In Tanzania, it is estimated that there are about 14 million hand hoes in use, 585,244 animal drawn ploughs, 1,307,655 oxen and 7200 working tractors (Shetto, 2008). Overall, the use of draught animals and tractors is limited to primary tillage and transportation with subsequent field operations being carried out manually with the activities being designated by gender (Shetto, 2008). Ox-training centres, the main sources of animal-draft training, favored man and discriminated against women by taking them away from their family responsibilities. Introducing a technology to only half of its potential users limits its adoption (Sizya, 2005).

CHAPTER THREE

METHODOLOGY

3.1 Area of the Study

The study area was Handeni district. It is one of the seven districts in Tanga region, Tanzania. To the West it is bordered by Kilindi district, to the North by the Korogwe district and the Kilimanjaro region, to the East by the Pangani district, and to the south by the Pwani region. According to the 2002 Tanzania National Census, its population was 248,633. The district is administratively divided into 7 divisions, 19 wards and 112 villages. This study is to be conducted at Handeni district from the reason that it is one of the districts in Tanzania which has implemented a number of agricultural projects including NALEP, NAEP, PIDP, and recently PADEP. Other districts like Shinyanga, Maswa, Mpwapwa and Kasulu to mention some, having implemented only NALEP, NAEP, and currently DASIP, and following history as shown above, DAP at Handeni District was introduced by missionaries in 1922, still there was no appreciable adoption of the technology among farmers as explained earlier. Figure 2 is the map of Tanga region to show Handeni District, wards and study villages.

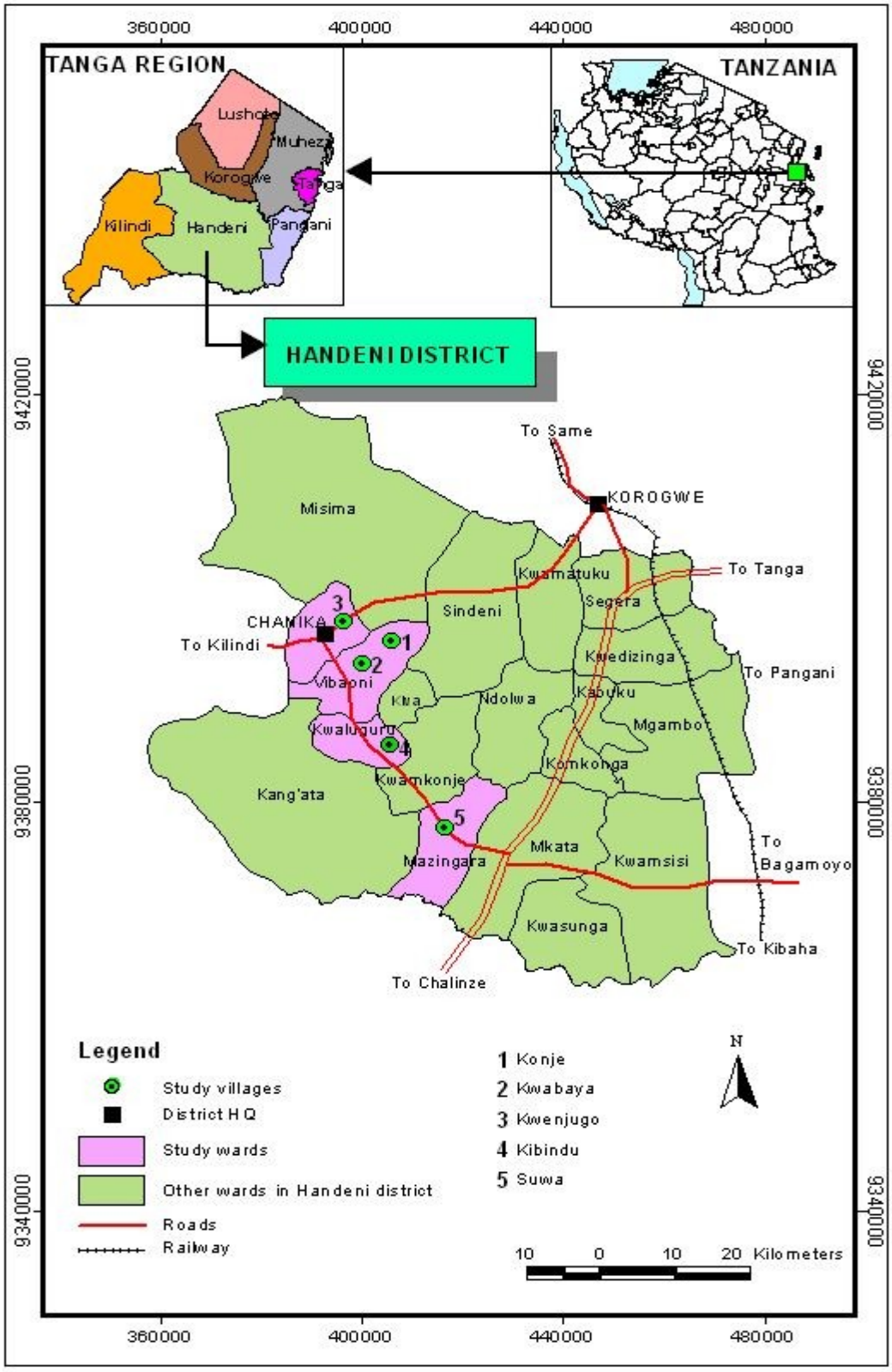

Fig. 2: Map of Tanga region showing Handeni District

3.2 Research Design

According to Kothari (2008), cross-sectional research design was adopted. This qualified from the fact that the one year period arranged for the study particularly meets the method and it also coped to financial limited resource. Furthermore, cross-sectional research design allowed the collection of data from different groups of respondents at relatively the same time.

3.3 Sampling

Multistage sampling was used. Initially purposive sampling method was done with respect to 32 villages involved in the PADEP projects. These 32 villages were listed and its number was divided by the required number of villages to be used in the study which was five. This was meant to get sampling interval which approximately fallen to six. The first village was then picked randomly after which the calculated sampling interval was adhered to. Then sampling frames were obtained with respect to individual members of draught animal subprojects out of which a total of 60 respondents were again selected for the interview using simple random sampling method as summarized in the Table 1.

Table 1: Sampling procedures used to get respondents using DAP technology

S/no	Village	Number of members	Sampling interval	Sampled members	Number of sampled members	Percentage (%)
1.	Konje	28	2	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24.	12	42.8
2.	Kwenjugo	37	3	1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34.	12	32.4
3.	Suwa	32	2	5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27	12	37.5
4.	Kibindu	29	2	4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26.	12	41.4
5.	Kwabaya	24	2	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23.	12	50.0

This was followed by taking sampling frame of households which were not involved in the project, from the same five villages. Using simple random sampling the other 60 households were obtained as indicated in the Table 2, from which heads of households were interviewed.

Table 2: Sampling procedures used to get households not using DAP technology

S/no.	Village	Number of households	Sampling interval	Sampled households	Number of sampled households	Percentage (%)
1.	Konje	218	18	3, 21, 39, 57, 75, 93, 111, 129, 147, 165, 183, 201.	12	5.5
2.	Kwenjugo	226	18	5, 23, 41, 59, 77, 95, 113, 131, 149, 167, 185, 203,	12	5.3
3.	Suwa	194	16	10, 26, 42, 58, 74, 90, 106, 122, 138, 154, 170, 186,	12	6.2
4.	Kibindu	178	14	8, 22, 36, 50, 84, 78, 92, 106, 120, 134, 148, 162	12	6.7
5.	Kwabaya	203	16	1, 17, 33, 49, 65, 81, 97, 113, 129, 145, 161, 177.	12	5.9

This made a total of 120 respondents. The two groups were used to get as much unbiased information as possible. According to Bailey (1994), the studies in which statistical analysis is to be done, the sample size of 30 respondents is required regardless of population size. The sample of this study exceeded the minimum suggested sample and hence provided acceptable representation of the actual population.

3.4 Data Collection

Both quantitative and qualitative data was collected using an interview schedule where respondents were asked questions by the interviewer who also recorded the answers.

3.4.1 Primary data collection

These were obtained from the field. Data to determine the perception of farmers on PADEP was obtained using interview schedule (Kothari, 2008) comprising both closed and open ended questions. This method is to be applied so as to minimize the chance of non response due to the fact that filling of the information from respondent is done by the interviewer. Meanwhile the method will ensure appropriate utilization of the scheduled time.

Data to determine the perception of farmers on the use of draught animals in agriculture were obtained using interview schedule as described above with the same reasons. This tool was also qualified for obtaining data to assess farming practices used by farmers and factors for the use of certain technology together with data to determine factors hindering use of draught animals. Before going to the field for primary data collection pilot study was done at Mpalahala village, Kilindi District, the population with similar characteristics

with the intended study population. This was meant to identify ambiguous questions and realize whether the flow of questions was good or not.

3.4.2 Secondary data collection

These were obtained from Sokoine National Agricultural Library, (SNAL). These included books, research reports and journals. Others were from Handeni District agricultural department. These included number of wards and villages in the District, and villages where PADEP conducted their projects. From the ward executive office, where a number and least of households were obtained, web pages such as Yahoo and Google were used for journals, articles and conference papers.

3.5 Data Analysis

3.5.1 Qualitative data analysis

In analysis of qualitative data thematic analysis was used where the frequency of the occurrence of certain incidences or words that denoted various themes were noted. Data analysis to determine the perception of farmers on PADEP was done using Likert scale. Every respondent was asked to say with their points in brackets if he/she strongly disagreed (1), disagreed (2), undecided (3), agreed (4) or strongly agreed (5) with each item of the scale. The total scores from each statement were obtained by adding up the scores that different respondents got from the same statements. These total scores were regrouped into three categories; strongly agree and agree were regrouped into agree; strongly disagree and disagree were regrouped into disagree while undecided was left intact. A total of ten (10) statements were constructed to show the frequency of perception towards Participatory Agricultural and Empowerment Project (PADEP). The scores in disagree ranged from 10 to 29 points, undecided (neutral) lied within 30 points, and agree ranged from 31 to 50 points. Descriptive analysis was also employed where tables of

frequencies showing the number and percentage of respondents who have given certain answer was used.

Farmers' Perception on the use of DAP was also analyzed using a Likert scale with their respective points in brackets. Every respondent was asked to say if he/she strongly disagreed (1), disagreed (2), neutral (3), agreed (4) or strongly agreed (5) with each item of the scale. The total scores from each statement were obtained by adding up the scores that different respondents got from the same statements. The responses were regrouped into three categories; strongly agree and agree were regrouped into agree; strongly disagree and disagree were regrouped into disagree while undecided was left intact. A total of six (6) statements were constructed to show the frequency of perception towards the use of DAP. The scores in disagree ranged from 6 to 17 points, neutral lied within 18 points, and agree ranged from 19 to 30 points. This also included descriptive analysis where tables of frequencies showing the number and percentage of respondents who have given certain answer were used. Then cross tabulation was employed where chi-square was used to find relationship between variables.

3.5.2 Quantitative data analysis

Data analysis to assess farming practices used by farmers and factors for the use of certain technology was analyzed using descriptive statistics where tables showing frequencies and percentage of responses were used together with chi-square to find out relationship between some variables. Data analysis to determine factors hindering use of draught animals was done using inferential analysis where logit regression model was employed as explained here under.

3.5.3 Model specification

The most commonly used econometric models in adoption studies are the limited dependent variable models such as logit regression and probit model. These model are used to examine relationship between adoption and determinants of adoption which involve a mixed set of qualitative and quantitative analysis (Kark et al., 2004). The Logit and Probit models are both are based on a commutative distribution function. It is also true that various adoption studies so far done on crop, livestock, soil conservation etc. have used Probit and Logit models for identifying the impact of independent variables on dependent variables. However, the outputs of Probit and logit models are usually similar though the logit model is easier in estimation. Based on this study logit model was used where dependent variable was adoption of DAP technology by farmers and independent variables were factors that had influence on the adoption of the technology. To find relationship between the respective attributes against adoption, the model below was used:

$Y = a + \beta_1X_1 + \beta_2 X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \beta_{15}X_{15} + \beta_{16}X_{16} + e$ where:

Y = Adoption

a = Constant

β1- β15 = Regression coefficient parameters represent the slope of regression line,

X_1 = Age

X_2 = Sex

X_3 = Marital status

X_4 = Education

X_5 = Household size

X_6 = Perception

X_7 = Size of the farm

X_8 = Land owned

X_9 = Relative advantage

X_{10} = Credit

X_{11} = Cost

X_{12} = Market

X_{13} = Trialability

X_{14} = Observability

X_{15} = Complexity

X_{16} = Compatibility

e = error of measurement

Qualitative data were summarized and categorized with regard to similar responses which descriptive statistics was then used.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Demographic and Socio-economic Characteristics of Respondents

This part will discuss about demographic characteristics of respondents. The areas to be included are; sex of respondents, sex of household heads, origin of the heads of the households, education level of the respondents, marital status of respondents and main occupation of the head of the household.

4.1.1 Years of education

Most of respondents had seven years of schooling known to be primary education. This was 91.7% and those who had zero years of schooling in formal education were 6% while the remaining 3.3% had fourteen years of schooling known to be secondary education as shown in Table 3. The small percent in secondary school education may be due to the fact that after completing primary education, which was compulsory to all children of 7 years, the majority did not pass or afford the costs associated with secondary education. The adoption of technologies is proportional to the level of education. As this study has shown, having small percent of farmers who have secondary education provides the possibility that the adoption could be of the low level too. It is common to find that people who have managed to get secondary level education seek for other employments rather than farming and leave those with low education participate mostly in that activity. Through education, an individual becomes more critically aware of the need and scope for social change (Rahim *et al.* 2005). On the other side Senkondo *et al.* (1999) contends that the adoption of rainwater harvesting technologies in Western Pare, Tanzania is not

significantly explained by education but rather other factors such as experience in farming and perceived technology characteristics.

Table 3: Education level of respondents (N = 120)

Education level of respondent	Frequency	Percent
0 years	6	5.0
7 years	110	91.7
≥14 years and	4	3.3
Total	120	100.0

4.1.2 Sex of the respondents

From the total number of respondents it has been found that men constituted large percentage than women as indicated by the Table 4 as 80.8% and 19.2% respectively. This shows that women were not given equal economic opportunities as compared to men. This low percent of women respondents could be attributed to cultural barrier in the study area where women were only considered as household heads when they were widowed or divorced.

4.1.3 Age of respondents

The study found that respondents' age had a minimum of 20 years constituting 0.8% and a maximum of 77 years of age with 0.8% too. This gave a range of 57 years with an average of 43 years and standard deviation of 12. This range could be small due to the fact that most of primary school leavers failed to join into secondary education do not immediately engage in farming activities. Instead, they seek for non farm activities in their respective villages leaving agricultural activities to old age group as found on the maximum age of the respondent above. It could also be due to the reason that majority of the youth migrated to the urban centres looking for waged labour. It was also found that the average could still favour farming activities as long as it was in the midst of youth and old age.

4.1.4 Marital status of the respondent

The study found that 95.8% of all respondents were married, 1.7% were single with the same percent being widowed. The remaining 0.8%were divorced or separated as indicated in the Table 4. The occurrence of large percent of married respondents could be due to the need that farming activities requires support from each other to be performed at timely.

Table 4: Marital status (N = 120)

Marital status	Frequency	Percent
Single	2	1.7
Married	115	95.8
Divorced/separated	1	.8
Widow	2	1.7
Total	120	100.0

4.1.5 Household size

The number of household members had the minimum of 2 by 1.75% and maximum of 13 by 0.8%. The total number of members in all households was 673 with a mean of 6 and standard deviation of 2. Together with other factors, the number of household members has an effect to the adoption of agricultural technologies including the use of draught animal power. This is because during the tilling of the land at least two people are needed to run the activity. This composition has shown to support the adoption of draught animal power with regard to the need of working force at a time as explained above.

4.1.6 Main occupation and source of income

The main occupation of the respondents was agriculture providing both food and income of the household. This means that to change the life standard of farmers, the government and private institution has to invest a lot in agriculture as far as about 80% of people in our country are farmers.

4.2 Community/ respondents perception towards PADEP

To determine community perception towards PADEP, Likert scale was used and the results of the overall perception were obtained. These were then computed and three categories were obtained and showed that more than a half (51.7%) of the respondents had negative perception towards PADEP (that is, they scored less than 30 out of 50). This negative perception could have been contributed mostly by those who were not in the project for the reason that they were out of the project due to the limited number of people required to have been included. The later findings revealed that more than half of all respondents wished the project of using draught animal power to be continued. In the other case 40.8% had positive perception towards PADEP (that is, they scored more than 30 out of 50 points). These are likely to be farmers who have started getting benefits of using draught animal power technology. The remaining 7.5% had neutral perception (that is, they scored 30 out of 50 points). These could be people who are not well informed about PADEP as some complained to have never been reached by extension workers. The mean of overall perception towards PADEP was 29 out of 50. This mean lies below the neutral points and therefore it implies that the overall perception towards PADEP was negative to most of farmers. Three categories of overall perception of farmers towards PADEP are presented in Fig.3.

