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A Study on the Factors Influencing the Adoption of Motorized Water Pump for
Irrigation: the Case of South Gonder Zone, Dera Woreda, Amhara Region, Ethiopia

By

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DECLARATION

I hereby declare that the dissertation entitled A STUDY ON THE FACTORS INFLUENCING THE ADOPTION OF MOTORIZED WATER PUMP FOR IRRIGATION: CASE OF DERA WOREDA. Submitted by me for the partial fulfillment of the M.A in Rural Development to Indira Gandhi National Open University, (IGNOU), New Delhi, is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in the whole or in part is lifted and incorporated in this report from any earlier work done by me or others.

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ACRONYMS

ANRS = Amhara National Regional State

BOA=Bureau of Agriculture

CIMMYT=International Center for Maize and Wheat Researcher

DAs =Development Agent

DWAFEDO=Dera Woreda Administrative Finance and Economic Development office

EPRDF=Ethiopian People's Revolutionary Democratic Force

EARO=Ethiopian Agricultural research Organization

FAO=Food and Agriculture Organization

GDP = Gross Domestic Production

LDCs=Less-Development Countries

MOA=Ministry of Agriculture

MWR=Ministry of Water Resource

NGO =Non-Government Organization

PA=Peasant Association

SPSS=Statistical Package for Social Science

Executive Summary

This study was conducted in Dera woreda of South Gondar Zone with an objective to analyze factors that influence the adoption of motorized water pump. In the process of the study both primary and secondary data were used, and multi-stage purposive and random sampling procedures were also used. The respondents were selected by employing probability proportional to size (PPS) random sampling procedure. The required data were collected using interview through structured questionnaire.

Descriptive statistics were used to understand the socioeconomic, demographic and institutional factors while Chi-square tests were employed to examine the mean difference of adopters and non adopters.

The socio-economic factors of this study revealed that adopters of motorized water pump were relatively elder, have lower family size, better wealthier, involved on off-farm activities, participate in more type of social organization, having longer farming experience and more literate. With regard to farm characteristics adopters have low farm size, and have lower livestock unit

With respects to extension service and information access it was found that adopters of motorized water pump have high frequency of extension contact, and have more radio access than the non-adopters.

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1. INTRODUCTION

1.1 Back ground

Agriculture is the leading sector in the national economy of Ethiopia, accounting for about 46% of Gross Domestic Product (GDP), while contributing almost 90% of export earnings and employing 85% of the population (MOA, 2011). The country is endowed with a wide range of natural resources such as land, irrigation potential and agro-ecological diversities suitable for the growing of various crops and need prime consideration and a more systematic utilization in order to bring a sound change and sustainable growth in the agriculture sector, which positively contributes for the overall economic development of the country. The irrigation potential of the country is estimated to be about 3.7 million hectares, of which about 20 to 23% is currently utilized, even there is no consistent inventory with regard to the developed area under irrigation both traditional and modern irrigation schemes. The major production constraints that impede the development of the irrigation sub sector among others are predominantly primitive nature of the overall existing production system, shortage and increased price of agricultural inputs and limited availability of improved irrigation technologies, limited trained man power, inadequate capacity and skills in the area of irrigation, inadequate extension services, particularly in irrigated agriculture

Therefore, the importance of irrigation development, particularly in the peasant sub-sector needs prime consideration to raise production to achieve food self-sufficiency and ensure food security at household level. The irrigated agriculture can play a vital role in supplying sufficient amount and the required quality of raw materials for domestic agro-industries and increase export earnings.

Agriculture in the Ethiopian economy is the largest contributor that amounts 50% of Domestic Product (GDP), employment of 80% of the population working force, and is the main income generation sector for the majority of rural population. It also serves as the

main source of food, and generates 90% of the foreign exchange earnings. It provides raw materials for more than 70% of the country's small, medium and large agro-based industries (USAID, 1995),

Crop production is estimated to contribute on average around 60 percent, livestock accounts for around 27 percent and forestry and other sub-sectors around 13 percent of the total agricultural value addition (Getahun, 2003).

Irrigation technologies

Most of the irrigated land is supplied from surface water sources, while ground water use has just been started on pilot phases in east Amhara, southern Tigray and in the Rift valley areas. Surface irrigation methods are dominated throughout. Local factors are coming up and actively engaged in manufacturing irrigation technologies and improved farm implements, which could be considered as a promising step in strengthening the irrigation sub sector (MOA, 2011)

Past studies revealed that adoption of agricultural technologies have attracted considerable attention among development economic activities. Because the majority of the population of less-developed countries (LDCs) derives its livelihood from agricultural production and new technology offers opportunity to increase production and income substantially. But, the introductions of many new technologies have been partially success as measured by observed rates of adoption (Feder et al., 1984).

According to various estimates the potential of irrigable land in Ethiopia ranges from 1.0 to 3.5 million hectares. Despite this potential, only about 160, 000 to 190,000 hectares of land (5-10%) has been brought under irrigation. Out of this about 65,000 hectares is estimated to be covered by traditional irrigation system. About 352,000 hectares of land is said to be irrigable using small-scale irrigation schemes (Berhanu and Don Peden, 2003).

Modern water development schemes are recent phenomena in Ethiopia. The imperial government in the 1950s took the first initiative in water resource development. Large scale water development projects both for agricultural purposes and power generation were constructed at the end of the 1950s. These developments were concentrated in the Awash valley as part of the Agro-Industrial Enterprises Development Initiative.

The focus on large-scale irrigation development and the neglect of small-scale schemes was reversed when the Ethiopian People's Revolutionary Democratic Front (EPRDF) took power in 1991. The EPRDF government put the development of small-scale irrigation schemes and improvement of farmer-managed traditional schemes at the forefront of its water development policy. Moreover, with the creation of the Ministry of Water Resources (MWR), there is now a unified public agency for water resources development (Berhanu and Don Peden, 2003).

Farmer participation has moved from a peripheral issue in irrigation management to center stage. Once thought to be limited to small- scale traditional systems, farmer participation and even control has become a major component of policies for irrigation development and reform. Programs to promote farmers' involvement range from participatory irrigation management with farmer input as a supplement to agency management to irrigation management transfer, in which farmers assume full responsibility for operation and maintenance of specific units of systems. While increasing farmers' financial contributions or direct involvement in operation and maintenance on tertiary systems is the most common element of such programs, a few also involve farmers in main system operation and maintenance, decision making, and may even transfer full ownership rights and responsibilities to farmers' organization (Dick, 1997).

Motorized water pump is a mechanical device to increase the pressure energy of a fluid. Generally the motorized water pump is used for raising the fluid from a lower level to a higher level.

In the study area irrigation technologies and management was introduced by Koreans in 1988-1992 G.C specifically at jigna kebele by using Gumara River for developing and producing rice and vegetables.

Motorized water pump and other irrigation technologies is introduced lately in the study areas Dera woreda following the government's development policy and irrigation technologies and as well irrigation production attention given by the government and special supports by NGOs. As a result the motorized water pump technology adoption needs high efforts by different stakeholders. By understanding these facts the study is conducted with the aim of analysis of factors affecting the adoption of motorized water pump in Dera woreda. Over 90% of agricultural production depends on rain fed agriculture, which also facing serious challenges and constraints that unable to produce sufficient production to fulfill the food requirements of the whole nation, This indeed, the importance of irrigation by using motorized water pump and other technologies in the overall economic development of the country and practical demonstrations have been observed that through irrigation there is a possibility to attain agricultural surpluses enough to satisfy the need for domestic consumption and for external markets, of course with the required quality of produce.

Therefore, the irrigation sub-sector need to be supported by appropriate irrigation technologies and related research findings that would assist farmers engaged in irrigated agriculture to increase production and productivity of irrigated crops, particularly giving priority to high economic value crops in order to bring sound economic advantage and alleviate food insecurity problems increase their incomes.

Increasing population pressure decreasing land holdings necessitates intensification of production practices and using modern irrigation agricultural technologies to meet the increasing and unlimited demand for food and income of the population

The advantages of using motorized water pump for irrigation creates employment opportunity, it saves time, it helps to irrigate large plot of land within a short period of time, it brings water from surface water sources by crossing hill area to level areas, it is portable, it can be move place to place by persons and back animals, for food security and no need of waiting rainfall season to produce

Amhara region has a vast water resource potential in surface water, river water, ground water, international river like that of the Blue Nile draining into the neighboring countries and other rivers. Therefore there is a good opportunity to use and develop irrigation by motorized water pump and other irrigation technologies

Over 90% of agricultural production depends on rain fed agriculture, which is also facing serious challenges and constraints that unable to sufficient production to fulfill the food requirements of the whole nation. This indeed, the importance of irrigation in the overall economic development of the country and practical demonstrations of have been observed that through irrigation there is a possibility to attain agricultural surpluses enough to satisfy the need for domestic consumption and for external markets.