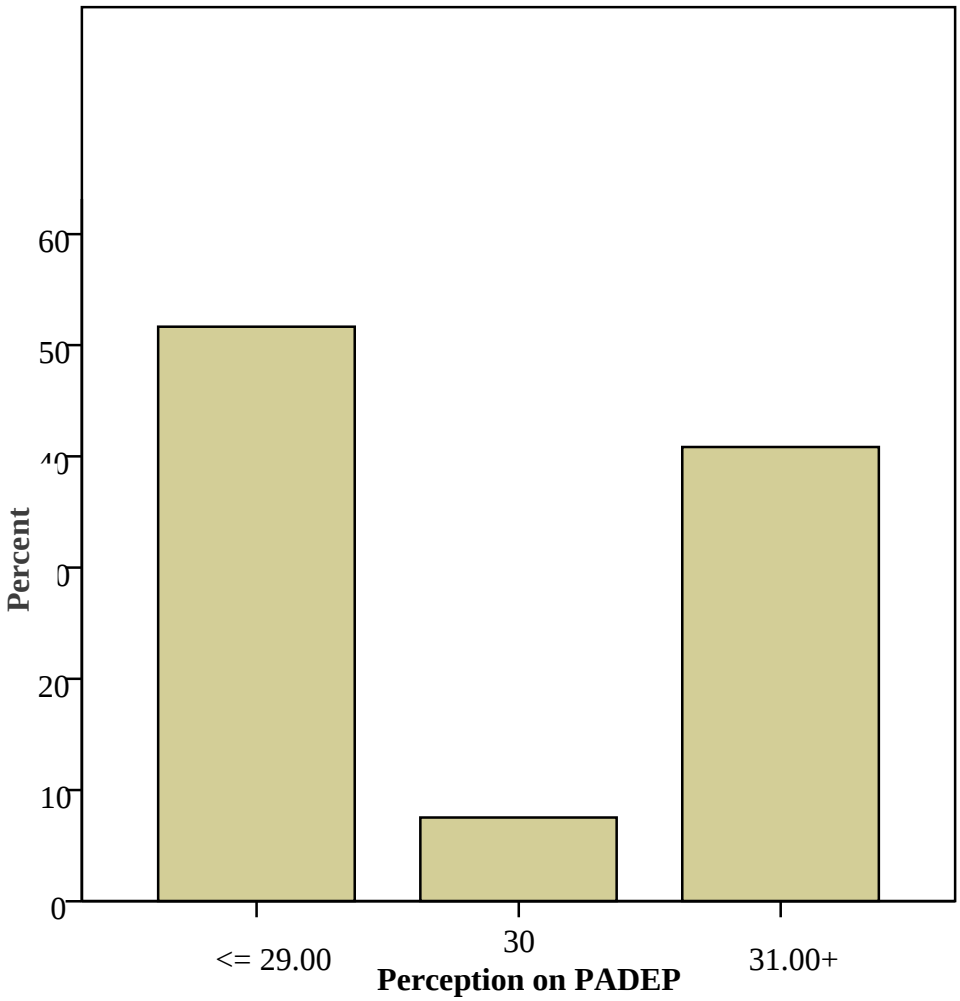

Fig. 3: Categories of overall perception towards PADEP

Qualitatively the perception of farmers on Participatory Agricultural Development and Empowerment Project was analyzed from the Likert scale. Results were shown in Table 5 that a good number of farmers were not reached by various agricultural projects established earlier by the government where about 93.4% were found to be so and only 6.6% were reached by these projects. In this case 88.4% revealed that past projects were not able to change their life standard while 4.2% were not aware as to whether they experienced some changes or not. Only 7.1%, which is more or less similar to the percent found to have been involved in the past agricultural projects, witnessed the past agricultural projects to have been improved their life standard.

After getting involved in the PADEP project, 65% of farmers are expecting to improve their life standard though it. This implies that farmers do trust the government initiated projects on changing their life standards. 25.8% do not think that PADEP could change their life. These includes some who were involved in the project and stopped on the use of the technology for various reasons and those who are not in the project but have observed the direction of the results in the project to be not promising. It is more or less similar to the finding that those expecting PADEP to change their life standard are those who think that PADEP is carried in the proper way to meet the need of farmers in agriculture which was 57.5%. Similarly 31.7% did not agree while 9.2% being neutral on changing their lives through PADEP, 10.8% was also neutral to the way PADEP was carried out.

The good thing PADEP did and highly appreciated by farmers was to involve them on deciding the type of projects to be carried out. 80% agreed to it while 15% opposed. The opposed might have not been reached for various reasons, e.g. traveling, falling sick or even neglecting call made by the government office by that time. By comparing the services provided by PADEP, 70% feel the project to empower farmers and only 24.1% feel not doing so. It seems that many of the later are those who were not involved in the project. Despite the percent of those expecting PADEP to change their life standard exceed half, 63.4% have not yet witnessed positive changes in agricultural production since PADEP has started working with farmers. But the other 34.1% have already seen positive changes. There were also 89.1% who agreed that PADEP brought new technology in farming practice and 10.1% found the technology to be common one.

Table 5: Perception of farmers on PADEP

Statement	Disagree (%)	Neutral (%)	Agree (%)
Been involved in agricultural projects before PADEP	93.4	-	6.6
Past projects were able to change your life standard	88.4	4.2	7.4
PADEP could be able to change your life standard	25.8	9.2	65
PADEP is carried in the proper way that could be able to meet the needs of farmers in agriculture	31.7	10.8	57.5
PADEP involved farmers in deciding on the projects to be carried out	15	5	80
PADEP provide services you were expecting to get from the government	41.6	9.2	49.2
PADEP empower people in agricultural production	24.1	5.9	70
There are positive changes in agricultural production since the PADEP has started	63.4	2.5	34.1
PADEP had bias in selecting farmers groups	62.5	0.8	36.7
PADEP bring new technologies in farming practice	10.9	-	89.1

4.2.1 Perception by age

Age could have an influence on the perception of farmers towards PADEP such that those with old age have more information on the performance of different projects established by the government or private institution. Such information could be little or absent to those who have nearly engaged in agricultural activities. The average age of farmers in this study was found to be 43 years. The results of the cross tabulation indicated that 55.0% of all respondents fallen on the age between 26-45 years. Among them 27.5%, 23.3% and 4.2% had negative, positive and neutral perception respectively. Having many people in neutral perception could have been resulted from fact that they were not exposed

to other agricultural projects and get the actual outcomes from them. This was similar to group aged from 46-65 years comprised 35.0% of which 19.25, 12.5% and 3.35% had negative, positive and neutral perception towards PADEP. The age of less than or equal to 25 years was 5.0% of all farmers with 3.3% perceived negatively and 1.7% positively. None of the respondent in this group had neutral perception towards PADEP. Then a group aged 66 years and above who were also 5.0% with 3.3% perceived positively and the remained 1.7% negatively. This could be due to the reason that members in them had various farming experiences which some might be compatible to new ones. Using chi-square analysis it was found that there was no statistical significant relationship between age and perception of farmers towards PADEP where $p > 0.05$. These results are presented in Fig. 4.

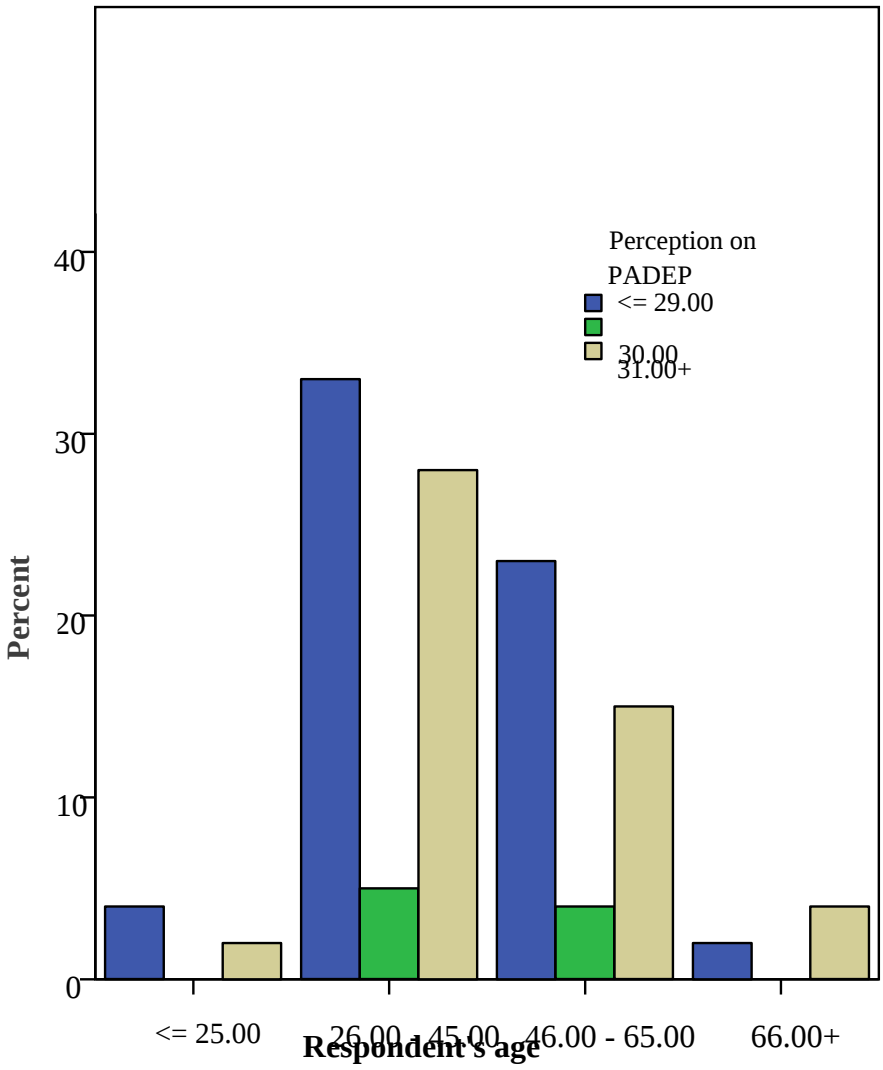

Fig. 4: Perception towards PADEP by age

4.2.2 Perception by sex

Sex of an individual could be one of the factors influenced perception of farmers towards PADEP. In this study 80.8% of respondents were males and among them 41.7% had negative perception while the remained 33.3% and 5.8% had positive and neutral perception respectively. The negatively perceived males might have largely arisen from those who were not involved in the PADEP and hence not well informed about the project. This also applied to females who had negative perception by 10.0% while positive and neutral perception by 7.5% and 1.7% respectively as shown in Fig.5. Using chi-square

regression analysis it was found that there was no statistical significant relationship between perception of farmers on PADEP and sex where $p > 0.05$.

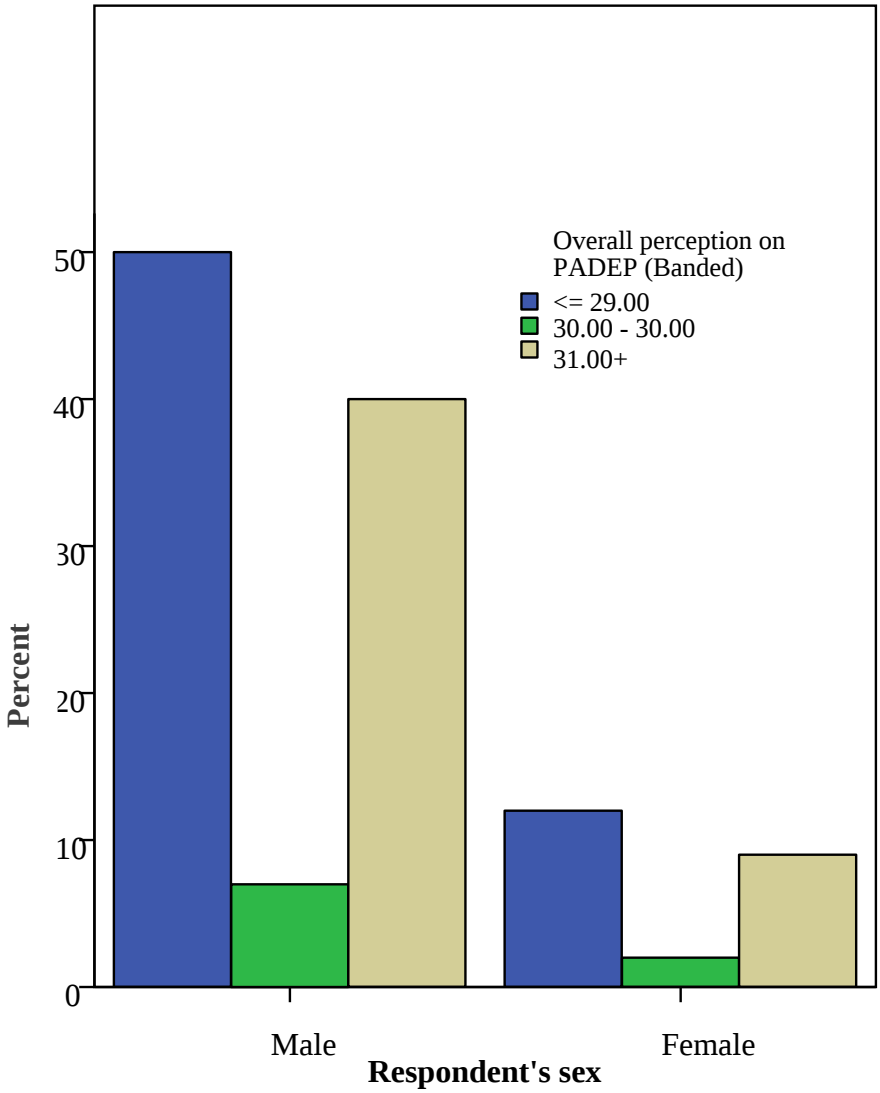

Fig. 5: Perception towards PADEP by sex

4.2.3 Perception by occupation

With regard to this study a good number of respondents engaged in farming activities and these were 96.7% of all. From them, 50.0% had negative perception towards PADEP despite farming being their main occupation while 49.5% and 7.5% had positive and neutral perception. This could be due the reason that they were not sure on the

performance of PADEP it gets to some years of work. Those engaged in farming and off-farm activities, 1.7% each perceived positively and negatively as shown in Fig. 6. Using chi-square test it was found that there was no significant relationship between perception on PADEP and occupation of respondents where p > 0.05

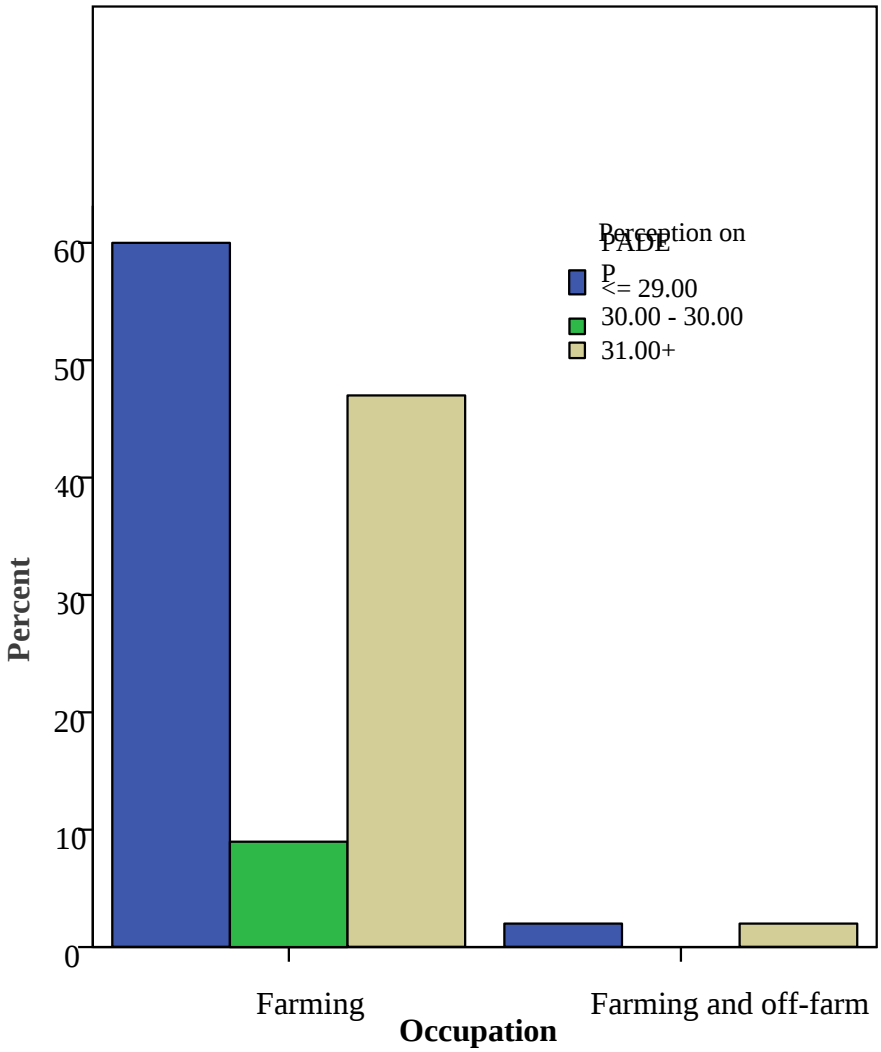

Fig. 6: Perception towards PADEP by occupation

3.2.4 Perception by income

The main source of income in the study area was agriculture despite having no specific cash crop grown. Most of farmers had an income of less than or equal to Tsh. 300 000/=. Among them, 50.0% had negative perception towards PADEP while the remained 35.8%

and 7.5% had positive and neutral perceptions respectively. This might be due to the fact that one of the conditions to join into PADEP was to provide cash contribution which many people couldn't afford to provide them. Another group was that of income from Tsh.300 001 to 700 000 constituted 3.3% subdivided in two equal groups of 1.7% each with positive and negative perception. Then the group with income of Tsh. 700 001-1100 000 had only 0.8% and positively perceived the project. Lastly the group with income from Tsh.1100 001 and above comprised a total of 3.3%, all with positive perception towards PADEP as presented in Fig. 7. From the second to the last group it can be found that there was increased tendency of perceiving the project positively. This could be so from the fact that the income of members in these groups could allow them to provide the required cash contribution and meet the condition of joining into the project. In this study using chi-square regression analysis, it was found that income had statistical significance to perception of farmers towards PADEP where $p < 0.05$.