Therefore, the irrigation sub-sector need to be supported by appropriate irrigation technologies to increase production and productivity of irrigated crops, particularly giving priority to market oriented and high economic value crops in order to bring sound economic advantage and alleviate food insecurity problems

According to Amhara region BOA the irrigated agriculture development department 2011 and agricultural input supply and distribution department 2012 annual report indicates that According to water potential study there is a stock of water estimated to 1.2 million hectare of land irrigate by this different types of water resource (river, lake, ground water, surface watered) potential, 1,812,112 hectare plough for irrigation, 192,855,512 quintal of produce was obtained from this land, more than 15 thousand of farmers participate in irrigation

UP to 2012, 57,478 motorized water pump was supplied and 20,067 was distributed ,255,116 tridl pump was supplied and 10,560 was distributed ,72,052 drip irrigation technologies was supplied and 16,895 was distributed

Even if this motorized technologies supplied and distributed to farmers there is low level of knowhow and limited practical skills of farmers in irrigated agriculture and agricultural irrigation technologies with predominated traditional and inefficient water management practice

The ANRS BOA and irrigation projects were involved for the adoption and dissemination of motorized water pump technology. However, the extents of which farmers have adopted these motorized water pumps have not been studied and the factors affecting the adoption of motorized water pump were not yet known

1.2 Statements of the Problem

Ethiopia is experiencing a rapid population growth (about 2.9% per annum) and the great challenge is that the growth of the agriculture sector is not proportional with the rate of population growth and as a result the sector is unable to fulfill the food requirements of the whole nation and even not satisfying the need of domestic industries in supply of raw materials with quantity and quality of produce. Crop production is mostly dependent on rain fed agriculture, which is characterized at the same time with low crop yields, due to erratic and uneven distribution of rainfall throughout the growing period and even crop failures are being the common phenomenon, particularly in some drought prone areas of the country .This fact can bring irrigation to the forefront in the national economic development plan of the country and this indicates that there is a great need of strengthening the national capacities and technical capabilities in the irrigation sub-sector to make the best use of the available water and land resources for improving the irrigation systems and increase the role of irrigated agriculture in the development of the agriculture sector in particular and the overall economic development of the country in general. (MOA, 2011)

The rainfall, characterized with erratic nature and uneven distribution throughout the crop –growing period. Therefore for this vagary of nature producing by using agricultural irrigation technologies is very important

Therefore, this study is examine the factors influencing the adoption of the motorized pump for irrigation in south Gonder zone , Dera woreda and how user and non-user participation will be associated with different socio-economic factors of smallholders in the study area.

The Regional Government has supply and distributed motorized water pump for irrigation for house hold farmers in the study area and handed them over to the smallholder farmers. However, most of the farmers around the study area do not utilize the motorized water because of technical knowledge problems, lack of technical support of development agent (DAs), climatic condition, fragmented of land, knowledge gap, income, initial cost of pump, educational level, land size, the increase of fuel cost. In spite of the serious problem of the adoption of agricultural irrigation new technology.

Therefore, I am interested to study and examine the factors influencing the adoption of the motorized water pump for irrigation in south Gonder zone, dera woreda and how user and non-user participation was associated with different socio-economic factors of smallholders in the study area

1.3 Objectives of the study

1.3.1 General objective

To study and examine the factors influencing the adoption of the motorized water pump for irrigation in south Gonder zone, Dera woreda and how user and non-user participation will be associated with different socio-economic factors of smallholders in the study area

1.3.2 Specific objectives

1. To identify socio-economic and other factors that influences the adoption of motorized water pump
2. To assess the role of the motorized water pump in the study area
3. To analyze factors influencing the adoption of the motorized water pump for irrigation in the study area
4. To assess the impacts of the technologies on yields and farmers' incomes.

1.4 Important terms used in the project title

Information: - providing information about events and conditions in society and the world, indicating relations of power, facilitating innovations, adaptation and progress

Adoption:- is the decision to make full use of an innovation or Technology

Adoption stage:- is the final stage when you decide to continue the full use of the new ideas. After seeing the performance of technology on a limited scale you will assess the results of in comparison with your previous experience, the experience of your neighbor and accordingly decide to go for adoption of technology on a large scale and continue the adoption of technology for a longer time till you are exposed to another new technology

Innovation:- is the activity by which something new done which could be a new product , a better method of production, an improved and better product, a way to reduce cost or a totally new product for anew or perceived demand. Generally according to Schumpeter innovation is the introduction of a new product, Adoption of a new technology Opening up of a new market, Finding out a new source of supply, Bringing about a new organization of an industry

Creativity:- is the ability to develop new ideas which could result in new product or services

Change:- involves the replacement of an already existing idea with another idea. Unlike innovation, which implies adoption of an idea perceived as new, change is necessary to involve a new idea.

Diffusion:-is the spontaneous spread (dissemination) of new idea, concept or technology from one person or group to another

"Diffusion" refers to the stage in which the technology spreads to general use and application. "Integration" connotes a sense of acceptance, and perhaps transparency, within the user environment

1.5 Hypothesis of the Study

The two hypotheses of this study are:

- ❖ Socio-economic, institutional, infrastructure and demographic factors influence farmers' decision to adopt motorized water pump
- ❖ The physical environments of motorized water pump influence the adoption of farmers.

1.6 Universe of the Study

The study was conducted at the Amhara National Regional State (ANRS) of south Gondar administrative zone of Dera woredas' on kebeles those which use motorized pump for irrigation and three kebeles shall be purposively selected for this study based on their accessibility for transportation facility. The sample size of the study was 50 farmers from users and 50 from none users and total sample size was 100 farmers for this study.

1.7 Significance of the study

The productivity of smallholder farmers must be increased considerably in order to be achieve food self-sufficiency and to diversify their income source. Unless their farm productivity and diversify increase their food self-sufficiency achievement would be in question. In this respect, all development partners like extension educators, technical assistants, NGOs and other development agents involved in agricultural development must be aware and understand the impacts and factors affecting the adoption of new technologies in order to target and extend appropriate technologies to farmers, it is also important for policy makers to know the impact of new technologies and the critical factors that could accelerate their use. This could facilitate efficient allocation of major resources for research, extension and development programs, hence, this study attempted to figure out the impact of adoption of motorized water pump on farm

income and factors affecting its adoption by smallholder farmers in the study area and it is expected that this study will serve as springboard to undertake detailed and compressive studies for other researchers.

2. LITRATURE REVIEW

According to Augustine L. and Mulugetta M. (2005), the simplistic definition of adoption is basically the use of a technology. This is further elaborated as the incidence /pattern and intensity of adoption. The incidence indicate whether a farmer has used a technology or not and the intensity explains the degree of use of technology

Feeder et al. (1985) defined adoption as the degree of use of a new technology in a long-run equilibrium when a farmer has all of the information about the new technology and its potential. Therefore, adoption at the farm level describes the realization of a farmer's decision to implement a new technology. On the other hand, aggregate adoption is the process by which a new technology spreads or diffused through a region. Thus, a distinction exists between adoption at the individual farm level and within a targeted region. If an innovation is modified periodically, however, the equilibrium level of adoption will not be achieved. This situation requires the use of econometric procedures that can capture both the rate and the process of adoption. As the new technology is introduced, some farmers will experiment with it before adopting. The "rate of adoption" is defined as the proportion of farmers who have adopted a new technology at a specific point in time (e.g., the percentage of farmers using motorized water pump). Furthermore, the "intensity of adoption" is defined as the level of adoption of a given technology, for example, by the number of hectares planted /irrigated with motorized pump improved.

Chilot (1994) in his study of factors influencing adoption of new wheat technology in selected district of Ethiopia , found that access to timely availability of fertilizer, perceived relative profitability of the improved variety, number of extension contact and wealth position had positively and significantly relation to new improved wheat variety adoption.

As of Van den Ban and Hawkins (1996) adoption of improved technologies is strongly affected by the policy environment like input supply, market .credit, price policies and improved supply system. Likewise, the effectiveness of extension service and other communication media as well as farmers educational level influence the use of improved technology adoption.

Farmers with high number of livestock have an opportunity to bear the risk that may occur .As a result; it encourages adoption of in new agricultural technologies. In line of this, studies of Getahun et.al (200) and Endrias, (2003) showed that the number of livestock owned .that is expressed by Tropical livestock Units (TLUs) significantly influence the probability of adoption of farm technologies in their respective studies.

Birhanu (2002) observed that the availability of off-farm incomes, extension contact the total livestock owned, distance between residence and the market are found to have appositive and significant influence the adoption decision of farmers.

Cramb, (2003) inferred that a number of farms –household factors are typically associated with adoption, such as, age ,education and personal characteristics of the household head,size location and tenure status of the farm ,availability of cash or credit for farm investment,access to market for farm produce

Determinants of technology adoption encompasses characteristics of the technology ,features, of the farming system ,market and policy environments as well as socio-economic characteristics of the decision making unit(household, farmer Ehui et.al (2003)

The study conducted by Million and Belay (2004) indicated that age had a weak and at the same time negative association with adoption. In contrast, Omiti et al. (1997) investigated a positive relationship between age and adoption behavior of farmers.