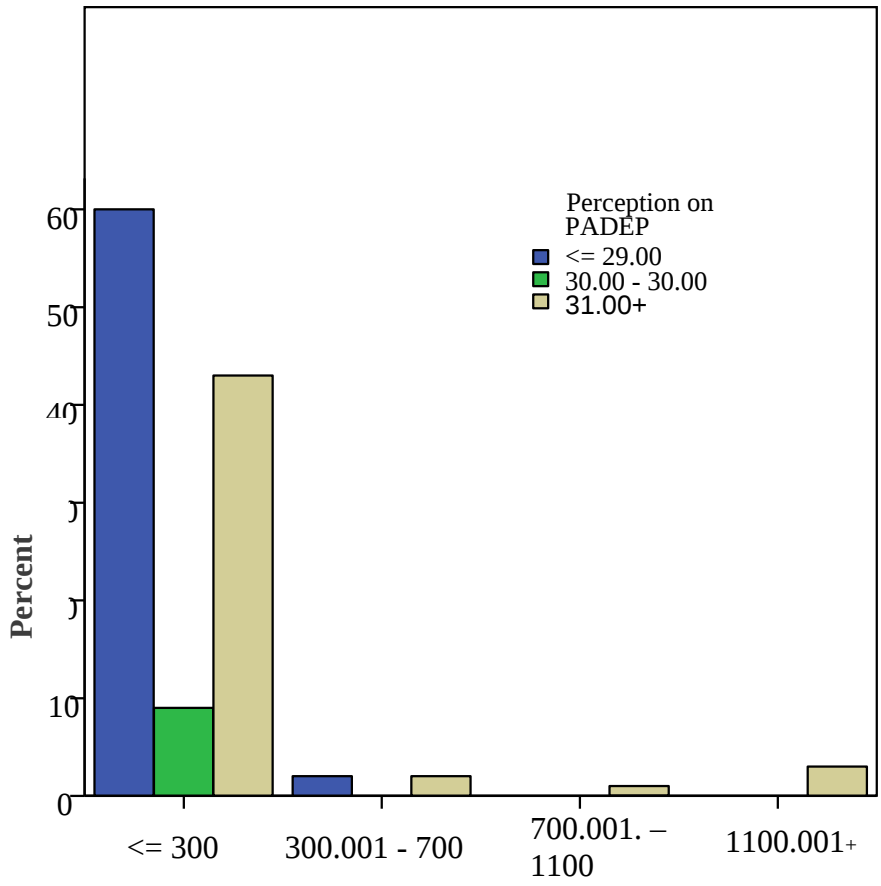

Fig. 7: Perception towards PADEP by average annual income

4.2.5 Perception by household size

The average household size in the study area was found to be six and this can influence perception in different ways. Based on this study, these include the circumstance where large family can differ in ideas with regard to the perception on PADEP. Most households in this study fallen from four to six members with 60.8% and among them 32.2% had negative perception towards PADEP while the other 20.8% and 5.8% had positive and neutral perception respectively. This was followed by the group of members from seven to nine who were 22.5% of all, among which 12.5% had positive perception towards PADEP while 9.2% had neutral perception and 0.8% neutral perception. This group had more of the positive perception due to the fact that members had more opportunity to distribute themselves into various economic activities including farming. The household size with

members less than or equal to three constituted with 5.8% who had positive perception while 5.0%, negative and 0.8% neutral perception. Then the group of members from 10 and above which comprised of 3.3% with negative perception and 1.7% positive perception as shown in Fig. 8. None of the member in this group had neutral perception. Using chi-square regression analysis it was found that household size was statistically significant to the perception of farmers on PADEP where $p < 0.05$.

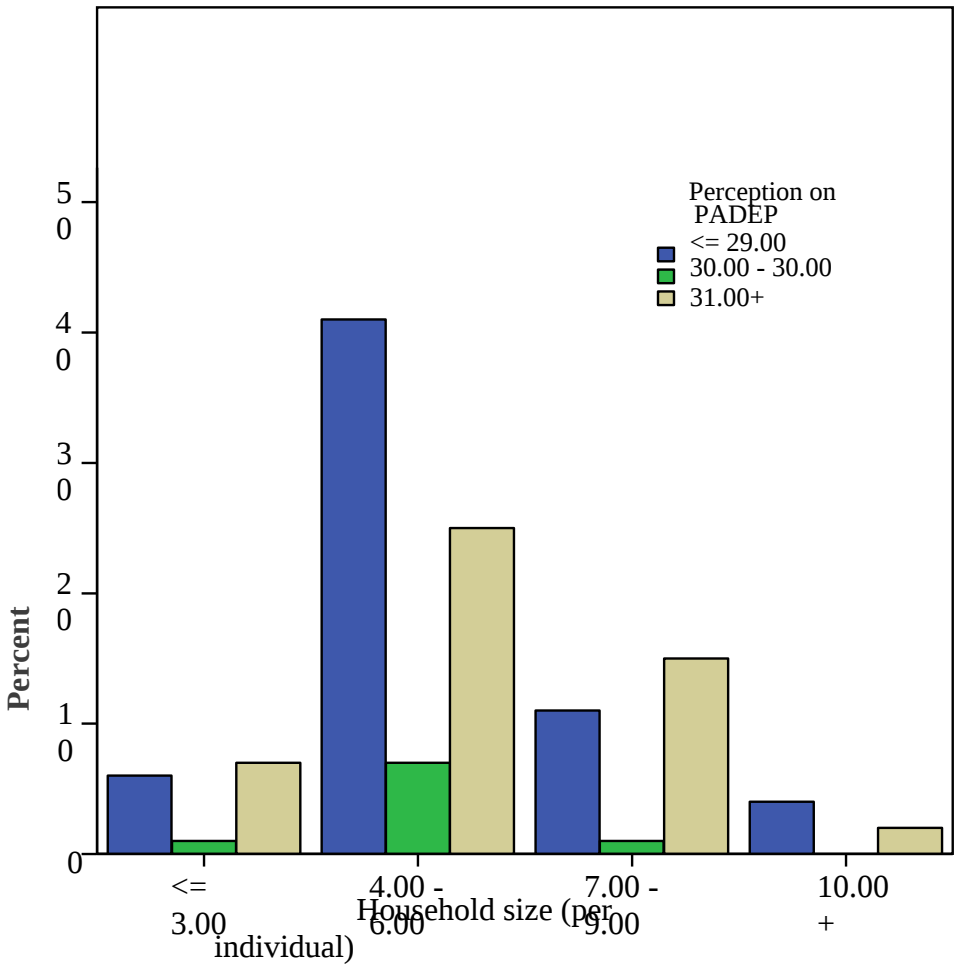

Fig. 8: Perception towards PADEP by household size

The summary of results on perception of farmers towards PADEP by sex, age, household size, occupation and income are presented in Table 6.

Table 6: Chi-square regression results on perception of farmers towards PADEP by sex, age, household size, occupation and income.

Independent variable	df	χ^2 value	P-value
Age	6	3.269	0.774
Sex	2	0.074	0.963
Household size	6	12.357	0.051
Occupation	2	0.398	0.820
Income	6	14.465	0.041

4.3 Community perception over Draught Power

To determine farmers' perception on the use of DAP the results of the total scores and their frequencies were obtained and overall perception were computed to get three categories of the result that 74.2% of farmers had positive perception towards the use of DAP i.e. they scored more than 15 out of 30). This also can be explained that, there were some farmers who were not in the project but still they wished to join and use the technology. About (13.3%) of the respondents had negative perception towards the use of Draught Animal Power (DAP) (that is, they scored less than15 out of 30). These could be laggards who want to observe from others, the benefits of using the technology before they put it into application. There was also 12.5% who had neutral perception i.e. they scored 15 out of 30). The mean of overall perception towards the use of DAP was 17 which implied that the overall perception towards the use of DAP was negative. Therefore, most of farmers preferred the use of DAP. This result was similar to that of Stroud (1993) pointed out that many social and economic benefits could come from the use of animal-drawn implements. Also Fraser (2010) found that animal agriculture was useful activity that produced food from grassland and other resources that would not otherwise be used for human nutrition. But this result is contrary to Rifkin (1992),

portrayed animal agriculture as harmful to the environment. Common themes are that livestock cause water pollution and global warming. The results of three categories can be presented in bar chart as in Fig. 9

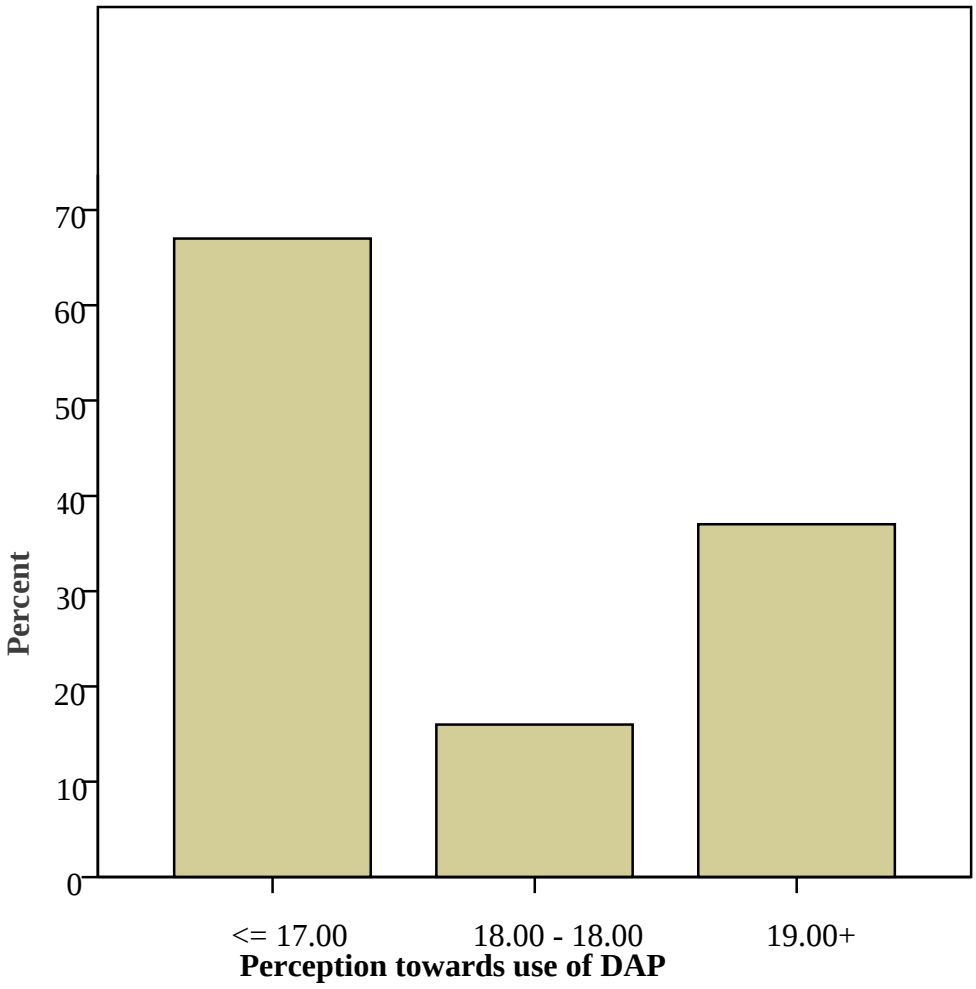

Fig. 9: Perception towards DAP in bar chart

Qualitatively the perception of farmers on the use of draught animal power was analyzed from the Likert scale. Results were shown in Table 7. Farmers were asked if the technology used was the result of their own choice and 74.2% found to agree with it. Involving farmers on the projects to be implemented is the key to the adoption of technologies. But 22.5% of these farmers were found to have not been involved in the initial stages of the project. This might also apply to the reason that they were absent for

various commitments during the day in which the meeting was conducted. It was found that the meeting was conducted in respective villages for the purpose of introducing the information about the project and the other procedures went forward for the project. But it was better to have arrangement which could have enabled the information to reach to those others who failed to attend in either one or two meetings.

To know whether the technology in practice meets the need of farmers in agriculture, 48.3%, nearly half of respondents agreed to this. But close to that, 47.5% found the technology having failed to meet their need. The later group might get into the project without an intension to sustain in it and this could result into failure to adopt the technology.

The use of draught animal power was found to be not labour intensive compared to the use of hand hoe as reported by 70.8% of farmers, most of which said the technology do simplify the work. The adoption can well be achieved if it is accepted in that way. The other 25.8% regarded the technology to be labour intensive. These might have been trained and not well understood on the use of the technology, or they have not been in the project and hence never tried the use of draught animal power. Trying the technology may give true information on whether it is labour intensive or not.

Table 7: Perception of farmers on the use of draught animal power technology

S/N	Statement	Disagree	Neutral	Agree
1	The technology used is the result of farmers choice	22.5	3.3	74.2
2	The technology in practice meets need of farmers in agriculture	47.5	4.2	48.3
3	The technology in practice was just presented to farmers for selection	50.0	8.3	41.7
4	The use of draught animals is labour intensive	70.8	3.3	25.8
5	The use of draught animals requires further instructions	20.8	1.7	77.5
6	The use of draught animal power does not meet your values	92.5	2.5	5.0

To the use of draught animal power, 77.5% of farmers preferred further instructions. This group is more than half of all respondents, signifying that there are some who were in the project and applied it without clear understanding of instructions. This could be corrected by constant visits of project assistants to ensure that the technology is correctly used. Though 20.8% did not need further instructions, theoretically they might assist others in using the technology but their distribution might not be even to the respective groups. They might be concentrated in some and leave others without getting assisted.

Values of people can make them adopt or not adopt the technology. The use of draught animal power in most cases was not against the value of farmers as 92.5% of them said to be free on the use of technology. The other 5% were not on line with their values for reason that using animal for production is like using human being and therefore the animal should not be used for meet purpose again. 3.3% did not know whether the values could allow them to use it or not.

4.3.1 Community perception towards DAP by sex

Sex could determine the perception on the use of a certain technologies. Based on this study the use of DAP could be more muscular activity when compared to the use of hand hoe. In this case men could well fit to the technology than women and the two groups might perceive the technology differently. Using cross tabulation it was found that males constituted 80.8% of all respondents. Among them 43.3% had negative perception towards DAP while 27.55 and 10.0% had positive and neutral perception respectively. On the other side females comprised 19.2% of all respondents from which 25.0% had negative perception. This large percent might be due to muscular need as explained earlier. Others 22.4% and 10.8% had neutral and positive perception respectively. In this study chi-square test found that there was no statistically significant relationship between sex and community perception towards the use of DAP where $p > 0.05$. The results can be presented in the bar chart as shown in Fig. 10.

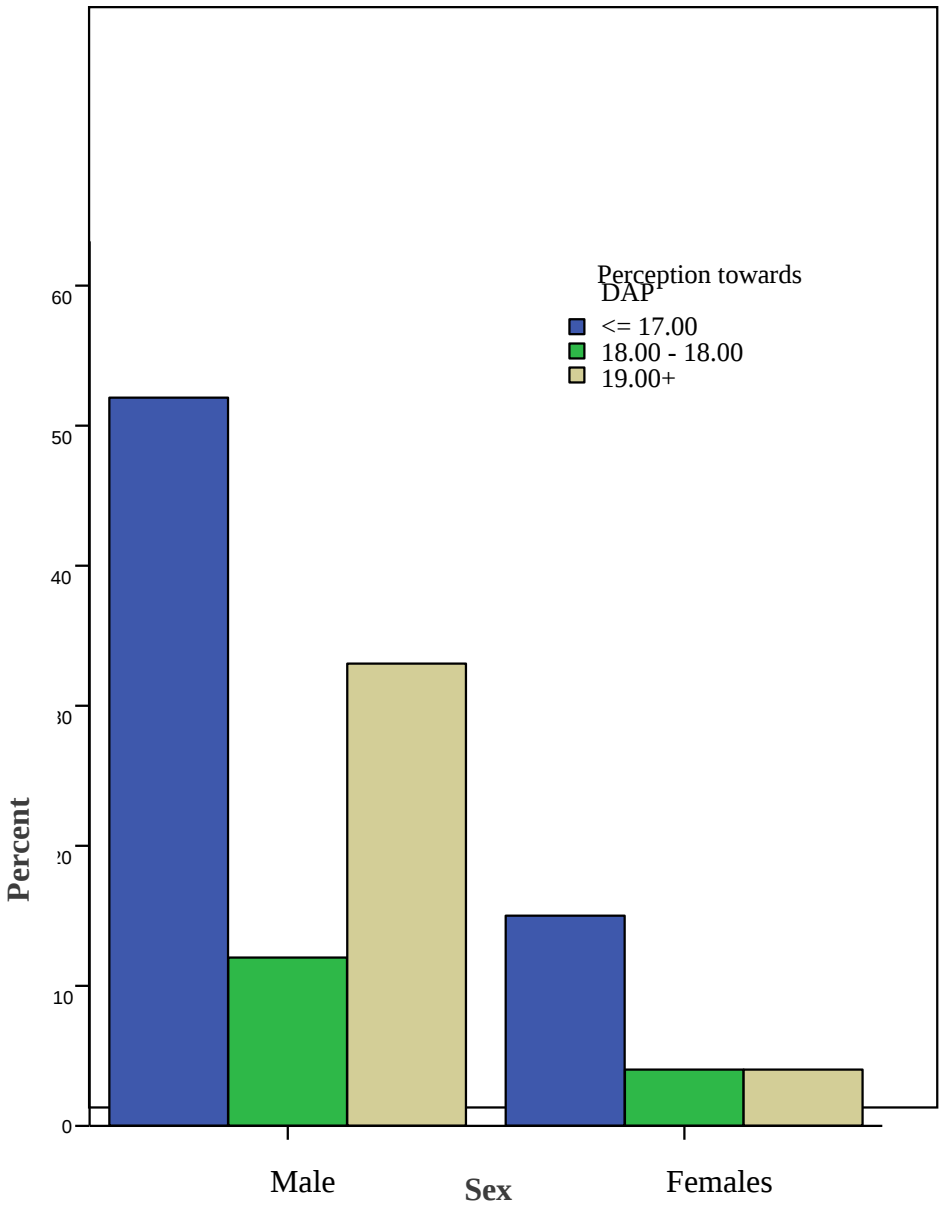

Fig. 10: Perception towards DAP by sex

4.3.2 Community perception over Draught Power by age

65.2% had neutral perception and 34.8% had positive perception. This group might have constituted large percent from the fact that it was actually the working age

Age also determines the use or not use of a given technology. Using the cross tabulation on perception of farmers towards DAP by age it can be found that 55% of farmers fall under the age between 26-45 years among which 28.3% had negative perception towards the use of DAP while 19.2% and 7.5% had positive and negative perception respectively.