2.1 Differentiation of technology adopters

The traditional adoption/diffusion continuum recognizes five categories of participants:

- **Innovators** :- who tend to be experimentalists and "techies" interested in technology itself;
- **early adopters**:- who may be technically sophisticated and interested in technology for solving professional and academic problems;
- **early majority**:- who are pragmatists and constitute the first part of the mainstream
- **late majority**:- who are less comfortable with technology and are the skeptical second half of the mainstream;
- **Laggards**:- who may never adopt technology and may be antagonistic and critical of its use by others. The distribution of these groups within an adopter population typically follows the familiar bell-shaped curve.

The traditional adoption/diffusion continuum recognizes five categories of participants: 1) innovators who tend to be experimentalists and "techies" interested in technology itself; 2) early adopters who may be technically sophisticated and interested in technology for solving professional and academic problems; 3) early majority who are pragmatists and constitute the first part of the mainstream; 4) late majority who are less comfortable with technology and are the skeptical second half of the mainstream; 5) laggards who may never adopt technology and may be antagonistic and critical of its use by others. The distribution of these groups within an adopter population typically follows the familiar bell-shaped curve. Moore (1991) sees these groups as significantly different "markets" in the "selling" of an innovation to faculty adopters. He suggests that the transition from the early adopters

to the early majority--one that is essential to an innovation's success--offers particular potential for breakdown because the differences between the two groups are so striking

Early Adopters	Early Majority
<ul style="list-style-type: none"> • Technology focused • Proponents of revolutionary change • Visionary users • Project oriented • Willing to take risks • Willing to experiment • Individually self-sufficient • Tend to communicate horizontally (focused across disciplines) 	<ul style="list-style-type: none"> • Not technically focused • Proponents of evolutionary change • Pragmatic users • Process oriented • Averse to taking risks • Look for proven applications • May require support • Tend to communicate vertically (focused within a discipline)

2.2. Empirical studies

Adoption is not just an issue of factor ratios. It is an issue of the overall efficiency of use and the relative speed of growth in production. Econometric evidence from the Indian Punjab (Sidhu, 1972) indicates that new wheat technology was not strongly biased in either a labor saving or a capital saving. Small and large farmers achieved approximately equal gains in efficiency. Data from the Pakistan and the Philippines indicate that although small farmers face more constraints on obtaining irrigation and credit than large farmers, these constraints are not large enough to cause any significant differences in yields between the two categories of size (Ruttan and Binswanger, 1978).

In an exhaustive survey of literature on technology adoption, Feeder et al., (1985) indicated that farm size, risk, human capital, labor availability, credit and land tenure were factors

that influenced technology adoption. The relationship between these variables and adoption, however, was not consistent.

One obvious reason for differences in adoption rates in many areas is the degree to which credit is a constraint (Feeder and Gerald, 1981). Working capital required for new technologies (hybrid seed, fertilizer, herbicides etc.) are substantially higher than working capital needed when using traditional technology and this can become an obstacle to the rate or extent of adoption (Rahman, 1983). Thus, in areas where credit and cash for small farmers is severely limited, farmers may not be able to adopt high yielding varieties and fertilizer at the same rate even though these are divisible and require relatively small amounts of cash.

According to Feder et.al, (1985) in their study of adoption innovation in developing countries, factors that influence technology adoption are credit, farm size. Risk, labor availability and human capital and land tenure. The same authors stated that farmers' awareness about the technology can increase, if they have access to education. Education can also directly facilitate technology adoption by increasing access to information about alternative market opportunities and technologies.

Feder et al. (1985) attributes the diffusion path of aggregate adoption of new technologies to the dynamics of the spread of information. In explaining and interpreting the S-shaped diffusion curve, Mansfield (1961) hypothesized that the rate of adoption is a function of the extent of economic merit of the technology, the amount of investment required to adopt the technology and the degree of uncertainty associated with the technology. Hagerstand (1967), meanwhile, offered an information transfer explanation. In contrast, Sahal (1981) employed a learning perspective when explaining diffusion patterns.

The findings of Worman et al. (1990) in Botswana demonstrated that the percentage of adopters among male-headed households was not significantly greater than for female and defacto female-headed households.

A study carried out by Legesse (1992) in Arsi Negele, Ethiopia using probit and tobit regression models indicate that the factors significantly influenced the probability of adoption of improved varieties and intensity of adoption of fertilizer and herbicide include experience, credit, expected profitability as represented by expected yield, cash availability for down-payment, participation in farm organizations as a leader and close exposure to technology.

Legess (1992) revealed that extension contact, poor distribution of inputs and technical assistance, socio psychological variables such as farmers' ability, belief, habit and customs, and expectations affect the technology adoption.

A study done by Mulugetta (1994) showed that wheat production technologies are profitable but inputs are used sub-optimally. Mulugetta also pointed out that institutional variables (input availability, credit access and extension contact) significantly affect the incidence of adoption while economic factors (farm size, oxen ownership, labor availability) influence the intensity of use.

An adoption study by Chilot et al. (1996) indicated that probit and tobit regression models to assess factors affecting adoption of new wheat technologies in Wolmera and Addis Alem areas found that perceived profitability of the new wheat technologies and the timely availability of fertilizer and herbicide had significant effect on farmers' decisions to adopt. Distance of respondents' homes from extension centers also influenced the probability of adopting improved wheat variety, as well as the intensity of fertilizer and herbicide use. Characteristics of the household and household heads had little influence on the adoption decisions of farmers.

Chilot (1994) in his study of factors influencing adoption of new wheat technology in selected district of Ethiopia, found that access to timely availability of fertilizer, perceived relative profitability of the improved variety, number of extension contact and wealth position had positively and significantly relation to new improved wheat variety adoption.

Another adoption study by Bekele et al. (2000) indicated that the to bit analysis revealed that access to credit is an important factor in influencing farmer's decision to adopt improved wheat technologies (variety and fertilizer). Access to credit not only relaxes the cash constraint currently existing in most farm communities, but also facilitates input availability for farmers. Hired labor is another determinant of a farmer's ability to adopt higher nitrogen fertilizer rates.

Furthermore, an adoption study by Tesfaye et al. (2001), shows that farm size influenced the adoption of improved wheat varieties positively and significantly. Participation of farmers' on-farm demonstration also positively and significantly affected the adoption pattern of respondents. Contacts made with extension agents, service cooperative (SC) representatives, or PA chairmen contributed significantly and positively to adoption. Other variables such as radio ownership contributed very little suggesting that information about improved wheat production technologies is more effectively diffused among farmers through other methods such as extension contact and demonstration of an improved wheat variety. Number of livestock units, distance to a development center, and years of farming experience did not contribute to the adoption of improved wheat varieties.

From the review of empirical studies, it could be inferred that agricultural technology adoption and diffusion patterns are often different from area to area or location to location. Such differences were attributed to variations in agro-climatic, information, resource endowment and the type of technologies adopted in the respective study areas of the sampled farmers. Hence, carrying out adoption studies to identify adoption determinants for different areas can help in developing suitable technologies and in effectively promoting them.

Lack of adequate information on farmers' perception about new technologies, farm and farmers' characteristics often place new technologies wrong target regions where they failed or registered with partial success. In Ethiopia with its main agriculture based economy, the development initiatives seems to be impractical if smallholder farmers are not provided with a full scope of means for increasing their productivity, income and standards of living. This would be of paramount importance when it comes to motorized water pump

users. We know little about the kinds of situations needed to encourage farmers to use new technologies particularly, our understanding of rural decision-making and decision-making situation is very limited. The situation of smallholders need to be thoroughly investigated and understand in order to design an appropriate policy.

According to Endrias 2003, the past adoption studies have tried out to identify factor influencing towards adoption of new technologies. Results of the study indicate that there is a low level adoption of new technologies. However, it can also be informed that the factor influencing the adoption of innovations have not been studied in detail. It is also an accepted fact that the factor influencing adoption of new technologies varies from one context to another. With this observation and analysis based on the desk review it could infer that there is a need for a study on understanding the potential influencing factors responsible for the adoption of new technologies of a particular context. The significance of such study will provide knowledge and information on the critical factors that can enhance adoption of modern technologies for different development actors to enhance production and productivity towards better social and economic life of the farming community.

Farmers with high number of livestock have an opportunity to bear the risk that may occur .As a result; it encourages adoption of in new agricultural technologies. In line of this, studies of Getahun et.al (200) and Endrias, (2003) showed that the number of livestock owned .that is expressed by Tropical livestock Units (TLUs) significantly influence the probability of adoption of farm technologies in their respective studies

The adoption of agricultural innovation in developing countries attracts considerable attention because it can provide the basis to adopt or not adopt agricultural technologies depend on their objective and constraints as well as cost and benefit accruing to it (Mesfin, 2005). Hence farmers will adopt only technology that suit to their needs.