Having large number with negative perception could be due to the fact that many people have not witnessed positive results due to the use of improved technologies as it has been found that none of the farmer participated in any past agricultural projects. This was followed by the age group of 46-65 years constituted 35.0% of farmers who had 21.7%, 10.0% and 3.3% with negative, positive and neutral perception respectively. Other age groups included less than or equal to 25 years comprised of 5% of farmers. Lastly the age group of 66 and above with 5% of farmers had neutral perception towards DAP. This could be due to fact that the past agricultural project had no positive results to farmers as explained earlier and the same was expected to the present project. Using chi-square test, this study found that there was no statistically significant relationship between community perception over DAP and age where $p > 0.05$.The results can be presented in the bar chart as shown in Fig. 11.

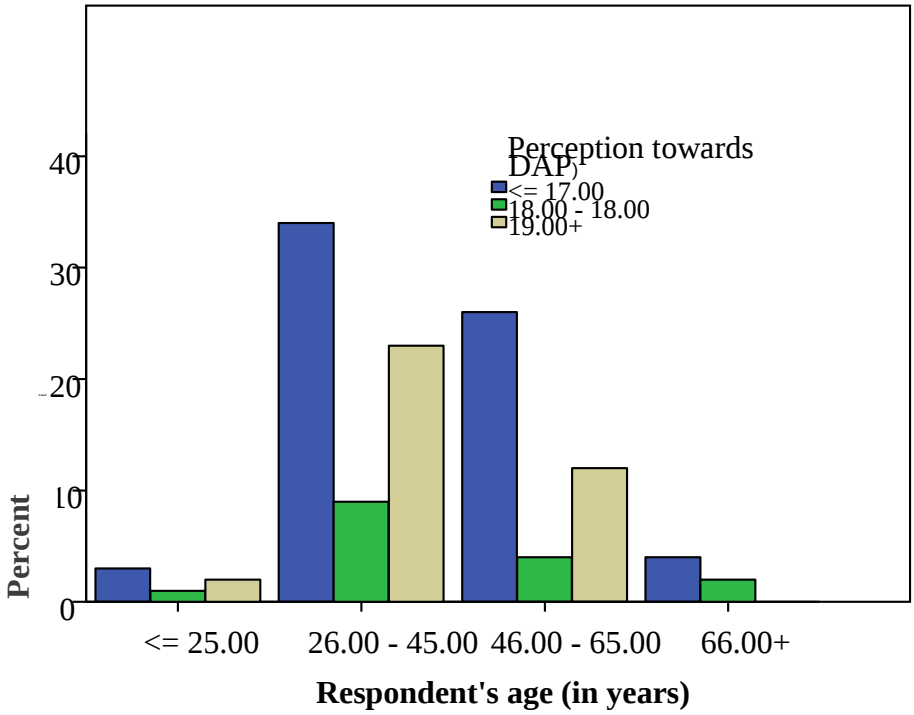

Fig. 11: Perception towards DAP by age

4.3.3 Community perception over DAP by income

Income of the household influences perception of DAP either positively or negatively. Farmers with low income could perceive the technology negatively if it involves high costs which are out of their reach while those who were able to meet the costs perceive it otherwise. This study found that many farmers fallen on income of less than or equal to Tsh. 300 000 among which 50.8%, 30.0% and 12.5% had negative, positive and neutral perception respectively. Those with negative perception in this group might be so to avoid all risks attached to the failure of the technology because they have no extra fund to fill the gap due to loss on the costs of the technology. The same reason might apply to farmers with income ranging from Tsh. 300 001 to 700 000. Farmers with income of Tsh. 700 001 to 1100 000 constituted 0.8%, all had positive perception towards the use of DAP. This could be due to the fact that they have a bit enough money which could allow them to invest into different areas. This was different from farmers with income from 1100 001 and above comprised 1.75% and 0.8% with negative and neutral perception respectively. These might be so from the fact that their income was large enough to think about investing other areas rather than agriculture. Chi-square results found that there was statistical relationship between income and perception towards the use of DAP where $p < 0.05$. The results can be presented in bar chart as indicated in Fig.12.

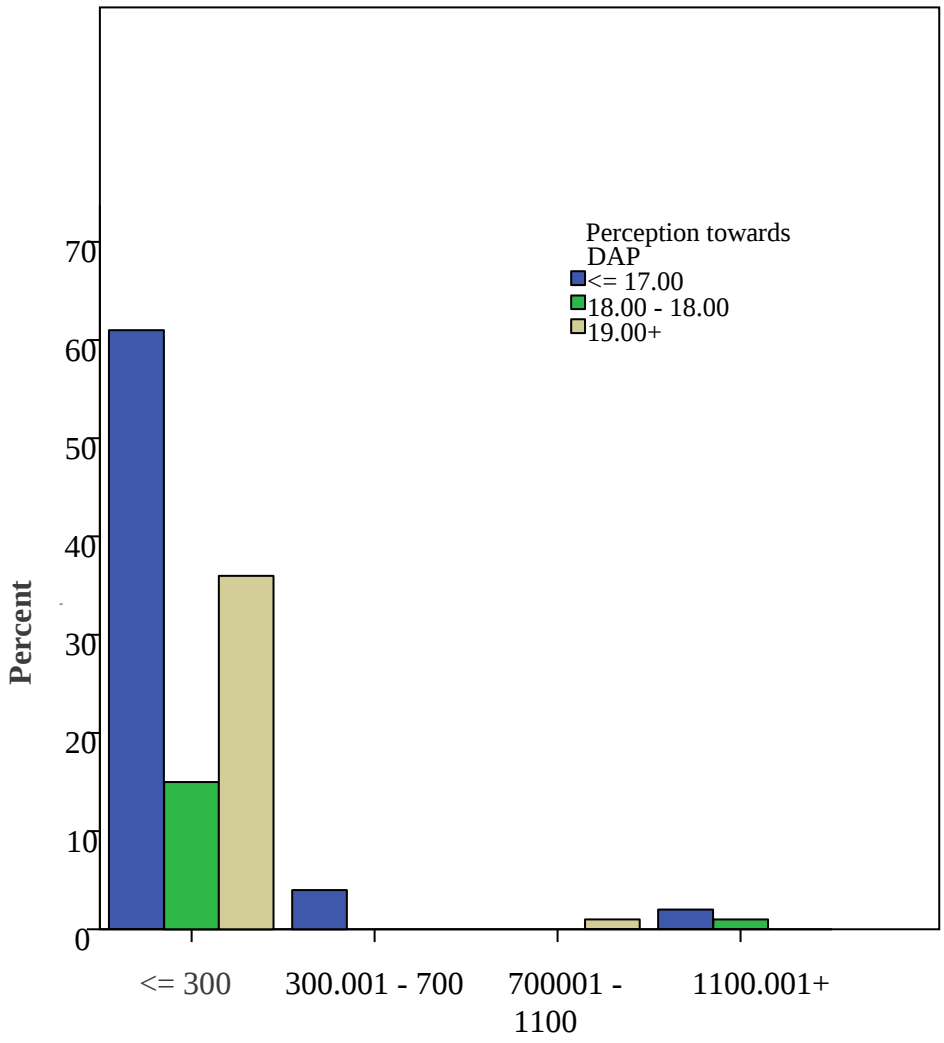

Fig. 12: Perception towards DAP by average income

4.3.4 Community perception over DAP by farm size

Farm size could have an influence on farming technology used in an area such that a farmer having small size of farm which could be cultivated using hand hoe could have no interest of using improved technology. A good number of farmers had farm size between 3-6 acres and they constituted 55.8% of all. From that total 34.2% had negative perception towards the use of DAP followed by 14.4% and 7.5% who had positive and negative respectively. Those with negative perception had large percentage from the fact that their farm sizes were still small such that they can work on them without using improved

agricultural technology. This group was followed by those with farm size of less than or equal to 2 acres with 35.8% of all farmers among which 16.7%% had negative perception more or less the same to 15.0% who had positive perception towards the use of DAP while the remaining 4.2% had neutral perception. Farmers with farm size between 7-10 acres were 7.5% whose 5.0% 1.7% and 0.8% had negative, positive and neutral perception respectively. Then farmers with 10 acres and above were 0.8% of all and these had neutral perception towards the use of DAP as shown in Figure 13. Using chi-square test it was found that there was statistically significant relationship between farm size and perception of farmers over DAP where $p < 0.05$. The results of perception of farmers towards DAP by age have been summarized in bar chart as indicated in Fig.13.

.

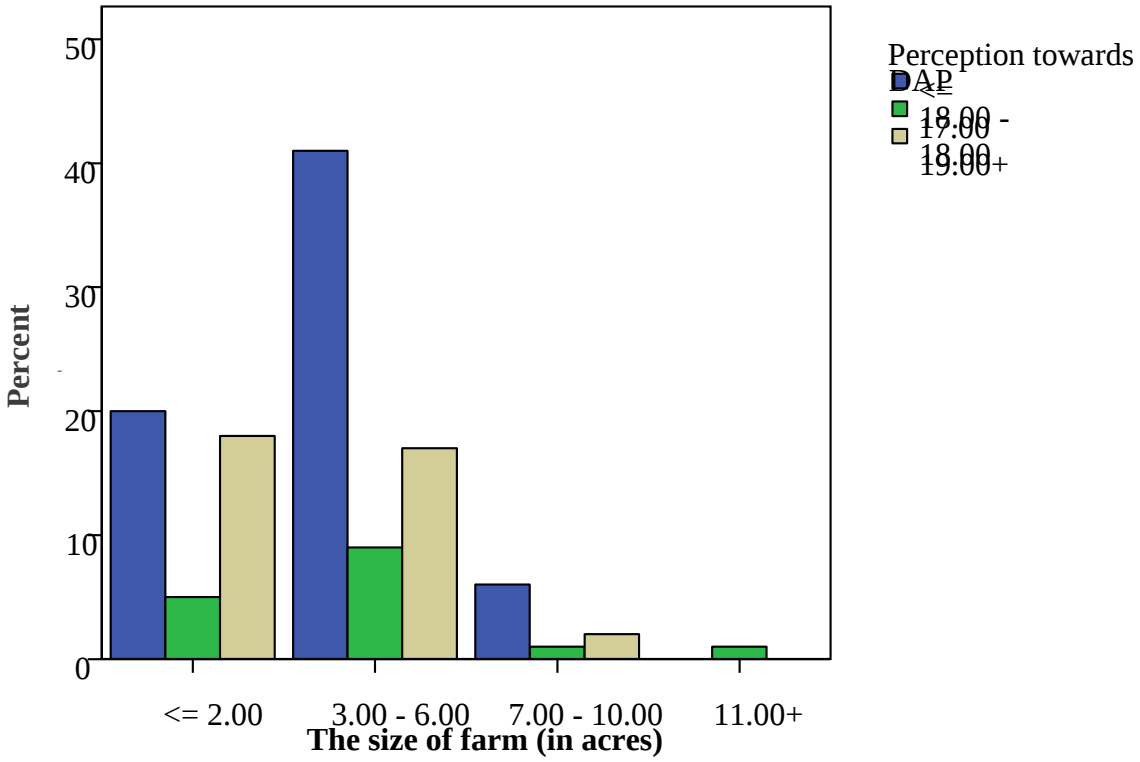

Fig. 13: Perception of farmers towards DAP by farm size

4.3.5 Community perception over DAP by household size

Household size is considered to be all persons related to the particular farmer and dependent on family farm land (Mulugeta, 2000). Large number of household size fallen from four to six members who took 60.8% of all members. From them, 30.8% had negative perception towards the use of DAP. Others included 21.7% and 8.3% who had positive and negative perception respectively. Then the group with household size ranging from 7-10 members with 22.5% among which 13.3%, 5.8%, and 3.3% had negative, positive and neutral perception. Those with household less than or equal to 3 together with 10 and above, in total had negative perception by 11.6% with positive perception and neutral perception by 3.3% and 1.6% respectively. Using chi-square test it was found that there was no statistically significant relationship between household size and perception of farmers towards DAP where $p > 0.05$. Results of farmers perception towards DAP can be presented as shown in Fig.14.

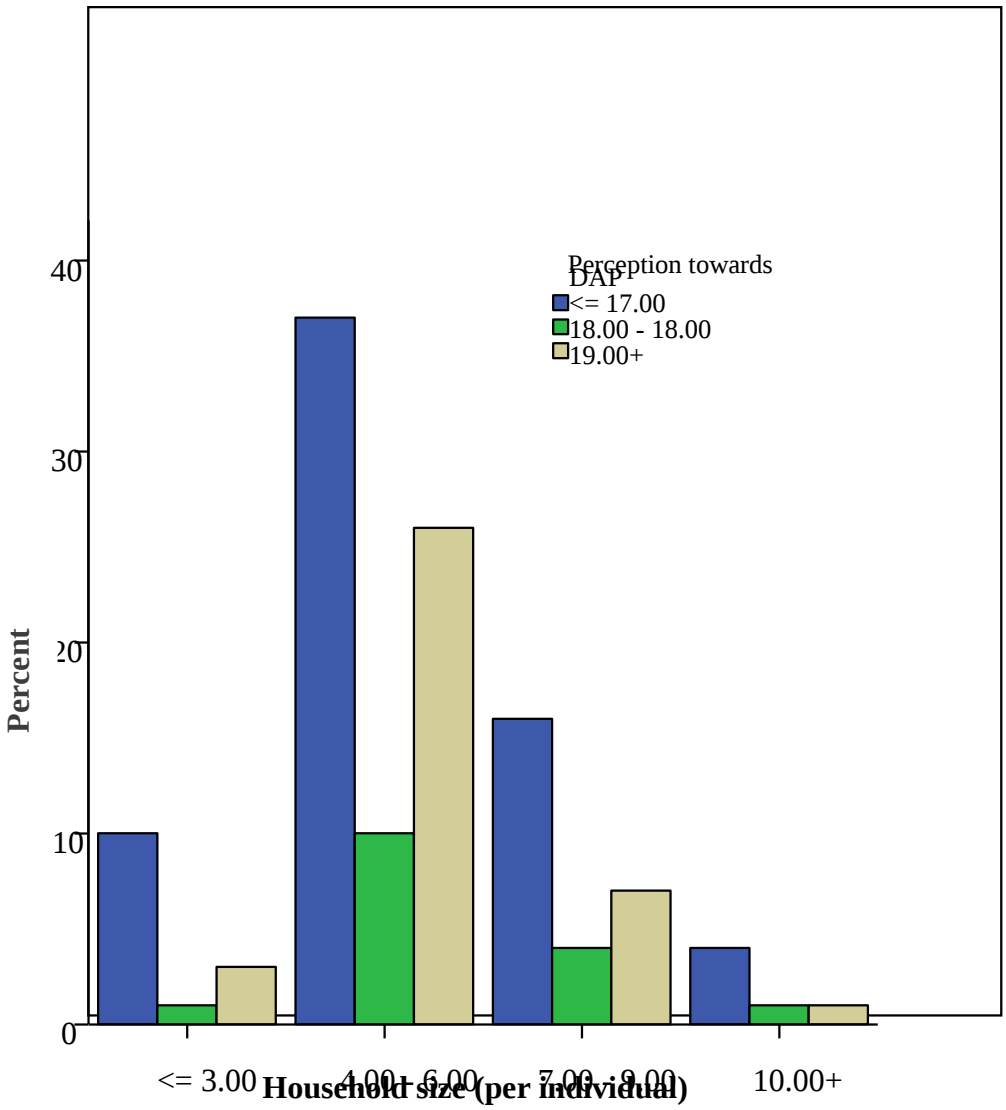

Fig. 14: Perception towards DAP by household size

Household size is considered to be all persons related to the particular farmer and dependent on family farm land (Mulugeta, 2000). This study found that the average household size of the respondents was 6 persons. According to Mulugeta (2000), it was above the national average reported by Central Agricultural Census Commission (CACC, 2003). Based on this study it was found that in using the DAP technology at least two people are require to run the activity. Using cross tabulation chi-square test it was found that there was no statistically significant relationship between household size and

perception of farmers on the use of DAP where $p > 0.05$. The summary of results on perception of farmers on the use of DAP was shown in Table 8.

Table 8: Summary of results of cross tabulation using chi-square on perception of farmers on use of DAP by age, sex, income, farm size and household size

Independent variable	df	χ^2 value	p-value
Age	6	5.249	0.512
Sex	2	2.468	0.291
Household size	6	3.188	0.785
Farm size	6	9.391	0.037
Income	6	8.996	0.049

4.4 Farming practices employed and factors for the use of certain technology

This study involved equal number of farmers who were in the project and those who were not in the project of using draught animal power. Both were identified on their farming practices and 78.8% said to use hand hoe and 21.7% used ox-plough, below which it started in the project. This reveals that some farmers who were included in the project of using draught animal power in agriculture left the use of the technology. The reason included absence of fund for carrying out services of implements meanwhile there was persisted draught which made the soil to be so hard for use of DAP. From these reasons many farmers did not observe the immediate benefits of using DAP and hence dropout from the project.

Further results in this study has shown that 49.2% of farmers have used more than one farming practices, especially hand hoe and ox-plough, while the remaining 50.8% did not use any other kind of farming practice. In most cases those found to have used more than one farming practice were those involved in the PADEP project on the use of ox-plough and count the past use of the hand hoe to be second one. This information might tell that

most farmers were not yet reached by new farming practices initiated by the government or private institutions. Involving farmers in various farming projects which include farming practices could easily lead to adoption of other technologies.

When asked as to why they continued using farming practices they had, 94.2% said it was due the absence of the capital as shown in Table 9. This implies that farmers are ready to adopt various farming technologies but they lack external support to implement those changes. Because those who used certain farming practice for the reason that it has been used by their parents were only 1% of all. Other 1% found their farming practices to be still profitable and find no need of changing it. The last 5% did not change it due to draught condition. Since the new farming practices could involve some costs farmers are worried from getting less return in their harvests. Farmers with high income are more likely to be adopters of new practices than farmers with low income, as income increases farmers' ability to hire labour and meet costs associated with technology requiring increased demand for labour and other inputs (Casey, 2001; Cramb, 2005).

Other studies shows that farmers tend to continue using their traditional practices after assuming that it is still useful to them. In other cases it was found that farmers were right on rejecting the technology. For example, Fujisaka (1993) reported that economic impact on adopters and non adopters of nitrogen fertilizer was not significantly different. This implied that the practice used by farmers were as suitable as those recommended by scientists.

Table 9: Reasons for continuing with the farming practices used now (N = 120)

Reasons	Frequency	Percent
Due to absence of capital	113	94.2
It has been used by our parents	1	0.8
It is still profitable	1	0.8
Due to drought	5	4.2
Total	120	100.0

Respondents who were not included in the project of using draught animal power in their agricultural activities were asked on the reasons from which they do not use the technology. Among them 50% said the equipments were very expensive that they could not manage to by them as shown in Table 10. This calls for the deliberate effort by the government or private institutions to provide loans to subsistence farmers and enable them to make a step ahead in agriculture. 38.3% said it was due to the lack of knowledge of using the technology. This could be the results of poor extension services as it has been found that 63.3% of respondents when asked whether thy get extension services, said no only the remaining 36.7% agreed to the question as indicated by the table below. Those who were reached by those services arouse among farmers involved in the PADEP project. That percent is below half because after introducing the project most of farmers complained of missing extension services. This means that when there is no special agricultural program, the services are generally poor. In responding to the reasons of not using draught animal power, the other 11.7% said the equipments were no available. Being unavailable could be the result of business people failing to reach in many areas of the country from the fact that only small number of farmers are informed and hence the low demand of the equipments.

Table 10: Reason for not using draught animal power in agricultural activities (N = 60)

Reasons	Frequency	Percent
Equipments are not available	7	11.7
Too high costs of equipments	30	50.0
Lack of knowledge of using the technology	23	38.3
Total	60	100.0

Despite having not used DAP technology many farmers were found to be ready for intervention which will change their farming technologies apart from those now put in use. The results showed that 98.3% were ready but they were not yet reached by such service as it has been explained earlier. The other 1.7% was not ready for intervention. These might be reluctant for the reason that they have not yet witnessed positive changes in the past interventions. They are likely to wait for others in order to observe the results before adopting the technology. This situation makes the whole process of adoption to delay for a certain period of time where only the small group of adopters tends to engage into the intervention.

4.4.1 Farming practices by farm size

Farm size also could have an influence on farming practice used in the study area such that a farmer having small size of farm which could have been cultivated using hand hoe had no need of using improved technology like ox-plough. That was opposite to farmers who had large farms. This was highly observed to farmers with less than or equal to 2 acres constituted 35.8% from which 30.8% used hand hoe and only 5% used ox-plough. Also those with 3 to 6 acres occupied 55.8% with 42.5% hand hoe users and 13.3% ox-plough users. The difference of the two groups decreased as farm size increased such that those with 7 to 10 acres 5.0% used hand hoe and 2.5% used ox-plough. This trend improved as the farm size was further increased such that farmers with 11 acres and above who took 0.8% used ox-plough only. Using chi-square test it was found that there was no

statistical significant relationship between farming practice and farm size of the farmer where $p > 0.05$. The results of farming practice by farm size can be presented in bar chart as shown in Fig. 15.

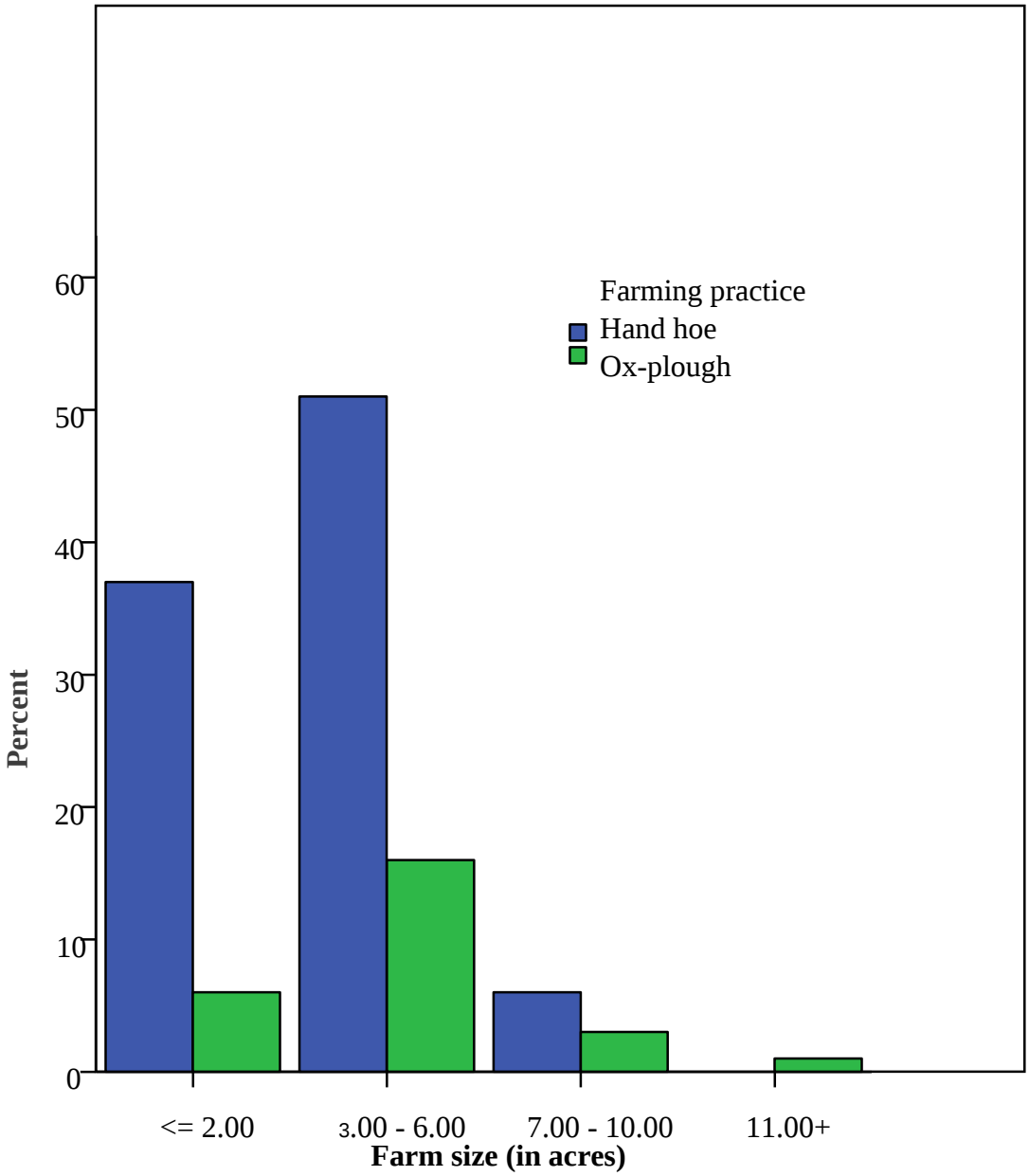

Fig. 15: Cross tabulation results of farming practice by farm size

4.4.2 Farming practices by average annual income

Farming involves some costs and this have an influence on the practice to be used. If the average income of the farmer was small compared to the cost of running a certain farming

practice, it was likely that the practice could be left out. This was also true to the opposite case. As seen earlier that most farmers fall on an average income of Tsh. Less than 300 000/= constituting 93% of all. From them 75.8% were using hand hoe and the remaining 17.5% used ox-plough. This distribution could have been contributed by the fact that using ox-plough requires more fund when compared to the use of hand hoe. With regard to their average income most of farmers were likely to use hand hoe rather than other improved technologies which were in most cases expensive to their reach. This could apply also to farmers with income from Tsh.300 001-700 000 comprised 3.3% of all among which 2.5% used hand hoe and 0.8% used ox-plough. The opposite was true to farmers with income from Tsh.700 001 to 1100 000 in 0.8%, and Tsh. 1100 001 in 2.5% both used ox-plough. Using chi-square test it was found that there was statistical significant relationship between farming practice and average income of the farmer where $p < 0.05$. The results of cross tabulation on farming practice by average annual income can be presented as shown in Fig. 16.

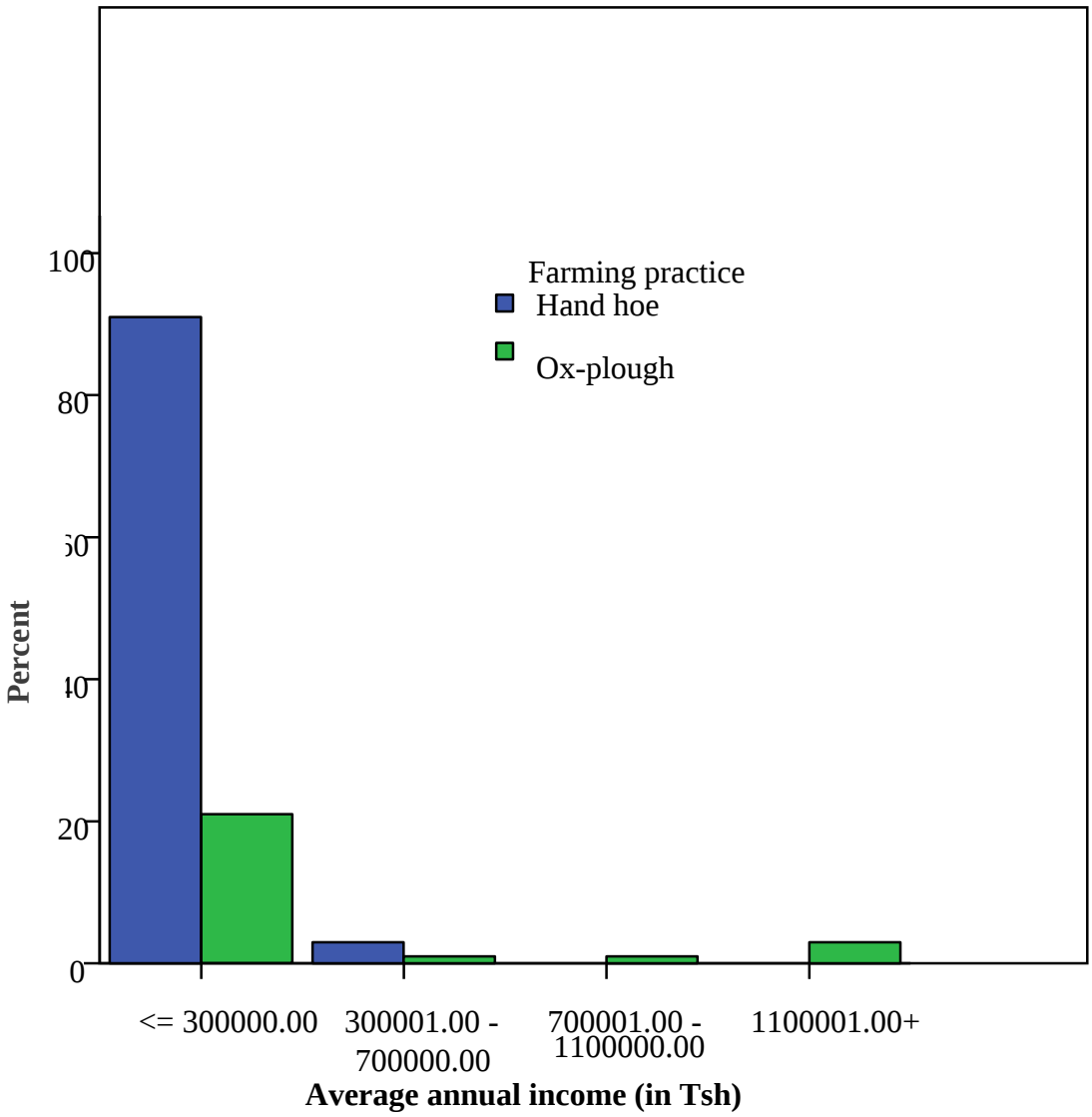

Fig. 16: Cross tabulation results of farming practice by income

4.4.3 Farming practices by household labour

Household labour can determine the farming practices to be used as some were required to be carried out b more than one person. This was experienced in the use of ox-plough where farming was to be done by not less than two people. Large number of farmers 60.8% fallen in the household labour between four to six person and from them 47.5% were hand hoe users and 13.3% were ox-plough users. These were followed by household labour of seven to nine persons who were 22.5% in total with 17.5% hand hoe users and 5.0% ox-plough users. Then household labour with less than or equal to three persons

among which from the total 8.3% were hand hoe users and 3.3% were ox-plough users. Lastly households labour with 10 and above persons who were 5.0% in total and all used hand hoe. The trend of most household labour using hand hoe might have been caused by the perception of farmers towards the use of DAP which was found to be negative. Using chi-square test it was found that there was no statistical significant relationship between farming practice and household labour where $p > 0.05$. Results of farming practice by household labour can be presented as shown in Fig. 17.

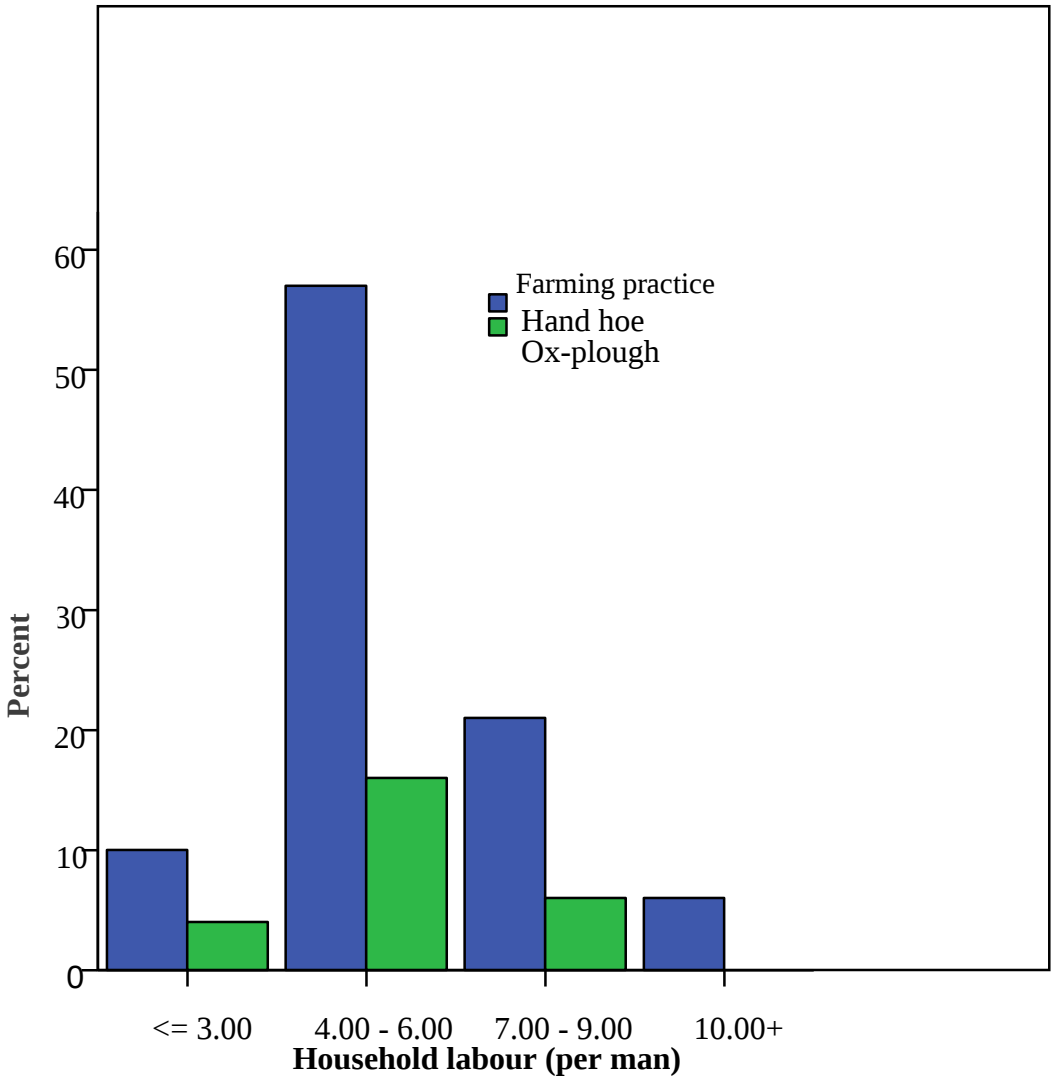

Fig. 17: Cross tabulation results of farming practice by household labour

The results of cross tabulation on farming practice by average income, farm size and household labour were shown in Table 11.

Table 11: Summary of results of cross tabulation using chi-square on farming practice by average income, farm size and household labour

Variable	χ^2 value	df	P-value
Income	15.049	3	0.002
Farm size	6.038	3	0.110
Household labour	2.060	3	0.560

4.5 Factors responsible for adoption

4.5.1 Model specification

The results of logit model in this study are presented in Table 12.