Research study of Itana (1985) showed that literacy, farm size and adequacy of rainfall affect the adoption of farm decision of farmers positively, while un availability of cash for down payment and price of farm inputs affect's adoption decision negatively. In the same

study farmer's asset position, non-farm income and price of farm output also found to be affecting negatively the adoption decision of farmers agricultural technologies..

A study by Makokha et.al (1999), confirmed that farmers characteristics such as participation in field days and demonstration ,attendance at workshops and seminars contact with extension and leadership position have significant influence on perception and hence adoption decision of farmers.

Berhanu (2002) observed that the availability of off-farm incomes, extension contact the total livestock owned, distance between residence and the market are found to have appositive and significant influence the adoption decision of farmers.

Cramb 2003) inferred that a number of farms –household factors are typically associated with adoption, such as

Age: education and personal characteristics of the household head

Size ,location and tenure status of the farm

Availability of cash or credit for farm investment

Access to market for farm produce

Determinants of technology adoption encompasses characteristics of the technology ,features, of the farming system ,market and policy environments as well as socio-economic characteristics of the decision making unit(household, farmer Ehui et.al (2003)

The study conducted by Million and Belay (2004) indicated that age had aweak and at the same time negative association with adoption .In contrary Omiti et.al (1997) investigated positive relationship between age and adoption behavior of farmers.

2.3 Water Pump and pump types

2.3.1 Pump

A pump is machine which changes fuel energy into useful water energy and needs petrol or diesel engine or an electric motor to drive it .In special circumstances it may also be possible to use wind or solar energy. For surface irrigation the pump lifts water from arriver or groundwater into a channel or pipe system. For sprinkler and trickle irrigation the pump provides the energy for the pressure and discharge needed to distribute water in the pipes to the sprinklers and emitters, in addition to the energy needed to lift water from the source.

2.3.2 Pump types

Although there are many types of pumps and water lifts devices the most commonly used types are the axial flow (or propeller) pump, the radial flow (or centrifugal) pump, and the mixed flow pump. These are looked at in detail below.

Axial flow pump

An axial flow pump consists of a propeller hence its alternative name housed inside a tube, which is located below the water level. The tube acts as the discharge pipe, and the power unit turns the propeller by means of a long shaft running down the middle of the water at low pressure and is ideally suited to lifting water from a river or lake to provide surface irrigation water to a farm with open channel distribution. However, these pumps tend to be very expensive because of the high cost of materials, particularly the drive shaft and bearings to support the shafted propeller. For this reason there are no small axial flow pumps manufactured of a size suitable for the small farm of 1 - 2 ha. They tend only to be used on larger farms and for communal schemes, where several small farms are irrigated from the same pump. They are particularly suited to paddy rice schemes because of the large volumes of water usually needed for this crop.

Radial flow pump

Centrifugal pumps are the most common type of pump used on small schemes because they are much cheaper than axial pumps to buy and maintain .small pump sets are often

readily available in most developing countries .They are best suited to sprinkler and trickle irrigation ,where a higher pressure is needed than for surface irrigation

Mixed flow

This pump is a mixture of the axial flow and the centrifugal pump and has the advantage of combining the best features of both pump types. Mixed flow pumps are more efficient at pumping larger quantities of water than centrifugal pumps and are more efficient at pumping to higher pressures than axial flow pumps. They can also operate as submersible pumps, i.e., being completely below the source water surface (M.Kay, silsoe college, uk and N.hatcho, 1992)

2.4 The importance of pump

- A mechanical device to increase the pressure energy of a fluid
- Generally the pump is used for raising the fluid (liquids or gases) from a lower level (wet well,river,lake)to a higher level
- For efficiency Or to save time and lab our within a short period of time to cultivate a large plot of land

Pumps are used for variety of application like

Supplying of drinking water, irrigation purpose, mine water drainage

Therefore, this study was proposed to analyze factors that influence the adoption of motorized water pump and it attempts to fill the existing knowledge gap.

2.5 Why adoption studies are important

Any technology can be create and innovate by the researchers and then disseminate to the users .Most of the technology creation and innovation was driven by the demand of users Therefore adoption studies are important for the following reasons

1. to identify the Innovators, Early adopters, Early majority, Late majority, Laggards
2. to identify the traditional or backward technologies that the farmers used and compare with the modern technologies and then to update the old technology or create and innovate new technology

3. to know the number of the technology users and non users and then to supply appropriate technology on the right time and place
4. to increase the living standard of the poor people, food in secured people
5. to design information dissemination
6. to develop inadequate agricultural development policies such studies would enhance the development of effective polices for technology adoption.

It is well understand that technology generation and development is an iterative process and the supply of technologies needs to be driven by demand from the users. Adoption studies are therefore important for the following reasons:

1. To quantify the number of technology users over tome to asses impacts or determine extension requirements. An adoption study would help as in monitoring and feed back in technology generation. In a traditional
2. technology generation/ development and transfer continuum model, it is used that researcher would pass the technology on to extension agents to take it to farmers and the technology would work and be adopted by farmers. Many years of development efforts proved that such approach has not worked. A participatory approach to technology development and transfer model is very popular and contribute to better technology development and transfer. Adoption studies would provide further insights into effectiveness of technology transfer.
3. To provide information for policy reform. It is well documented that agricultural development efforts are constrained by the lack or inadequate agricultural development policies that support development in general and agricultural research and development in particular. It is important that adoption studies emphasis and understand the policy bottlenecks to technology adoption. Such studies would enhance the development of effective polices for technology adoption.
4. To provide a basis for impacts. A number of economists have estimated the high rate of return to investments in agricultural research. Despite this, policy makers and donors are not convinced that their resource allocation to agricultural research brings the desired impact and development. We are observing the downward trend in investments in agricultural research and transfers in most areas.

According to Chris (2000), innovation adoption theory has been applied to wide variety of products and services. The first step to understand the adoption of new product and services is to understand the process used by the potential adopters to select or reject a technology. The adoption process is found to combine five essential steps in all cases: knowledge, presumption, decision, implementation and confirmation or denial. There broad categories are found in all type of adoption decision and are unique within any population. Innovations are not accepted simultaneously by all of the participants. Certain individuals are predisposed to try out innovation first. Some people are inclined to take greater risks, be more venturesome and tolerate and Early disappointments. This difference are based on personality, temperament, experience and perceived need.

Innovation researcher label those individual as innovator and research find that they are typically about 1.5 – 3% of population success with the innovator does not guarantee success with the later adopters, but it is required step in the adoption of any innovation. Innovators and early adopters are frequently categorized together combined; innovators and early adopter constitute 16% of the population. Recent studies confirm that the adoption by early adopters does not guarantee. Success with the broader population of mature, late and laggard adopters and that “gap” may occur after the introduction of technologies to the early adopter and innovator as Chris (2000) cited from Moore (1991)

3. METHODOLOGY

3.1 DESCRIPTION OF THE STUDY AREA

Location and physical features

Dera woreda (district) is one the south Gonder administrative zone woreda in Amhara National Regional State which is found in western part of the zone. Anbesame is the capital city of the Woreda, which is 42 km from bahirdar i.e. the capital city of the region and 78 km from debretabor i.e. the capital city of the zone .The boundaries of the woreda are fogera woreda in the north, eastern estie woreda in east, hulet eju woreda in south and bahirdar zuriya woreda in the west.The woreda is divided in to three town and twenty nine rural administrative kebeles .

Area

Dera Woreda has an area of 159.079 km² width. The topography surface of the woreda characterizes 20 % , mountainous 35% plain and 27% gorge

Climate

The woreda has two agro climatic zones namely Dega 15 % and W/Dega 85% and contribute the major climatic shares of the area with the main annual rainfall ranges between 1006 to 1500 mm

The altitude of the study ranges between 1656 ---2600 meter above sea level, the major types of the soil in the study area are categorized as red 35% gray, 4% black and others 61%.

The major crops cultivated in the study area are teff, maize, rape seed, millet, rice. The crops that are produced by irrigation are potato, onion, maize, cabbage, tomato In the

study area there are 428,578 livestock resource, out of these 39.66% is cattle, 13.48% shoats, 3.51% equines, and 43.35% poultry the live stock resource potential

Rainfall

The annual rainfall ranges between 1006 to 1500 mm The rainfall pattern distinguishes as high variability, uneven distribution, uncertain and erratic in nature

Land use

About 37.57 percent of the land is cultivated and used for production of annual and perennial crops 17.42 percentage of the land covered by forests and herbs. 6.38 percent of the land is not used for productive purposes /wast land, and 18.49 percent is covered by water, 7.24% represents for house construction and 1.415 covered by others.

Irrigation users , potential rivers ,lakes and distributed irrigation technologies

The irrigation user household was male 26,148 and female 2,740 totally 28,888 households were irrigation users. In the woreda there are 174 rivers and 1 lake. But the main potential once are five rivers and one lake ,namely gumara ,gelda,wojo, gebete, ankata and lake tana , 595 motorized water pump, 282 pedal pump and 224drip irrigation technologies was distributed (Woreda BOA ,Annex3). .

Population

The woreda has the population male 136,083 and female 137,939 totally 274,022.

Types and numbers of Cooperatives

Primary cooperatives (multipurpose, milk development, fish, irrigation, saving &credit), and these cooperatives was 29 in number and have 16,044 members out of this 1,294 was females (Woreda Cooperative Office Annex2)

Financial institutions

There are one commercial bank, one credit and saving institution and seven saving and credit cooperatives

3.2 Sampling

Multi-stage stratified random sampling method was taken to achieve the objective of the study. Both primary and secondary data were used for the study. All data collected from those who have motorized water pump and no motorized water pump and these two groups of farmers were forming the most important sources of information. The water pump user farmer's were considered adopter farmers whereas the non motorized water pump farmers were referred as non adopter farmers.

Multi-stage refers to due to time availability, financial capacity and other logistics of the researcher out of the ten zones in the Amhara region. South Gonder zone was purposely selected based on access to irrigation and proximity.. Dera woreda was selected based on its irrigation potential. Accordingly, three kebeles were selected, namely,

- (a) Gina kebele is found near to Lake Tana and Gumara River,
- (b) Qorata kebele is found to gelda river and Lake Tana and
- (c) Mtili kebele is also found Gumara River and Lake Tana.

Therefore, for selection of the adopter farmers and non adopter farmers

a) In the first stage

Motorized water pump user kebeles was purposely selected based on their rivers and lake potential, transport facilities, number of irrigation users by water pump on river and lake schemes based on their proximity for the ease of data collection.

b) In the second stage

After identifying irrigated kebeles the respondents' farmers was selected from the motorized water pump user farmers and non- motorized water pump user farmers randomly. The adopter farmers and the non motorized water pump user farmers were identified by the kebele development agents and by the village leaders and based on their

lists the respondents selected randomly for this study. It covers both female and male farmer household respondents.

Therefore, the sample size was selected depending on the number the distribution of motorized water pump users in each kebele .Total sample size of the study area was 100 that was 50 from users and 50 from non users of farmers

3.3 Data Collection Tools and Procedures

Both primary and secondary source of data were used for this study. The primary data were collected using personal interviews through structured interviews .To make the communication easier during collection of data from the farmers the interview schedule was translated into the language of respondents (local language). The primary data was collected by using four enumerators at kebele level .The enumerators were trained and closely supervised by the researcher. The secondary data was collected by the researcher by using checklist guide. Secondary data were also taken from different sources such as, woreda agriculture, cooperative, administration, finance and economic development office as well as published and unpublished documents

Suitable techniques were employed to collect the data by considering the objectives stated and availability of source. Hence, the data collection method was included the interview schedule.

The interview schedule was containing mostly close-ended questions and some open-ended questions were included. The interview schedule was pre-tested. After that the interview schedule was standardized and finalized. Data collected for this study was cover several topics keeping in mind objectives and hypothesis of the study such as farmer's characteristics and broad technological attributes as they relate to adoption improved technologies.

3.4 Data processing

The completed interview schedules were scrutinized, verified edited and arranged serially. For coding one master code sheets was prepared. Data was preprocessed using computer SPSS software.

4. RESULT AND DISCUSSION

This chapter presents the results obtained from descriptive analysis. In the descriptive statistics percentage and chi-square test were employed in line with different adoption categories. The results about the significance difference between the adopters and non adopters are also presented.

4.1. Socio-Economic and Demographic Characteristics

Sex

A total of 100 respondents, of which 96 male and four female farmers were interviewed using structured questionnaire to get information on motorized water pump adoption.

Age

The age of the study subjects were ranging from 20 to 60 years; and 94% , 2% and 3% of them were married, single and widowed, respectively.

Wealth status

The wealth status of the total respondents of the study group was 34%, 59% and 7% as better-off, middle and poor, respectively.

Family size

The number of family size was 10%, 60%, 29% and 1% as family size groups are 1- 3, 4- 7, 8 – 10 and 11-13, respectively.

Educational Status

As indicated in Table 1 the respondents educational status in total is 28, 26, 24, 21 and 1 as illiterate read and write only, 1 -4 grade, 5 – 8 grade, 9 – 10 grade level, respectively. The number of male was much higher than that of the female. The illiterate male number was much higher than the other groups while the lowest number was from grade 9-10 Table (1).

Table 1 . Respondents educational status

Educational level	Educational status by sex		Total
	Male Number	Female Number	
Illiterate	27	1	28
Read and write	26		26
1-4	24		24
5-8	18	3	21
9-10	1		1
total	96	4	100

Farming Experience

As indicated Table 8 , the respondents farming experience were 1- 10 years, 11 – 20 years, 21– 30 years, 31-40 years and above 40 years, respectively.

House type

The type of house the sample households are living in were 10% grass thatched and 89% iron corrugated sheet

Land holding

The land holding size of the study group ranged from 0.5 hectare to 6 hectare .The distribution of the land size was: 0.5-1ha= 20%, 1-1.5ha= 15%, 1.5-2ha = 32%, 2-2.5ha =12% and

2.5 ha - 6ha =21% indicating that more people were having a land size that ranged between 1.5- 2 ha.

Livestock ownership

The livestock ownership of the respondents ranged from 1-10, 11-20, 21-30 and above 30 units of livestock 27.6%, 26.3%, 5.2% and above 40%, respectively

Off-farm activities.

It refers to the opportunity that the farm household had to work outside their own farm operations

The respondents were found that 36.1% involved on off-farm and 8.5% not engaged on off-farm activities. The finding of this study showed that most of the respondents' livelihood depended on off-farm activities.

Membership of social organization

The distribution of the respondents was: 12.9% in ider, 3.2% in peasant association, 1.1% in district council and 82.8% were a member of more than one types of social organization. From this study, there was an understanding that most of the respondents were participating and involving in some social organizations

4.1.1 Association between age and adoption of motorized water pump

The average age of the respondents was from 20 to 60 years, resulting non significant difference (p.value = 0.762) between age and adoption of motorized water pump Table (2). The result shows that as the adopter's age increase the number of adopters decrease. This might be because producing different vegetables fruits and crops by irrigation is labor intensive and as their age increases they are grouped as not an active one for agricultural works. According to Almaz Mesfin (May, 2008) study on the performance of dairy cooperative members satisfaction in input and output marketing decreases from the 80% to 33% as age increases from 15 to 67 years. This might be because dairy farming is labor intensive and old people are at a disadvantage to conduct their business for reasons of physical difficulties

Table 2. Association between age of respondents and adoption of motorized water pump

Respondent Age group	Adopter		Non adopter		Total	%
	Number	%	Number	%		
20-30	0	0	7	12.96	7	7
30-40	20	43.48	13	24.07	33	33
40-50	12	26.09	18	33.33	30	30
50-60	11	23.91	12	22.22	23	23
60-70	3	6.52	4	7.41	7	7
total	46		54		100	
$\chi^2 = 9.292$						
P.value=0.762						

4.1.2 Association between wealth status and adoption of motorized water pump

The survey result indicated that the wealth status of the sampled household heads: 35.79%, 62.11% and 2.11% was found better-off, middle and poor, respectively. Among the sampled respondents the wealth status of the non adopters: 50% , 47.8 %and 2.17% was found better-off, middle and poor respectively while the adopters was 22.45% 75.55% and 2.04% better-off, middle and poor, respectively. It was also tested statistically and its result indicated that there is a significant difference on the wealth status of the adopter and non adopter on motorized water pump technology.

The result showed that the wealth status and the adoption of motorized water pump has a statistically significant relationship (p.value 0.003) indicating that wealth status has an influence on the adoption of motorized water pump

Table 3. Association between wealth status and adoption of motorized water pump

Wealth status	Non Adopter		Adopter		Total	%
	Number	%	Number	%		
Better off	23	50	11	22.45	34	35.79
Middle	22	47.8	37	75.55	59	62.11
Poor	1	2.17	1	2.04	2	2.11
Total	46		49		95	
$\chi^2 = 11.05$ <p style="text-align: center;">p.value=0.003</p>						

4.1.3 Association between house type and adoption of motorized water pump

As indicated table (4) the adopters house type was 4.45% and 95.56% grass thatched roof and corrugated iron roofed respectively while 14.82% and 85.18% non adopters house type was made from grass roofed and iron sheet roofed, respectively Table(4)

Table 4. Association between house type and adoption of motorized water pump

House type of the respondents	Non adopters		Adopters		Total	%
	Number	%	Number	%		
Grass thatched roof	8	14.82	2	4.45	10	10.11
Corrugated iron roofed	46	85.18	43	95.56	89	89.90
total	54		45		99	

4.1.4 Association between educational status and adoption of motorized water pump

This is due to the fact that a farmer with a good knowledge can adopt a good practice to maximize the adoption of motorized water pump and increase the use of other agricultural and non agricultural technologies

The distribution of total sample respondents in terms of literacy level has shown that 28%, 26%, 24%, 21% and 1% illiterate, read and write 1-4grade, 5-8 grade and 9-10 grades respectively. Among the study group, the educational status of non adopter were found 17.39%, 26.09%, 34.78%, 19.57% and 2.17% illiterate, read and write,1-4 grade, 5-8 grade and 9-10 grade respectively, while the adopters were found 37.04% ,25.93%,14.81%and 22.22% illiterate, read and write,1-4 grade,5-8grade and 9-10 grade, respectively (Table 5)

The majority of the adopter sample farmers who pursued grade 8 and grade 5-8 were motorized water pump users. This can be interpreted in such a way that farmers who are educated are more eager to grasp new ideas and allocate their resources to their best use. Besides, they could have a better understanding of the technology and could recognize the importance of motorized water pump for irrigation through better management

The result indicated on Table (5) shows the statistical significant relationship p.value (0.001) , between the educational status and the adoption of motorized water pump, indicating the positive role of education on the adoption of motorized water pump. .The finding is in agreement with the idea of Feder et.al, (1985) who indicated that education or awareness can directly facilitate technology adoption through increasing access to information about alternative market opportunities and technologies.