Table 12: Logit model statistical results

Independent variable	β	S.E	Wald	P- Value
Age	0.04	0.034	1.446	0.229 NS
Sex	-0.812	1.241	0.428	0.513 NS
Marital status	0.396	1.238	0.102	0.749 NS
Education level	2.317	1.098	5.039	0.037*
Household size	0.774	0.295	6.881	0.009**
Farm size	0.464	0.291	2.540	0.111 NS
Land size owned	-0.005	0.041	0.014	0.906 NS
Average income	0.000	0.000	6.724	0.010**
Cost	1.942	1.532	3.607	0.048*
Extension	1.559	0.730	4.556	0.039*
Market	2.617	1.046	6.255	0.012*
Relative advantage	2.215	1.039	4.550	0.033*
Trialability	-0.699	0.519	1.814	0.178 NS
Observability	-0.348	0.343	1.027	0.311 NS
Complexity	-2.866	1.050	7.452	0.006**
Compatibility	-2.537	1.058	5.755	0.016*
Constant	-3.846	3.985	0.932	0.334

NS= Non significant (p >0.05), * = significant at (p< 0.05), ** = significant at (p = 0.01),

4.5.2 Age

Regression results, Table 31, indicate that age was not statistically significant factor influenced the adoption of DAP, where $p > 0.05$. It was found from this study that the average age of respondent was 48 years. This can be seen to be the working group age which could be important in agricultural practices. These results were in conformity with those of Okike (2005) observed that adult farmers have more experience and potential labour contribution in agricultural production. They further observed that adult farmers may have more experience and able to assess the characteristics of new technology before adopting it.

4.5.3 Sex

Regression results show that there was no significant relationship between sex and adoption of DAP technology where $p > O.05$. It is commonly seen that women play a major role in agricultural activities in developing countries as compared to men. This study found that 80.2% of farmers were men and the remaining 19.8% women. Sylwonder (1994) pointed out that in most cases men benefited more than women I case of knowledge acquisition from extension services, but unfortunately they were not in position to deliver the same to women. Moshi (1999) found out that if women were equipped with resources they could increase productivity through utilization of innovations and ensure greater return of their labour.

4.5.4 Education

The results in regression analysis shown that education influenced significantly the adoption of DAP in the study area with $p < 0.05$. These results are similar to those of Barker (2006) who observed that there was a significant relationship between education

level and adoption of agricultural technologies. This was contrary to the Ekene and Ogalo (2004) observed that some of the skills adopted were not necessarily correlated with years of schooling but with other factors.

4.5.5 Household size

The number of household members has an effect to the adoption of agricultural technologies which include the use of draught animal power. This study found that farm size was statistically significant to the adoption of DAP where the value of $p < 0.05$. This study found that the average household size of the respondents was 6 persons. According to Mulugeta (2000), it was above the national average of reported by Central Agricultural Census Commission (CACC, 2003). These results are similar to those of Makarius (2006) who observed that with large size of labour force it is relatively easier to participate in various interventions as opposed to small labour force that merely concentrates on production of basic needs. He further noted that inadequate labour force in most cases is one of the major limiting factors associated with low implementation of agricultural practices. Mugisha *et al.* (2004) observed that households with large number of family members are more likely to practice various technologies as they can distribute labour in different interventions.

4.5.6 Farm size

The size of farms respondents had, range from less than or equal to 2 acres and above 11 acres. There is no doubt that these are small scale farmers whose production depends mostly on rainfall which are not reliable. Apart from the low technology they are using, they are also bound to having small sized farms to avoid serious loss in case of the low amount of rainfall. On average every farmer had 3.4 acres of farm. This number of acres

includes all types of crops the one cultivated the year before. When subdivided in that way it can be found that farming involves small portions which could not enable them to engage into business oriented agriculture. Efforts which involve expansion of agricultural activities like farm size are to be emphasized. Those farmers who have managed to have 10 and 15 acres, who constitute 0.8% each, are likely to be using improved methods of farming like use of draught animal power or employing other workers out of his/her personal work force. The percent of these people is small and therefore they are to be empowered to make a step ahead. A good number of farmers, 55.8%, fall on group of having 3-6 acres each, more or less similar to the average, thus facing the same problems as explained earlier. Those who possessed less than or equal to 2 acre either cultivated one crop or different crops, which in most cases they were likely to fall into hunger. The categories of farm size were represented in bar chart as shown in Fig.18.

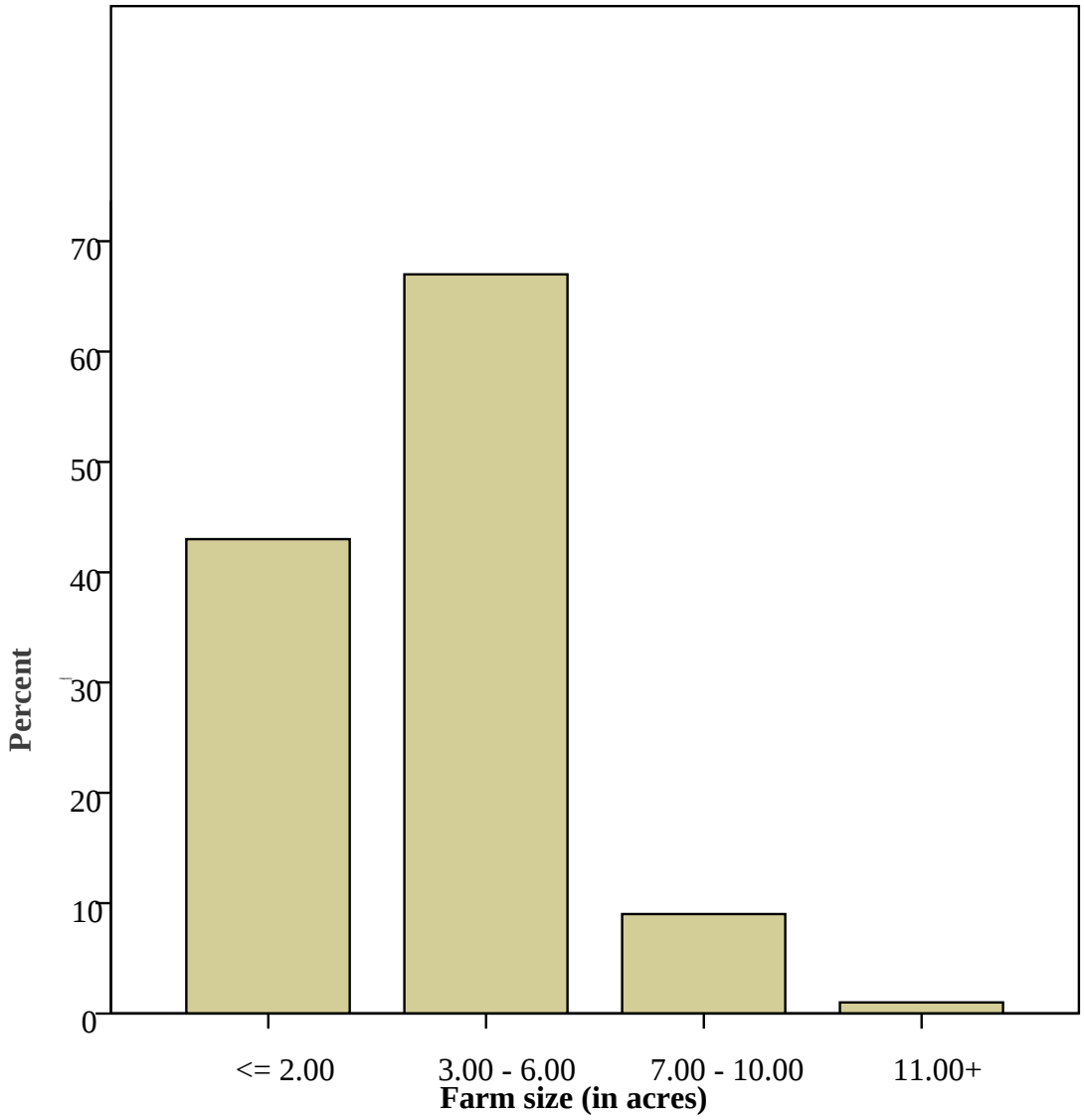

Fig. 18: Categories of farm size

Regression results shows that the influence of farm size was statistically insignificant to the adoption of DAP in the study area where $p > 0.05$. These results are similar to those of Abdelmagid and Hassan (1996) found that farmers with large size of farms had high rate of adopting new technologies than farmers with small farm sizes because it pays to do so.

4.5.7 Land size owned

The total area of land owned by farmers range from 4 acres, 4.2%, to 70 acres, 1.7% as shown in Table 13. The draught animal power technology could be enough for them. This

is also to be understood that the size of land owned was meant to the whole family. When distributed in that way, it can be found that every member of the family owns small size of the land for farming which, unless for the purpose of simplifying work, it can be worked out using hand hoe. Therefore farmers might find no need of adopting the initiated projects intended to expand the size of farm because the land they have is within their ability to be cleared.

Table 13: Three categories of the total area of land owned by farmers (N = 120)

Total land owned	Frequency	Percent
≤ 10	61	50.9
11-30	55	45.8
≥ 31	4	3.3
Total	120	100

Owning more land is one of the needs of farmers because when asked from the total area of land owned whether they needed more of the land, 71.7% agreed to it. If empowered to achieve this it will create the foundation on the means of cultivating the total area owned and hence the adoption of technologies which include draught animal power. 28.3% had no need of owning more land and these might be so from the fact that the current size of the land owned can not finished when cultivated and no deliberate and reliable efforts seen to enable them to cultivate more land. For them to adopt farming technologies might be easy when well educated. Results in this study has shown that it was not statistically significant between the size of land owned and adoption of DAP where $p > 0.05$. These are contrary to those of Rogers (2003) that farmers' control of and access to land and labour are major factors limiting the uptake of the technologies. They are also contrary to

Wetegere (2010) found that availability of household resources such as land, labour, cash income, knowledge and other inputs like feeds, fertilizers, water and seeds.

4.5.8 Average income

It has been found the main source of income from all respondents, 100%, those who were in project and those who were not in the project was agriculture. A total of twelve crops were grown by farmers and the mostly grown one nearly by all farmers 99.2% was maize as shown in Table 14. This might be due to the reason that being subsistence farmers, they wanted to ensure availability of food in their households before they look for crops meant for business. At the same time this crop when harvested in extra amount from the household food, it is used for business purpose. Other crops which grown, listed in their descending order of the number of farmers , were cowpeas 35%, beans 29.2%, sunflower 18.3%, cassava 18.3%simsim 17.5%, and round potatoes 5.8%. Others were pegion pea 4.2%, sorghum 3.3%, rice 3.3%, ground nuts3.3% and finger millet 1.7%. The last four crops might have not been commonly grown for some reasons which included soil type and amount of rainfall, to mention some.

Table 14: Type of crops grown

S/N	Type of crops	Frequency	Percent
1	Maize	119	99.2
2	Cowpea	42	35
3	Beans	35	29.2
4	Sunflower	22	18.3
5	Cassava	22	18.3
6	Simsim	21	17.5
7	Potatoes	7	5.8
8	Pegion pea	5	4.2
9	Sorghum	4	3.3
10	Rice	4	3.3
11	Ground nuts	4	3.3
12	Finger millet	2	1.7

The number of bags yielded by farmers went in the decreasing order similar to the number of farmers grew a certain crop. In this case 1 213 bags were maize followed by cowpeas and beans as shown Table 15. The last three were still rice, ground nuts and finger millet. The same purpose led to the option of growing some crops might be applicable to the number of bags yield. In addition this low yield was contributed by the number of farmers grew the crop.

Table 15: Number of bags yield

S/N	Crop	Number of bags (Sum)	Mean
1	Maize	1213.00	10.2797
2	Cowpea	13.00	.1102
3	Beans	87.00	.7373
4	Sunflower	9.00	.0763
5	Cassava	33.50	.2839
6	Simsim	73.00	.6186
7	Potatoes	6.00	.0508
8	Pegion pea	1.00	.0085
9	Sorghum	.00	.0000
10	Rice	.50	.0042
11	Ground nuts	.50	.0042
12	Finger millet	2.50	.0212

Maize having been grown by almost all farmers, again it has been the most sold crop by 69.1% as compared to others. Growing maize was seen to be given special attention because when a farmer grew one crop, it was maize which appeared to be given the first priority and therefore the opportunity. In that case, to some households, maize appeared to be only crop to be sold. Other crops followed in selling were; cassava 12.3%, and beans

12.3% as shown in Table 16. Generally it was found that those crops which were commonly used for food led in having been sold compared to crops which were grown for business like simsim and sunflower took 1.8% and 1.2% respectively. It was also found that four crops despite having been grown, none of them happened to be sold. These included sorghum, pegion pea, rice and ground nuts which also appeared as the last in the yield.

Table 16: Number of bags sold

Crop	Number of bags sold (Sum)	Percent
Maize	343.00	69.1
cassava	61.00	12.3
Beans	61.00	12.3
Simsim	9.00	1.8
cowpea	8.10	1.6
Sunflower	6.00	1.2
round potatoes	6.00	1.2
finger millet	2.50	0.5
sorghum	.00	0.0
rice	.00	0.0
pegion pea	.00	0.0
groundnut	.00	0.0
Total	496.6	100

This study found that about 99.2% of all farmers grew maize and only 0.8% did not grow the crop. This might be due to the reason that farmers wanted to assure themselves on the availability of household food as cash crops performed poorly in the study area. Otherwise, a considerable number of farmers would have grown cash crops only,

expecting to buy food from the cash obtained in crop sales.

Generally the number of bags sold from one crop to another ranged between 0% for rice and sorghum, pegion pea and ground nuts because the yields of these crops were low and what was obtained was just used for food to 69.1% for maize. In most cases crops like simsim and sunflower were all sold after harvest. This might be for the reason that to get oil from the crop requires machine which is expensive to the reach of farmers.

The value of the crop differs from one another. The prices of crops again differ from the harvest season, when they fetch very low, to the rain season, during which crops are grown and the prices are high. The under mentioned prices were taken on their averages prices per 100Kgs of a crop and in Tanzanian shillings. Without any order of listing the prices were found to be as follows maize 30000/=, sunflower 50000/=cassava 20000/=, cowpeas 35000/=, sorghum 25000/=, groundnuts 55000/=, pegion peas 25000/=, round potatoes 50000/=, beans 40000/=, rice 70000/=. Finger millet 40000/= and simsim 60000/=

For those who sold their crops, the lowest cash obtained by the farmer was Tsh. 30 000 which constituted to 6.7% of all farmers. The highest cash yield was Tsh. 2 380 000 to only 0.8% of farmers who was one in number. When put into categories it was found that 95.8% of farmers had an income below or equal to Tsh. 500 000 per year while 0.8% had between Tsh. 5000 001 to 1 000 000. the remaining 3.4% had above Tsh. 1 000 001 per year. The categories of average farmers income is shown in Table 17.

Table 17: Average annual income of farmers from sold crops (N = 120)

Average income (Tsh.)	Frequency	Percent (%)
≤ 500 000	115	95.8
500 001 – 1 000 000	1	0.8
≥ 1 000 001	4	3.4
Total	120	100

A total of Tsh. 10 975 000 with an average of Tsh. 91 458/= were obtained by farmers from crop yields per year. Based on the information that their main economical activity was agriculture, this income, which was also supposed to support their basic needs, could not be enough to be used in the adoption of technologies as far as cash contribution was needed in order to join in the project.

When taking the average number of members in the household, which was six as shown in the household composition and the average income of the households being Tsh. 91 458, per capita income can be obtained by dividing the later to the earlier number, which gives Tsh. 15 243. This is little amount of money which could even not support basic needs of an individual per year. This study found that there was statistically significant relationship between average incomes and adoption of DAP in the study area where $p < 0.05$. These results conform to that of Rayburn (2005) indicated that farmers with high income are more likely to implement new technologies than those with low incomes because high income increases farmers' ability to hire labour and meet costs associated with adoption of technologies. The results also are similar to those of Mugisha *et al.* (2004) who observed that wealthier farmers are most likely to be the first to try a new technology as they can

withstand the risks which may be associated with implementation of technologies as opposed to resource poor farmers.

4.5.9 Costs of technologies

It was found that in running the agricultural technologies there were some costs involved to where 70.8% agreed to it and the other 29.2% said none of the cost is involved. For those who finds the need of the fund to run the technologies, it is not clear how do they solve the problem of the fund, but when it happens that they have failed to it from any source, the only thing to happen is to leave for anything to happen on their farming activities. As a result the harvests are lowered despite a farmer having spent more effort in terms of time and energy to it. Here the issue of loans to farmers remains to be important to enable them to solve these problems. Saying there is no any cost can be due to the fact that they are able to manage them therefore they do not get stranded in their farming activities or they do not use modern farming technologies which require some fund to be spent to the farm.

During the implementation of the PADEP project also there was the contribution as the condition to join in the project as said by 92.5% of all. The demand for contribution can prevent some from joining into the project because this takes place during the preparation of farms when most of subsistence farmers do not have stored crops which would have been used to sell and get fund for contribution. This contribution gives further opportunities to farmers who have economic relief and block it to the economically disadvantaged farmers. Or else, to enable many farmers to join in the project equally alternative contributions should be introduced such as labour, contrary to this project where cash was the case.

It was found in the study area that the equipments for draught animal power were available to many farmers where 63.3% agreed to it. Despite the equipments being available it was found that farmers had to travel some distance to get them because the places they could find them easily were District centers. This increased cost of getting the equipments and it might contribute to the failure of continuing with the technology. There are 36.7% farmers who complained on the absence of the equipments. These might drop the use of the technology once the first bunch of the equipments and spares have worn out. There is a need of informing project member on the way they could access spare parts for various maintenance. Stroud (1993) shows that implements constitute a greater drawback than any other factor in the adoption of animal traction. This is because many implements may be too expensive, inappropriate to farmers' local circumstances, imported and therefore not readily available locally, or too heavy for farmers. Statistical results of this study found that costs of running the technology influenced positively to the adoption of DAP in the study area as $p < 0.05$. This conforms to Odoemenem (2007) found that determinants influencing adoption of technology include, amount and use of credit, age, level of education, household size, cost of adoption and cooperative membership

4.5.10 Extension services

Extension services remains to be important in adoption of technologies. In this study 36.7% of farmers reported getting extension services and the other 63.3% did not get the services. If farmers are not reached by extension services it is difficult for them to be informed on different types of technologies developed and hence low adoption.