Table 5. Association between educational status and adoption of motorized water pump

Educational level	Non Adopter		Adopter		Total	%
	Number	%	Number	%		
Illiterate	8	17.39	20	37.04	28	28
Read and write	12	26.09	14	25.93	26	26
1-4	16	34.78	8	14.81	24	24
5-8	9	19.57	12	22.22	21	21
9-10	1	2.17	0		1	1
total	46		54		100	
$\chi^2 = 8.808$						p.value=0.001

4.1.5 Association between Perception of respondents about education and adoption of motorized water pump

The study result (table 6) indicated that the perception of the respondents about education and adoption of motorized water pump was found 85% very important 9% important and 6% less important. The perception of adopters were found that 80.43% very important, 13.05% and 6.52 less important while the non adaptors 88.89% very important, 5.56% important and 5.56% less important

Table 6. Association between Perception of respondents about education and adoption of motorized water pump

Perception of respondents on education	Adopter		Non Adopter		Total	%
	Number	%	Number	%		
Less important	3	6.52	3	5.56	6	6
Important	6	13.05	3	5.56	9	9
Very important	37	80.43	48	88.89	85	85
Total	46		54		100	

4.1.6 Association between Participation in Social Organization and Adoption of motorized water pump

From the total respondents 52 were adopters and out of these adopters 17.31%, 5.77%, 1.92% , and 75% participate in ider, peasant association, district council, more than one organization, respectively and 82.80% the sample households were found to participate in more than one types of social organizations. Out of 52 adopters 39 adopters were participated on more than one types of social organization. From this study adopters are more involved in different types of social organizations and were found to be statistically significant Table(7).

This result is in agreement with the idea of Makokha et.al (1999), who indicated that farmers characteristics such as participation in field days and demonstration ,attendance at workshops and seminars contact with extension and leadership position have significant influence on perception and hence adoption decision of farmers

Table 7. Association between of Participation in Social Organization and Adoption of motorized water pump

Item social organization	Non Adopters		Adopters		Total	%
	Number	%	Number	%		
Idler	3	7.32	9	17.31	12	12.91
Peasant association	0	0	3	5.77	3	3.23
District council	0	0	1	1.92	1	1.08
More than one organization members	38	92.69	39	75	77	82.80
Total	41		52		93	

4.2 Farming Experience

The adopter and non adopter farming experience were one year and above 40 years. Out of the total respondents the farming experience of adopters was 45 (45.46 %,) while the non-adopters was 54 (54.55 %) resulting non significant differences (Table 8).

Table 8. Association between of Farming Experience and Adoption of motorized water pump

Farming experience years Of respondents	Adopter		Non Adopter		Total	%
	Number	%	Number	%		
1-10	0	0	7	12.97	7	7.07
11-20	20	44.45	17	31.49	37	37.38
21-30	11	24.45	21	38.89	32	32.33
31-40	9	20	5	9.26	14	14.15
Above 40	5	11.12	4	7.41	9	9.09
total	45		54		99	

4.2.1 Association between of Land holding and Adoption of motorized water pump

The minimum size of land for adopter and non adopter was 0.5 ha .From the total sample of respondents 28 were adopters and 48 non adopters, resulting significant differences, indicating that land holding have a positive and significantly influence on the adoption of motorized water pump Table (9)

Table 9. Association between of Land holding and adoption of motorized water pump

Land holding size in ha	Adopter		Non adopter		Total	%
	number	%	number	%		
0.5-1	1	3.57	11	22.92	12	15.79
1-1.5	3	10.71	9	18.75	12	15.79
1.5-2	9	32.14	16	33.33	25	32.89
2-2.5	5	17.86	4	8.33	9	11.84
2.5- 6	10	35.71	8	16.67	18	23.68
Total	28		48		76	
		$\chi^2 = 8.986$				$p.value=0.004$

4.2.2 Distribution of respondents by access of sharing and land renting

From the total sample of respondents, 16.27% have their own land,13.56% rent land and 10.17% by sharing of resources Table.(10)

Table 10 .Distribution of respondents by access of sharing and land renting

Access of land	Adopter		Non adopter		Total	%
	Number	%	Number	%		
ownership	23	82.14	22	70.97	45	16.27
By rent	4	14.29	4	12.90	8	13.56
By sharing	1	3.57	5	16.13	6	10.17
Total	28		31		59	

4.2.3 Association between availability labor and adoption of motorized water pump

Out of the total respondents 11.54 percent of adopters not faced labor shortage and 88.46 percent of adopters faced labor shortage and 38.46 percent non adopters not faced labor shortage and 61.54 percent of non adopters faced during the irrigation season by using motorized water pump. Labor shortage is significantly affecting in the adoption of motorized water pump technology Table (11)

Table 11. Association between availability labor and adoption of motorized water pump

Labor availability	Adopters		Non adopters		Total	%
	Number	%	Number	%		
No labor shortage	3	11.54	15	38.46	18	27.70
Labor shortage	23	88.46	24	61.54	47	72.30
Total	26		39		65	
$\chi^2=5.647$			P.value=0.024			

4.2.4 Association between labor shortage operation types and adoption of motorized water pump

The result shows that out of 60 respondents 58 respondents were faced labor shortage problems in the agricultural operation .Out of 58 respondents 20.69%, 1.73%, 5.18% , 5.18% 8.62% and 58.62% faced problems respectively in planting , pitting , weeding , watering ,harvesting and at all operation Table (12) .

Table 12. Association between labor shortage operation types and adoption of motorized water pump

Respondents response On labor shortage	types of agricultural operation and faced labor shortage						Total
	Planting	Pitting	Weeding	Watering	Harvesting	At all operation	
yes	12 (20.69%)	1 (1.73%)	3 (5.18)	3 (5.18)	5 (8.62)	34 (58.62)	58
no	0	1 (1.73%)	0	0	1 (1.73%)	0	2
Total	12	2	3	3	6	34	60

4.2.5 The system of adopters solving the problem of labor shortage during irrigation by using water pump

Out of 60 respondents 33.33 percent, 43.34 percent and 23.34 percent solve labor shortage problems by labor hiring, debo (helping each other by setting the program) and using family labor respectively Table(13)

The result shows that most of the respondents solve labor shortage by debo and hiring labor

Table 13. The system of adopter solving the problem of labor shortage during irrigation by using water pump

Types of solving labor shortage problem during irrigation By using water pump				
	Hiring labor	debo	Using family labor	Total
Number of respondents	20 (33.33%)	26 (43.34)	14 (23.34%)	60

4.2.6 Association between distance of irrigable land from their residence and adoption of motorized water pump

Distance of the irrigable land of the respondents in km from the residence, and walking hours from the residence to irrigable land has been found to be positively related with adoption. The closer the residence of the respondents to the irrigable land, more adopters involve in motorized water pump. From the total respondents of adopters 34.79% and 45.65% were \leq 1km and 1-2km far from irrigable land. The larger the distance the irrigable land from the residence the number of adopters decreased, resulting significant differences as indicated in Table (14).

This result is in agreement within the finding of Birhanu (2002) who indicated that distance between residence and the market are found to have a positive and significant influence on the adoption decision of farmers. The result is also in agreement with Chilot et al. (1996) who indicated that distance of respondents' homes from extension centers also influenced the probability of adopting improved wheat variety as well as the intensity of fertilizer and herbicide use.

Table 14. Association between distance of irrigable land from their residence and adoption of motorized water pump

distance	Adopters		Non adopters		Total	%
	Number	%	Number	%		
≤1km	16	34.79	31	88.57	47	58.02
1-2km	21	45.65	4	11.42	25	30.86
2-3km	5	10.86	0		5	6.17
3-4km	1	2.17	0		1	1.23
4-5km	2	4.34	0		2	2.46
>5km	1	2.17	0		1	1.23
total	46		35		81	
$\chi^2=24.302$		P.value=0.000				

4.3 Association between extension service and adoption of motorized water pump

4.3.1 Association between access to extension service and adoption of motorized water pump

Offering extension service is one of the important agricultural extension services that is required to increase agricultural productivity through the adoption of new technologies. Through the extension service inputs supply, credit service, information dissemination and technology familiarization is practiced and an enabling environment for production and productivity improvements created and farmers' income increment achieved. The survey

result showed that about 69 % of the respondents had contact with the extension agent Table(15).

In the study area, the offices of agricultural development at woreda and kebele level provide the extension services for the farmers. Out of the total sample farmers interviewed, 52.13% of them were adopters and 47.88% were non adopters. From the total adopters and non adopters 89.79% and 77.78% respectively said extension access was good for inputs/technologies supplying, timely harvesting and credit utilization and repayment, which resulted statistically significant difference between them

Table (15)

Table 15. Association between access to extension service and adoption of motorized water pump

Extension access	Non Adopter		Adopter		Total	%
	Number	%	Number	%		
Extension access was good	35	77.78	44	89.79	79	84.04
Extension access was not good	1	2.22	0	0	1	1.06
Extension access was some extent	9	20	5	10.20	14	14.89
Total	45		49		94	
$\chi^2=3.003$					P.value=0.004	

4.3.2 Association between training and workshop access and adoption of motorized water pump

Training is relatively a means of capacity building where most people tend to participate and acquired knowledge for proper implementation and properly utilization of agricultural technologies

Need of training or related to practical support for motorized water pump is a means to decrease the complexity of the technology. So that the components of the training like tour, field visit and demonstration trials positively have influenced human behavior and helps farmers get more information and make understand about the agricultural technologies

The result shows that out of 60 respondents 6 adopters and 4 non adopters totally 10 respondents attend related to on operation /practical of water pump training and at field demonstration day by NGO(Koreans') at near Gumara river and woreda agriculture office at Farmers Training Center (FTC). From 21 adopters 28.58 percent was attend this training and 71.43 percent not attend training and 89.75 percent the non adopters were not attend training Table (16)

The training was handled with the collaboration of office of woreda agriculture staffs.

Table 16. Association between training and workshop access and adoption of motorized water pump

Access of training	Adopter		Non Adopter		Total	%
	Number	%	Number	%		
Attend training Related to operation water pump	6	28.58	4	10.26	10	16.67
Not attend training Related to operation water pump	15	71.43	35	89.75	50	83.34
Total	21		39		60	

4.3.3 Association between radio access and adoption of motorized water pump

Out of the 100 respondents 73 percent of farmers have their own radio and 23 percent did not have radio. Out of 55 adopters 45 have their own radio and 10 have no radio and out of 41 non adopters 28 respondents have radio and 13 respondents have no radio . The result shows that most of adopters have their own radio table (17)

Table17. Association between radio access and adoption of motorized water pump

Access of radio	Adopter		Non Adopter		Total	%
	Number	%	Number	%		
yes	45	81.81	28	68.30	73	73
no	10	18.19	13	31.70	23	23
Total	55		41		100	

4.3.4 Association between access to credit and adoption of motorized water pump

Capital is basic in starting-up or running any business activity, be it agricultural or non-agricultural businesses. Credit is an important institutional service to poor farmers for input purchase and ultimately to adopt new technology. However, some farmers have access to credit while most of the respondents did not have an access to credit for irrigation. .

The survey result indicates that 58.82% of the adopters do not have credit access related to motorized water pump adoption to cultivate crop and fruit and vegetables.

Respondents reported about problems for credit access was related to many factors. About 10%, 33.33%, 53.33% and 3.33%, respectively was shortage of collateral, high interest rate, bureaucracy and no special credit service for motorized water pump

4.3.5 Association between irrigation product market and adoption of motorized water pump

The assessment of this part was to know the markets of irrigation product and farmers' price satisfaction and family consuming abilities. The result showed that the adopters said that 8.89% , 26.67 % and 64.44 % the respondents of the irrigation product was to sell, to consume and for both (to sell and to consume) respectively Table(18)

Out of 79 respondents 35(44.31%)sell their irrigation produce at their farm gate and 55.69% sell by taking to local market Table (19).

Table18. Association between irrigation product market and adoption of motorized water pump

Reasons to produce	Adopters		Non Adopters		Total	%
	Number	%	Number	%		
To sell	4	8.89	2	6.06	6	7.70
To consume	12	26.67	21	63.63	33	42.30
For both (for sell and consume)	29	64.44	10	30.30	39	50
total	45		33		78	

Table 19. Distribution of sample respondents where the farmers sell irrigation produce

Irrigation produce market	Adopters		Non Adopters		Total	%
	Number	%	Number	%		
Farm gate	28	62.23	7	20.59	35	44.31
Local market	17	37.77	27	79.41	44	55.70
Total	45		34		79	

4.3.6 Distribution of sample farmers feeling about the price of irrigation produce

The assessment of price feeling and satisfaction of the total respondents indicated that 30.38 % said cheap, 11.40 % said costly and 58.23% of the respondent said normal

Table (20)

Table20. Distribution of sample farmers feeling about the price of irrigation produce

Irrigation product price	Adopters		Non Adopters		Total	%
	Number	%	Number	%		
Cheap	20	39.22	4	14.29	24	30.38
Costly	3	5.89	6	21.43	9	11.40
Normal	28	54.91	18	64.29	46	58.23
Total	51		28		79	

4.3.7 Income Assessment

Assessment was done to know the feelings of respondents of adopters and whether their income increased as a result of producing different crops and fruits and vegetables by using water pump. The assessment indicated that among the adopters 92.5% their income increased and 7.5% did not increase, the reason why their income not increased was due to

- ❖ the price of irrigation product was decreased
- ❖ the cost of fuel for water pump was increased
- ❖ the land size was not enough for irrigation

4.3.8 Annual income of motorized water pump user between the Year 2006 and 2009

The average annual income of adopters in the year (2006) was 12,589 ET Birr. In the year (2009) the average annual income of adopters was 64,464.52 ET Birr. The study result indicated that the average annual income difference of the fourth year (2009) and initial year (2006) of adopters was indicated ET Birr 51875.50 .This also indicated that the average annual income of adopters increased by 80.48 percent . As at December 31,2009

the exchange rate of 1 USD in terms of Ethiopian birr was 12.8925. The income progress in terms of USD was $51875.50/12.8925=4,023.70$ USD

The income difference was from filed crop, from live stock, fruits and vegetables, tuber crop (potato, tomato, onion,) perennial tree and off-farm activity

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study has attempted to identify the contextual factors that influence farmers' adoption of motorized water pump for irrigation in Dera woreda, South Gondar zone of Amhara Region, Ethiopia. The socio-economic factors of this study revealed that adopters of motorized water pump were relatively elder, wealthier, more involved on off-farm activities, participate in more type of social organization, and the educational status was should significance difference on the adoption of the technology

The average ages of non adopter and adopters was found to be 20 to 60 years old. From the total respondents of adopters 20(43.48%) was the age of 30-40 years old more adopt than other adopters .It was found to be statistically insignificant Table(1)

Sex association on adoption of motorized water pump technology male house hold was higher than the female which could be the problem of economical or social of the female household.

The wealth status was found that there was a statistically significant difference on the adoption of motorized technology the wealthier the more to adopt the motorized water pump technology and the result showed that the adopters are wealthier than the non adopters

The farmers perception of education was showed that a significance difference on the adoption of the technology. This is due to the fact that a farmer with a good knowledge can adopt a good practice to adopt new technology

With regard to land holding farm size was showed that a significance difference on the adoption of the technology

Labour shortage was one of the factor which influence the adoption of motorized water pump technology and it was found that statistically significant

With respects to extension service the adopters have better extension service, more information and have more perception on technology adoption have more radio access than non adopters

The extension services in the study area play the role of fast technology supply and dissemination

So the survey result of this study showed that there was a significant difference on motorized water pump adoption between adopters and non adopters inter ms of their access to extension service in the study area agricultural technology training and workshop have also apposite influence on the adoption of motorized water pump technology

Distance of the irrigable land from the farmer's household to the residence has influence on adoption; the larger walking hours from the residence to irrigable land and the less km from the residence has negative and positive influence on adoption.

Finally Credit is an important institutional service to poor farmers for input purchase and ultimately to adopt new technology. However, some farmers have access to credit while most of the respondent did not have access credit for irrigation. . The survey result indicates that 58.82% of the adopters do not have credit access related to motorized water pump adoption to cultivate crop and fruit and vegetables. The researcher suggests that a special focus on credit would enhance the promotion of water pump technology adoption there by contributing towards achieving self-sufficiency in food production

5.2. Recommendation

The study revealed that farmers' perception on motorized water pump compared to other irrigation technology was and positive for this new technology. This significantly affects the adoption of motorized water technology.