Among those who were reached by extension services, only 38.8% were so at all time they needed, 27.35% once in two weeks, 22.7% once per week and the remaining 11.4%

once per month as shown in Table 18. This study found that the influence of extension services was statistically significant to the adoption of DAP technology in the study area where $p < 0.05$. This conforms to several studies indicated that farmer's contact with extension staff increases the probability of adopting the introduced technologies (Forson 1999; Adesina *et al.* 2000). Also Nkonya and Norman (2005) observed that there is a positive relationship between frequencies of extension contact with farmers and adoption of technologies. Similarly Dogbe (2006) observed that frequency of visits is an important factor in adoption of technologies since extension is an open system service and two way exchange between the farmer and the extension agent, although the decision is made by the farmer who must be provided with necessary information. Odoemenem (2010) investigated that extension workers, mass media and individual contact with neighbours proved most effective determinants in the adoption process. Nevertheless, some studies show that extension service influences negatively adoption of technologies (Dimara and Skuras, 1998).

Table 18: Frequency of extension services to the farmer

Extension frequency	Frequency	Percent
Once per week	10	22.7
Once in two weeks	12	27.3
Whenever I need	17	38.6
Once per month	5	11.4
Total	44	100.0

Extension services were not equally reached to farmers and even some of those reached by the services think the agents do not provide enough information which can be used in agricultural practices. This is because in responding to this question the percent of those who are reached has come down to 30% that the information was enough, and those who

found to be not enough raised to 70%. In this case there is a need of strengthening extension services even to those few are reached by the service.

4.5.11 Market availability for agricultural products

The market of the crops produced by farmers is not seem to be a serious problem as it has been found that 75% of all respondents said to have market but the other 25% said there was no market for their agricultural products. If no deliberate effort is done to ensure the market of that small percent, it is likely that to them the adoption will be low because they shall find no need to increase production while the access yields will be lacking the market. Machumu (1995) reported that well established system; research and marketing stimulate small businesses which later enable adoption of new technologies.

Among those found to have markets for their agricultural products, 46.7% said it to be reliable while the other 53.3% said the market to been not reliable. This large group is similarly exposed to the state of delayed adoption of agricultural technologies because producing more without being assured by the market of their excess yields some times leads to the loss of the crops.

Again those who have the market 70% complained on the price to be low and that it did not meet with their cost of production. Only 6.7% were comfortable with the price of their agricultural products. This later group could be among those who have ability to transport their crops to the place where they think that they can get good price of their crops. The adoption of technologies is intended, among other things, to increase production which in turn needs the market of the excess crops. This low price make farmers feel like wasting

their energy after spending a lot during the production. This study found that market statistically influenced positively to the adoption of DAP where $p < 0.05$.

4.5.12 Relative advantage

This study having had an attempt to see the adoption of draught animal power in agricultural activities, it intended to understand if farmers were aware that the use of those animals increase yields compared to the use of hand hoe. 99.2% found to agree on the increase of the yields and 0.8% were found on the opposite case. This means the use of draught animal power if well organized in agricultural projects established by the government or private institution, has more chance to be adopted and applied in agricultural activities. Farmers are ready informed on the advantage of using animals and this will lead to easy adoption of the technology.

Despite different costs involved in running agricultural activities, farmers do understand that the use of draught animal power is more profitable compared to the hand hoe. This provides information that farmers are ready for change of their farming technologies as it was found that 98.3% agreed to it while the remaining 1.7% said it was not profitable. This small percent might have not got opportunity to observe the results of using draught animal power. It is necessary then to ensure that education reaches to all farmers before establishing the project. Profitability is whether, from the farmer's perspective, the financial benefits obtained from using the technology is higher than for alternative technologies, including the ones farmers use (Pali, 2003). Statistical results explained that relative advantage influenced positively the adoption of DAP technology in the study area as $p < 0.05$. This result is in conformity to that of Forson, (1999) found that higher yield influences positively and significantly the adoption of technologies. Also (Wetengere,

2010) found that technologies that offer only marginal improvements to existing methods or are difficult or costly to use often diffuse slowly.

4.5.13 Trialability

Trial of the technology before putting into actual practice is important as it develops to getting experience and then adoption. It has been found that the use of draught animal power have never been tried by 73.3% of all farmers before putting the technology into actual practice and only 26.7% tried the technology at least once. Those who tried the technology 40.7% did it only once. This has the effect that it can not provide enough opportunity to gain the experience which could lead to the adoption of DAP. Only one person, 3.1% tried the technology more than 3 times. It shows that the use of the draught animal power at the study area was not famous to most farmers. This could hinder the adoption of the technology. The other two groups of 28.1% tried the technology 2 times and 3 times respectively as shown in Table 19.

Table 19: The number of times one tried the technology now in use before putting into practice

Number of trials	Frequency	Percent
1 times	13	40.7
2 times	9	28.1
3 times	9	28.1
more than 3 times	1	3.1
Total	32	100.0

This study found that the influence of trying the technology before putting into exact practice was statistically insignificant in the study area where $p > 0.05$.

4.5.14 Observability

Observing the technology could play part in its adoption from the fact that after seeing from others how much the work is simplified and the results of expanding the farm, can

convince others to adopt the technology. During the study it was found that 69.2% of all, at least observed the technology they have been using while 30.2% did not observe the technology at all as shown in Table 20.

Table 20: The number of times one got opportunity to observe the technology in use before putting into actual practice (N = 120)

Observed the technology	Frequency	Percent
0 times	37	30.8
1 times	8	6.7
2 times	19	15.8
3 times	50	41.7
more than 3 times	6	5.0
Total	120	100.0

This study found the relationship between observation of the technology and adoption of the DAP technology was statistically insignificant where $p > 0.05$.

4.5.15 Compatibility

Compatibility of the experience could promote the adoption of various farming technologies. This is because it makes the understanding of the technology easy as far as some experiences are matching. The use of draught animal power was found to be not very compatible to 76.7% of farmers when compared to their past experience. The adoption of the technology could not or take long time to be achieved. 23.3% of farmer felt that the use of draught animal power was compatible to their past experience as shown in Table 21. This percent is small to ensure the success of the project and it calls for well organized project to achieve the intended goal. The age and experience of the farmer may likely have the range of influences on adoption decision. Old age may for example, influence the farmer in the direction of not adopting (Ghadim and Pannell, 1999; Marenya and Barret, 2006).

Table 21: DAP compatibility to farmer's present experience (N = 120)

Experience compatibility	Frequency	Percent
Yes	28	23.3
No	92	76.7
Total	120	100.0

This study found statistically that there was no compatibility between past experience and adoption of DAP as the value of $p > 0.05$. This is contrary to a study conducted by Senkodo et al. (1999) in western Pare Lowland of Tanzania found that farmers with more experience in farming were more able to adopt rainwater-harvesting technologies compare to those with less experience. Odoemenem (2010) found that Adoption of improved technology packages may, in part, be related to the way farmers receive the technologies introduced to them He continue further by saying the important factors in such a perception are the difficulties inherent in using a practice, the consistency or how adaptable the practice is in the context of the existing practices in which the farmers are already familiar with; and the expectations of the farmers using the practice.

4.5.16 Complexity of the technology

Among those who got instruction 85.7% did understand. This percent, 14.3%, is still enough to lead those who have missed and others who failed to understand the use of the technology. It is likely that a more complex technology can discourage farmers to adopt as it might demand a lot of time to put into appropriate use. This study found that complexity of the technology was statistically significant to the adoption of the DAP technology where $p < 0.05$.

4.5.17 Access to credit

When farmer were asked if they had access to credit it appeared that none of them happened to get credit for implementing agricultural activities. This was so in both periods, before and during the project such that farmers were never reached by any financial institution and those who tried to go on them were given conditions which were far from their reach. The main reason was lack of collateral for the credit. Due to this their possibility to the access of credit was very much limited. In connection to the credit when asked whether credit could enable more people to adopt various agricultural technologies 97.5% agreed to it and the remaining 2.5% opposed from that idea. It is true that getting loan can enable the farmer to make use of various farming implements and do the timely preparation of the farm, timely planting, weeding and hence harvesting. The modern methods of storage also require the use of fund, without which great loss of crops could happen on post harvest. As far as the need of credit arise from farmers themselves, with the aid of the education on how to spend and return the money back, it is likely that they will make appropriate use of the fund.

4.6 Farmers' suggestions on the use of draught animal power

When asked for suggestions on the use of draught animal power three important points were offered where the increase of the number of draught animals was highly emphasized. About 64.2% requested the government to provide more draught animals than now it has done. As seen earlier that about half of members participated into the project have left the technology, this result signifies that there are some farmers who were not involved in the project are now willing to adopt the technology. 33.3% suggested on the change of the technology from the use of draught animal power to power tiller and tractors. Most of

farmers falling in this group were in the project and already stopped on the use of the draught animal power technology and some who were not willing to try it. The technology was said to be low still and they went further by saying that it was better for the government to provide one tractor in each Ward for agricultural activities rather than providing a number of animals which their capacity to work is not comparable. 6.7% suggested that the use of draught animal power should go together with the use of improved seeds of low price. This is because expanding the farm and remain on using low quality seeds still reduces the yields while having spent a lot of energy.

CHAPTER FIVE

CONCLUSSION AND RECOMMENDATIONS

5.1 Summary of the major findings

5.1.1 Perception of farmers on PADEP

When looked on perception of farmers towards PADEP it was found that most of them had perception negatively. The results in three categories shown that 52.5% of all farmers had negative perception and only 40% perceived it positively. The remaining 7.5% had neutral perception. The most interesting thing to farmers to PADEP was that it gave them a new technology in farming practices where 89.1% did agree. On the other hand 88.4% of farmers had experienced past agricultural project to have not changed their life standard.

5.1.2 Perception of farmers on the use of draught animals in agricultural activities

This study found that a good number of farmers had positive perception towards the use of DAP which constituted 74.2%. Others 13.3% and 12.5% had negative and neutral perception towards the use of DAP technology. Despite having positive perception on the use of DAP technology, most of farmers constituting 77.5% demanded further instruction on the use of DAP. Again there was 25.8% of farmers who found the use of DAP to be labour intensive. The idea of involving farmers on the project to be implemented was well adhered to such that 74.2% agreed the technology used to be the result of farmers choice.

5.1.3 Farming technology used by farmers and reasons for the use of certain technology.

It was found in this study that farming technology commonly used by farmers was hand hoe. This was meant to 78.8% of all farmers and only 21.7% used the ox-plough. This

implied that up to the study period some farmers who were involved in the PADEP project on the use of DAP technology did not sustain into the practice. Major reason for this was due to absence of the capital, applying to those who were not in the project and lack of fund for those who were involved in the project. Other reasons included that it was due to drought 4.2% and 0.8% found hand hoe to be still profitable when compared to DAP technology. The remaining 0.8% said to have well experienced in using hand hoe as taken from their parents.

5.1.4 Factors hindering the use of DAP technology

When looked on the factors hindered the adoption of DAP technology it was found that some influenced it significantly but others did not. Those influenced significantly at $P < 0.01$ included household size, average income of farmers and complexity of the technology while at $p < 0.05$ included education level, cost of the technology, extension services, market, relative advantage of the technology and the compatibility of the past and present experience. Factors which were found to be statistically not significant were age, sex, marital status, size of farm cultivated, size of land owned, trialability and observability. It was further found in this study that none of the farmer obtained credit from the government or private financial institution for agricultural activities though farmers themselves were ready to get and use if it would have been available.

5.2 Conclusion

A good number of farmers had negative perception towards PADEP in one side while on the other side they had positive perception towards DAP technology.

Extension workers had no constant visits to farmers unless there was a special project to be carried out as they did for PADEP.

No financial institution reached to farmers. All farmers complained of not getting the credit meanwhile they knew that credit could enable them to improve their agricultural practices.

Farmers had no appropriate advice on the type of soil and crop to be grown. Instead farmers were growing crops in trial and error method which led to some crops getting very low yields.

During the implementation of the project equipment were not readily available to farmers. To get them if needed, farmers were forced to travel to district centre. This might have contributed to some dropping the use of technology.

Farmers had markets but those markets were not reliable and complained selling their crops in low prices which yet were not stable.

5.3 Recommendations

The following recommendations have been suggested to improve the likelihood of farmers adopting agricultural technologies:

(1) In this study it was found that for those farmers who received extension service, did so immediately before the project and in early stages of the project such as during instructions. After this stage most farmers did not get further visits of extension workers. Government has to strengthen extension services so as to continuously provide services to farmers instead of waiting for established special projects. Constant visits are likely to influence adoption of technologies positively.

(2) This study found that many farmers who were not in the project were ready for intervention but they were not reached and get well informed about the project. During the establishment of the project several visits are to be made to farmers in order to create awareness on the presence of the project.

(3) It was also found in this study that none of the farmers in the study area got the credit for agricultural activities. Government and private financial institutions should provide credit to enable farmers to cover the costs of agricultural activities. Otherwise farmers will remain using their traditional farming knowledge for quit long time in the future.

(4) Many farmers in the study area grew some crops which meant for business but their yields were quite low. Following this situation farmers themselves were forced to sell food crops so as to fill the gap of the failed cash crops, the act which might lead to household food insecurity. To avoid this, appropriate advices are to be given to farmers on the type of crop to be grown in a certain area.

(5) Market of crops having been found to be the problem in the study area but influencing the adoption of DAP technology positively, farmers should be ensured by the market so that they will get encouraged to produce more for selling the excess yields.

(6) This study found that in case of a need of equipments, farmers had to travel some distance which in most cases at the district centre to look for them. This increases costs of production and might contribute to the poor adoption of technologies. When projects are established the related equipments should be well supplied and close farmers themselves.

(7) 74.2% of farmers had positive perception towards the use of DAP i.e. they scored more than 15 out of 30). This also can be explained that, there were some farmers who were not in the project but still they wished to join and use the technology. To them plan should be made to ensure that other agricultural projects involves as many farmers as possible.

5.4 Areas for further research

1) As some of farmers complained on the soil to be hard for cultivating using draught animal power, study should be made on the appropriateness of the soil to the use of the technology.
2) There was trial of farmers growing cash crops which included sunflower, simsim and round potatoes but the yields of these crops were poor compared to food crops. This call for research on appropriate cash crops which can be grown in the study area. This in turn will increase farmers' per capita income and hence their livelihood.

REFERENCES

Abadi G. A. K. and Pannell, D.J. (1999). A conceptual framework of adoption of an agricultural innovation. *Agricultural Economics* 21: 145–154.

Abdelmagid, S. A. and Hassan F. K. (1996). Factors affecting the adoption of wheat production technology in Sudan: Quarterly *Journal of International Agriculture*. 325-337.

Abrol, I. P. and Oman, S. A. S. (2002). Land degradation in arid irrigated areas. *Land Degradation and Development Journal 9: 283-294.*

Adesina, A. A, Mbila, G. B, Nkamleu, D. Endamana (2000). Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of South West of Cameroon. *Agricultural Ecosystems and Environment* 80pp.

Ajayi, M.T., (2003). Evaluation of Effectiveness of Extension Teaching Methods Used by Agriculture Trainees for Field Day. *Journal of Extension System, 17(2): 42-50pp.*

Barker, B. (2006). Selecting appropriate content and methods in programme delivery. [http://www.fao.org/docrep/w5830eoa.htm] site visited on 13/5/2010.

Casey, F. (2001). Examining adoption of agroforest in Southern East Mexico: three essays from the survey with farmers in Calakmul, Campeche. Thesis for the Award of PhD Degree at North Carolina State University, USA. 109pp.

CACC (Central Agricultural Census Commission), (2003). Statistical Report on Scio-economic Characteristics of Population in Agricultural Households of Oromia Region State. Part I. *Central Statistical Agency*, Printed in CSA, Addis Ababa, Ethiopia. 340pp.

Cramb, R. A. (2005). social capital and soil conservation; Evidence from Philliines and Australia. *Journal of Agricultural Resources Economics* 49(1): 211-226.

David, C. and Place, H. L. (2003). Delivery of extension to farmer in developing world. [http://www.knowledge.cta.int.en/ctm] site visited on 11/6/2011.

Dees J. G. and Anderson B. B. (2004). Scaling for Social Impact: Exploring Strategies for Spreading Social Innovations [www.caseatduke.org/.../survey_executivesummary_scalingsocialimpact.pdf] site visited on 19/6/2010.

Djkiman (2006). Draught Animal Power Contributes to Livelihood of Poor Farmers in the Mid-Andes [www.researchintouse.com/nrk/RIUinfo/outputs/R6605_2PS.pdf] site visited on 24/5/2010.

Dimara , E. and Skuras, D. (1998). Adoption of New Tobacco Varrieties in Greece; Impact of Emperical Findings on Policy Design. *Agricultural Economics* 19: 297-307.

Dogbe, E. (2006).extension and Extension Agents the Way-forward. *Agricultural Extension Journal 31: 56-67.*

Ekene, W. and Ogalo, O. (2004). Influence of Indigenous Knowledge in Agricultural production. [http://www.ed.org.fao/ind/ctng.htm] site visited on 13/9/2010.

Forson, J. B. (1999). Factors influencing adoption of land enhancing technology in the Sahe: Lessons from a case study in Niger. *Agricultural Economics* 20(3): 234-239.

Francis J. (2004). Animal draft power challenges in Zimbabwe [http://www.atnesa.org/challenges/challenges-francis-zimbabwe.pdf] site visited on 24/5/2010.

Fraser, D. (2010). The "new perception" of animal agriculture: legless cows, featherless chickens, and a need for genuine analysis. [http://www.fraserinstitute.org/] site visited on 13/9/2010.

Fujisaka, S (1993). Learning From Six Reasons Why Farmers do not Adopt Innovations Intended to improve sustainability of upland agriculture. *Agriculture System* 46 (1994): 409-425.

Hursey, B. S. (1997). Towards the twenty-first century—the challenges facing livestock production. World Animal. [http://jas.fass.org/content/79/3/634.full.pdf] site visited on 25/10/2010].

Kark, L. B. and Bauer, S. (2004). Technology adoption and household food security; Analyizing factors determining the adption and impact of project intervention: Acase of a smallholder peasant/farmers in Nepal. [http://www.trompetagde/2004/abstracts/full/107] site visited on 13/9/2010.

Kothari C. R. (2008). *Research Methodology Methods and Techniques*. New Age International (P) Ltd, Publishers.102pp.

Kremmis, S. (1992). *Becoming Critical: Education, Knowledge, and Action Research*. Falmer Press, London. 348pp.

Kwiligwa, E. M., Shetto, R. M. and Rees, D. J. (1992). The use of animal drawn cultivators for maize production in Southern Highlands of Tanzania. In *Proceedings of the Animal Traction Network for Eastern and Southern Africa*. (Edited by Starky, P. and Mwenye, J. S.), 18 – 23 January 1992, Lusaka, Zambia. 119-133pp.

Machumu F. B. N. (1995). Factors associated with adoption of agricultural technologies. Acase of Sasakawa Global 2000. project in Dodoma Rural District. 99pp.

Makarius, C.S. (2006) The influence of Technology Characteristics on Adoption. *Agricultural Economics Journal 21(3): 121-130.*

Marra, M., Pannell, D.J. and Abadi Ghadim, A. (2003) The economics of risk, uncertainty and learning in the adoption of new agricultural technologies: where are we on the learning curve? *Agricultural Systems* 75, 215–234.

Mbata, J. N. (2009). Determinants of Animal Traction Adoption in Traditional Agriculture: an Application of the Multivariate Probit Procedure to the Case of Lesotho. 76pp.

Mensah, M.C. (1996). Policy Setting and Institutional Framework for Rural Development in Africa. In: *Proceedings of the Review and Assessmet of Rural Development International Workshop.* Arusha, Tanzania. 17-21 January, 1994. 120pp.

Mothander, B. I., Kjoerby, F. And Harrick, K. (1989). *Farm Impliments for Small Scale Farmers in Tanzania Report.* Scandinavian Institute of African Studies, Uppsala, Sweden. 241pp.

Moshi, E. (1999). A Review of Women Empowerment Policies in Botswana. In *Proceedings of Policy Review Series, Gaborone*, Botswana, 25 July, 1999. 40pp.

.

Mugisha, S., Ogwal, O. R., Ekere, W. And Ekiya, V. (2004). Adoption of Integrated Pest Management. Groundnut production technology in Eastern Uganda. *African Journal of Crop Science 12 (1): 383-391*.

Mulugeta, I. (2000). Determinants of soil conservation practices in central Highlands of Ethiopia: the case of three weredas of Selale. Dissertation for award of MSc degree at Alemaya University, Dire-Dawa, Ethiopia, 120pp.

NIAEM, (2008). National Institute of Agricultural Extension Management,. Sustainable Livestock Development. Rajendranagar, Hyderabad – 500 030, Andhra Pradesh, India. [http://www.manage.gov.in/pgdaem/.pdf] site visited on 25/5/2010.

Nkonya, E.S.T. and Norman, D (2005). Factors Affecting Improved Maize Seed and Fertilizers in Northern Tanzania. *Agricultural Economics Journal 48 (1): 1-12.*

Odoeminem I. U. and Obinne C. P. O. (2010). Assessing the Factors Influencing the utilization of Improved Cereal Crop Production technologies by Small-Scale Farmers in Nigeria. [http://www.doc.com/docs/49102837/Assessing_the_factors_influencing_the_utilization_of_improved_cereal]. site visited on 13/9/2010.

Okike ,B. (2005). Recommended extension methods for use at different stages of adoption. [http://www.edugreen.teri.res.in/explore/water/pol/htm] site visited on 12/11/2010.

Pali, P, N. (2003). The profitability and acceptance of alternative soil improvement practices in Tororo district. Dissertation for Award MSc Degree at Makerere University, Uganda, 126pp.

Pearson R. A and Vall, E. (1993). Performance and Management of Draught Animals in Agriculture in sub-Saharan Africa. [www.springerlink.com/index/u62j5340qw651230.pdf] site visited on 13/7/2010.

Preece, R. (1999). *Animals and Nature: CulturalMyths, Cultural Realities*. UBC Press, Vancouver, Canada. 89pp.

Rahim, A. H, Ruben, R. And van Ierland, E. C. (2005) Adoption and abandonment of gum Arabic Agroforest in Sudan. *Journal Agricultural Economics* 33:227-235.

Rahman, M. A. (1991). *Action and Knowledge: Breaking the Monopoly with Participatory Action-Research*. Apex Press, New York. 102pp.

Rifkin, J. (1992). *Beyond Beef: The Rise and Fall of the Cattle Culture*. Dutton, New York. 204pp.

Rayburn, E. (2005). Soil Erosion and Global Productivity. [http://www.wvu.edu/agextn/vst.htm] site visited on 15/10/2010.

Rogers, E.M. (Eds.) (1995). *Diffusion of innovations*. The Free Press, New York. 11pp.

Rogers E. M. (Eds.) (2003). *Diffusion of innovations*. Free Press, New York. 519pp.

Senkondo, E. M. M, Lazaro, E. A. and Kajiru, G. J. (1999). Adoption of rainwater harvesting technologies by farmers in Tanzania with particular reference to the Western Pare Lowlands, Tanzania. *Journal of Agricultural Sciences* 2(2): 205-218.

Shetto R. M. (2008). Tanzania Policies and Investment Opportunities in Agricultural Mechanization. Paper presented at a CA Machinery Manufacturers' Workshop held on 19-21 May 2008 Londrina, Parana State Brazil. [http://www.policiesinvestment.tz.org/.pdf] site visited on 13/9/2010.

Shetto, R. M. and Mkomwa, S. S. (1996). *Study of Animal Draught Technology in the Southern Highlands of Tanzania Report.* IFAD-SHERFSP, Mbeya, Tanzania. 86pp.

Simalenga, T. E and Joubert, A. B. D. (1997). Developing Agrriculture with Animal Traction. [http://fastonline.org/CD3WD_40/LSTOCK/001/SA_InfoPaks/docs/Animaltraction.pdf] site visited on 20/8/2010.

Sizya, M. (2005). Women's participation in weed control with draft animals in Mbeya, Tanzania. [www.atnesa.org/weeding/weeding-sizya-women-tz.pdf] site visited on 24/5/2010.

Sosovelle, H. (1993). *The Role of Draught Animals in Agricultural Systems in Developing Countries.* Institute of Biology Press, London. 350pp.

Starkey, P. (1991). *Animal power in South Africa: empowering rural communities*. Development Bank of Southern Africa, Gauteng, South Africa. 160pp.

Starkey P. (1996). Animal traction in Tanzania: experience, trends and priorities. Ministry of Agriculture, Dar es Salaam, Tanzania and Natural Resources Institute, Chatham, UK. [www.worldbank.org/afr/padi/TZ_ASDP.pdf]. site visited on 18/10/2010].

Starkey, P. (1997). The History of Working Animals in Africa. [http://www.animaltractionorg/Starkey-history animaltractionafrica-97-draft.pdf] site visited 15/10/2010.

Sylwonder, L. (1994). Women and Traction Technology. In: *Proceedings of the Workshop of the Animal Traction Network for Eastern and Southern Africa.* (Edited by Sarkey, P.), 18-23 January 1992, Lusaka, Zambia. 260-265pp.

URT (2003). Government Programme Document: Agricultural Sector Development Programme (ASDP), Support Through Basket Fund. 69pp.

URT, PMO. (2008). Tanga Region, Agriculture, Livestock and Cooperative Report. 72pp.

URT, (2008). Economic and Social Research Foundation. Study on the Identification of Potential Growth Drivers for Tanzania Based on an Analysis of Tanzanians Competitive and Comparative Advantages Growth Sectors and Growth Drivers: *A Situational Analysis Report.* 207pp.

Vizard A. L. (2000). Animal Contributions to Human Health and Well-being [http://www.asap.asn.au/livestocklibrary/2000/Vizard_0001.pdf] site visited on 19/6/2010.

WB (2003). Development Data and Statistics. [http://worldbankexternal/DATASTATISTICS/opk] site visited on 9/8/2010.

Wetengere K. (2010). Determinants of Adoption of Recommended Package of Fish Farming Technology. [http://www.academicjournals.org/ijfa] site visited on 12/3/2011.

APPENDICES

Appendix 1: Variables, operational definitions, level and unit of measurement

Variable	Operational definition	Level of measurement	Units of measurement
Dependent variable	Adoption of DAP	Ratio	1= if adopted, 0= otherwise
Independent variables			
Age	The number of years that a respondent has lived	ratio	Number of years
Sex	Being male or female	nominal	1 = male 2 = female
Marital status	Whether married or not married	nominal	1= married, 2= single, 3= living together, 4=divorce, 5= widow
education	Highest level of formal schooling attained by a person	ordinal	1= no formal schooling, 2=primary school, 3=secondary school, 4= vocational
Relative advantage	The degree o which an innovation is perceived as being better than the idea it supersedes	ordinal	1= high 2= low
Perception	Is our sensory experience of the world around us and involves both the recognition of environmental stimuli and actions in response to these stimuli.	nominal	1= good 2= not good
Credit	Borrowed money to be repaid back at an agreed on time.	ratio	Amount of money
communication	Is a process whereby information is enclosed in a package and is channeled and imparted by a sender to a receiver via some medium.	ordinal	1= high 2= low
Trialability	The degree to which an innovation may be experimented with on a limited bases	ratio	Number of times innovation is tried

Observability	The degree to which the results of innovation are visible to others	ratio	Number of times innovation is observed
Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use	ordinal	1=very complex 2=complex 3=not very complex
Compatibility	Is the degree to which an innovation is perceived as consistent with the existing values and past experiences	ordinal	1=compatible 2=not compatible
cost	the total spent for goods or services including money and time and labor	ratio	Amount of money

Appendix 2: Farmers' interview schedule on factors hindering adoption of draught animal power innovation in Participatory Agricultural Development and Empowerment Project

A. Introduction

My name is **Kapinga George**, a master's student at Sokoine University of Agriculture (SUA). I am working on a research titled **Adoption of draught animal power innovation in Participatory Agricultural Development and Empowerment Project (PADEP).** The main objective of my research is to assess factors hindering adoption of draught animal power innovation in PADEP. Either, I promise that, any information provided will strictly be treated confidentially.

B. Demographic characteristics

Date of interview	Village/Hamlet	Division/Ward
Household code	Name	Ethnicity
Respondent' age (years)	Respondent's sex	
	(1.)Male (2.)Female	
Age of the HHH (years)	Sex of HHH	Origin of the HHH
[1] Less than 18 years [2] 18-35 years [3] 36-55 years [4] Above 55 years	[1]=Male [2]=Female	[1] Native [2]Immigrant

1. Education level:
    1. None
    2. Primary school education
    3. Secondary education
    4. Post – secondary education
    5. Others, specify …….

2. Marital status

1. Single
2. Married
3. Divorced/Separated
4. Widow

3. Household composition (only those living in this house)

Household members	Relationships to HH Head	Age (years)	Sex	Education level
	1=Head 2=Wife 3=Husband 4=Child 5=Other relatives 6=None relative		1=Male 2= Female	1=None 2=Primary education 3=Sec. education 4=Post-sec. education 5=Other
1.				
2.				
3.				
4.				
5.				
6.				
7.				

5. Main occupation of the household head

1=Farming
2=Farming and off-farm
3=Off-farm only
4=Others (please specify) ……..

Farmers' perception on Participatory Agricultural Development and Empowerment Project

Write an appropriate answer, use the worlds from the brackets (NOTE: 1= Strongly disagree 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly agree.

S. No.	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	You have been involved in agricultural project before PADEP					
2	Past projects were able to change your life standard					
3	PADEP could be able to change your life standard					
4	PADEP is carried in the proper way that could be able to meet the needs of farmers in agriculture					
5	PADEP involved farmers in deciding on projects to be carried out					
6	PADEP provide services you were expecting to get from the government					
7	PADEP empower people in agricultural production					
8	there are positive changes in agricultural production since the PADEP has started					
9	PADEP have bias in selecting farmers groups					
10	PADEP bring new technologies in farming practice					

Farmers' perception on the use of draft animal power

(NOTE: 1= Strongly disagree 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly agree).

Put the number in appropriate box against the statements given with opinions below

S. No.	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	The technology used is the result of farmers choice					
2	The technology in practice meets need of farmers in agriculture					
3	The technology in practice was just presented to farmers for selection					
4	The use of draught animal power does not meet your values					
5	The use of draught animals is labour intensive					
6	The use of draught animals requires further instructions					

Farming practices used by farmers and factors for the use of certain technology

1. What kind of implement do you use in your farming?
    1. Hand hoe
    2. Ox-ploughing
    3. Tractor
    4. Others (mention) ……...

2. Have you ever used any other farming practice apart from the one you are now using?
    1. YES
    2. NO

3. What makes you continue with the farming practice you are now using?
    1. Due to absence of capital
    2. It has been used by our parents
    3. Others (please specify)

4. If an intervention comes and there is opportunity to change your farming technology, are you ready to do that?

1. YES
2. NO

5. Why

1. ……..
2. ……..
3. ……..

6. Do you have animals which can be used for providing power in agricultural activities?

1. YES
2. NO

7. Why don't you use the animal for providing power in agricultural activities? (For non technology users)

1. Equipments are not available
2. too high costs of equipments
3. Lack of knowledge of using the technology
4. Others (specify please)

Production and economic factors hindering access and use of draught animals

Extension services

1. Do you get extension services for your farming activities?

1. YES (go to question 2)
2. NO (go to question 3)

2. How often do you get the services?

1. Once per week
2. Twice per week
3. Once in two weeks
4. Whenever I need
5. Others (please specify) ……

3. Do you think extension services are important to the adoption of technologies?

1. YES
2. NO

4. Have you ever used any agricultural practice learnt from extension agent?

1. YES
2. NO

5. Do you think extension agents provide enough information which can be used in your agricultural practices?

1. YES
2. NO

Economic factors

1. What is your main source of income?

1. Agriculture
2. Business
3. Formal employment

2. What type of crops did you grow in the last year and the number of bags did you yield?

Type of the crop	Number of bags yield

3. Did you sale any of these crops?

1. Yes
2. No

4. What amount of crops did you sale in the last year?

Type of crop	Number of bags sold

5. Was there any contribution as the condition for joining into the project?
    1. YES (go to question 6)
    2. NO (go to question 9)

6. What kind of contribution was needed for joining into the project?
    1. Cash
    2. Labour
    3. Technical
    4. Others (please specify)

7. Did you manage to provide the required contribution?
    1. YES (go to question 8)
    2. NO (go to question 9)

8. If cash was the case in question 18 above where did you get it?
    1. From own servings
    2. From relatives
    3. From the financial institution
    4. From the aid

9. Did you have access to credit from the government or any financial institution for the application into this technology?
    1. YES (go to question 10)
    2. NO (go to question 13)

10. Was the use of the credit explained to you well in advance?
    1. YES
    2. NO

11. Do you think the amount you got was enough for carrying out the practice?
    1. YES
    2. NO

12. Did you get the credit in appropriate time for your practice?
    1. YES
    2. NO

13. Do you think credit could enable more people to join into various agricultural technologies?

1. YES
2. NO

14. Is there any cost involved in running the technology you are now using?

1. YES (go to question 15)
2. NO (go to question 17)

15. Do you manage to run the costs on your own?

1. YES (go to question 17)
2. NO (go to question 16)

16. Where do you get cash necessary to run the costs of the technology you are now using?

1. From own servings
2. From relatives
3. From the financial institution
4. From the aid
5. Others (please specify)

17. Does the use of draught animal power technology increase yields compared to hand hoe?

1. YES
2. NO

18. Do you think draught animal power technology is profitable compared to that of the hand hoe?

1. YES
2. NO

20. Do you have a market for your agricultural products?

1. YES (go to question 21)
2. NO (go to question 1 on farm factors)

22. Is the market for your agricultural products reliable?

1. YES
2. NO

23. Does the market meet your need in case of the price of crops?

1. YES
2. NO

Farm factors

1. What size of farm do you have?

1. 1 acre
2. 2 acre
3. 3 acre
4. 4 acre
5. Others (please specify)

2. Is your farm enough for your agricultural activities?

1. YES
2. NO

3. What total area of land do you own?

1. 1 acre
2. 2 acre
3. 3 acre
4. 4. acre
5. Others (please specify)

4. Do you think there is a need of owning more land than you have at present?

1. YES
2. NO

Socio-cultural factors

1. Were the instructions in the use of draught animal power technology given to you in advance?

1. YES (go to question 2)
2. NO (go to question 3)

2. Were the instructions clear to you before putting the technology into practice?

1. YES
2. NO

3. How many times did you try the technology you are now using before putting it into exact practice?

1. 0 times
2. 1 times
3. 2 times
4. 3 times
5. Others (please specify)

4. How many times did you get the opportunity to observe the technology you are now using before putting it into practice?

1. 0 times
2. 1 times
3. 2 times
4. 3 times
5. Others (please specify)

5. Do you get assistance in case of need from specialist of agricultural technologies?

1. YES (go to question 6)
2. NO (go to question 7)

6. How often do you get visit from the district specialists?

1. Once per week
2. Twice per week
3. Once per 2 weeks
4. Once per month
5. Others (specify)

7. Do you still continue using the draught animal power technology you have learnt in this project?

1. YES (go to question 10)
2. NO (go to question 8)

8. When did you stop using the innovation you have learnt?

1. This year, 2010
2. Last year, 2009
3. Since 2008
4. Since 2007
5. Others (specify)

9. Why you stopped using the innovation you have learn in this project?

……

……

10. Are the equipments for draught animal power technology readily available when needed?

1. YES
2. NO

11. Is the use of draught animal power compatible to your present/past experience?

1. YES
2. NO

12. Is the use of draught animal power compatible to your values?

1. YES
2. NO

13. What are your opinions on the use of draught animal power in agricultural activities?

1. ……...
2. ……..

THAN YOU VERY MUCH FOR YOUR COOPERATION