However, according to surface water potential (rivers) the spread of this water pump technology is not as expected. Thus further work is required to create awareness and improving perception through training, education, workshop and demonstration. Therefore, due attention should be given to perception of farmers on new technology in order to promote adoption through provision of knowledge by strengthening frequency of extension contact, training, farmers demonstration As the study indicated that the level of men participation motorized water water pump technology is higher than that of women which is 4(4% female) . The women involvement is too minimal. Therefore, women participation is crucial for improving the existing technology for higher level of adoption.

The study finding showed that access of credit for motorized technology was less Therefore, it should be given more attention for increasing the adoption of the motorized water pump

Therefore, this area is a critical part gap for the credit access of motorized water pump technology and due attention should be given

The study revealed that most of the technology 75% adopters involved more than one types of social organization and 93% of non adopter involved more than one types of social organization but they are not adopters . So extension workers/agents should use those

social organizations as a good opportunity for extension communication media for the future intervention

Therefore, this area is a critical part gap for the spread of the technology and due attention should be given.

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7.ANNEX

Annex 1. Interview Schedule for the study

This interview Schedule is developed to collect data on the factors influencing the adoption of motorized for partial fulfillment of masters program me in rural development in South Gondar Zone Dera Woreda.

1. General Information

2. Circle (0) the chosen answer number or letter

- I. Date of Interview ----- Name of Interviewer -----
- II. Name of Respondent -----Kebele-----head ship-----sex---
- III. Age a) 20-30 b) 30-40 c) 40-50 d) 50-60 e) above 60
- IV. Wealth status a) better off b) middle c) poor
- V. Marital status a) Single b) Married c) Divorce d) Widow
- VI. Total Number of family size----- a) able bodied----- b) dependent bodied -----
- VII. Educational Level: 1) illiterate 2) read and write only 3) 1-4 4)5-8 5)9-10 6)10+
- VIII. Perception about the importance of education in life and development
1) less important 2) Important 3) very important
- IX. How many years you live in the locality-----years
- X. When did you start farming for your own? in -----
- XI. What is the type of house you own and live? a) Grass thatched roofed b) Corrugated tin roofed

3. Farm characteristic

3.1. Land holding

1. Total farm size -----hectare 2) irrigable land ---hectare3) Irrigated land-----hectare
- 4) Annual crop land -----hectare 5) Perennial cropland ----hectare 6) Grazing land ---hectare7) Fallow land --
-htr

3.2 Did you have your own water pump? 1) Yes 2) no

3.3 If no, how do you irrigate?1) totally by rent in 2) by sharing resource 3) Other specify -----

4).Distance of the irrigable land from home in Km 1) ≤ 1 km 2) 1-2km 3) 2-3km 4) 4- 5km 5) >5km

6) if other specify-----

5). Do you get inputs at the right time 1) yes 2) no

5.1) If not what is the reason?-----

6) How do you evaluate extension service? 1) Good 2) not god 3) some extent

4) if Other specify -----

7) How do you get irrigable land? 1) Ownership 2) by rent 3) by investment 4) by sharing 5) other ways

8) Livestock ownership

Type of livestock	Number	Tropical livestock unit
Oxen		
Cow		
Heifer /Gider		
Calf /Tija		
Sheep		
Horse		
Donkey		
Mule		
Chicken/Dero		
Bee hive		
Other		

9. Off- farm activities

9.1. do you and your family have involved in off-farm activities 1) Yes 2) no

9.2 If yes, which type of off - farm activity you and your family are engaged?

- 1) Paid daily labor 2) Petty trade 3) Handicraft (weaver) 4) Carpentry (masonry) 5) if other specify -----

10) Use of motorized water pump

10.1. Have you ever used motorized water pump?1) yes, 2) no

10.2. If yes, when did you start? in -----

10.3 If the answer of Q10.1 is No, what is the reason? 1) None availability of motorized water pump material

2) Not heard about introduction of the motorized water pump in the area 3) Land shortage

4) Not accustomed in the area 5) the motorized water pump is expensive

10.4. Where did you get the motorized water pump?

- 1) Market 2) Agriculture office 3) NGOs 4) Neighbor 5) other fellow farmers

10.5. Why did you decide to use the motorized water pump?

1) to save human lab our 2) to cultivate large area of land 3) to ensure food security 4) to increase income

5) if Other specify -----

10.6. From where did you first hear about the motorized water pump?

1) Development agents 2) Neighbor 3) Radio 4) Television 5) On farmers day 6) other fellow farmers

7) if Other specify -----

10.7. Do you get adequate motorized water pump on time? 1) Yes, 2) no

10.8. If no, what is the reason for not getting adequate motorized water pump for the cultivation of different crops? 1) Not available in the market 2) Too expensive 3) Not available on time

4) Cash shortage 5) if other specify -----

10.9 Is there sufficient access of maintenance for motorized water pump? 1) yes 2)no

10.10 How do you compare the characteristics of motorized water pump with the substitute of Drip irrigation technology, gravity/can anal irrigation technology, pedal pump technology 1) better, 2) poor, 3) no change

10.11 if your answer is better how?-----

10.12 If your answer is poor how?-----

10.13 if other specify-----

11. Availability of Credit

11.1 Do you use motorized water pump by buying in cash 1) Yes 2) no

11.2 If the answer is “no” what is the reason?1) Do not have cash 2) No access of credit

3) Use the cash for other business activity 4) if other specify -----

11.3 Have you ever received credit service for irrigation? 1) Yes, 2) no

11.4 If yes for what purpose do you use the credit?

1) For motorized water pump 2) For improved seed 3) For fertilizer 4) if other specify -----

11.5 What factors hinder for the access of credit?1) Shortages of collateral 2) High interest rate 3) Bureaucracy 4) No credit service for motorized water pump 5) if other specify -----

12. Membership of social organization

Type of organization	Position		
	Ordinary member	Committee member	Chair man/ leader
Irrigation cooperatives			
Multipurpose Cooperative			
saving & credit cops			
Ider			
Iqube			
Peasant association(PA)			
District council			
Other specify			

13. Extension services

13.1. Did you have any contact with extension agents during the last irrigation season? 1) Yes 2) no

13.2. If yes, on average how many days did the development agent contact (visit) you?

1) Once per month 2) Twice per month 3) Three times per month 4) if other specify -----

13.3. Have you attending any agricultural training related to the use and operation of motorized water pump ?

1) Yes 2) no

If yes where training	Duration	Title of the training	Which organization gives the
-----	-----	-----	-----

13.4 Have you ever attended in any practical motorized water pump field demonstration or practical workshop arranged by any body? 1) Yes 2) No

13.5. From whom/where do you adopt the motorized water pump other than extension agents?
1) NGOs 2) Experts in woreda office 3) Radio /television 4) if other specify -----

13.6 Have you ever been observing when other farmers sale the product of irrigation? 1) Yes 2) no

13.7. Do you have radio? 1) Yes 2) no

13.8 What are the most crop types that you cultivate by irrigation by using motorized water pump?
Onion----tomato-----potato-----maize-----carrot----cabbage----- if others (specify) -----

14. Labor availability

14.1. Did you face any labor shortage during the last irrigation season motorized water pump? 1) Yes 2) no

14.2 If yes, for which farm operation did you face the labor shortage by using motorized water pump in the irrigation season? 1)for plugging 2) for planting 3) for pitting 4)weeding 5) watering 6) harvesting

14.3 How did you solve the problem?
1) Hiring 2) debo (use of communal labor) 3) using family labor 4) if other specify-----

15. Market services

15.1. You are producing products with irrigation a) to sell b) to consume c) both

15.2 if it is to sell Where do you sell your irrigation product?1) At farm gate 2) Taking to local market
3) Through cooperatives 4) if Others specify -----

15.3. Do you think you have received a fair price for your irrigation product? 1) Yes 2) no

15.4. What do you feel about the price of irrigation product? 1) Cheap 2) Costly 3) Normal

16. Annual Income source

16.1. What are your major sources of income?1) Field crop 2) Live stock 3) Vegetable 4) Fruit 5) Perennial tree (eucalyptus) 6) off farm activity 7) if Other specify-----

16.2. Do you think after you use the motorized water pump your income increased? 1) yes 2) no

16.3 If the answer “no” why? 1)the price of irrigation product decrease 2)the cost of fuel for the motor was very high
3) much cost for the maintenance of the motor 4)There was no proper storage facility 5) if Other specify ---

16.4. four years of Income

Type of income source	Before using motorized water pump	After using motorized water pump		
	1999/2000 in Birr	2000/2001 in birr	2001/2002 in birr	2002/2003in birr
From filed crop				
From live stock				
From vegetable				
Tuber crop(potato ,carrot etc--)				
From fruit				
Perennial tree (eucalyptus)				
From off farm activity				
Total				

Annex 2. The primary cooperatives Information

s/no	Types of cooperatives	In number	Number of members			capital
			male	female	total	
1	Multi purpose	17	14057	1194	15251	9382113.59
2	Saving&credit	7	350	85	435	296480.59
3	Dairy cops	1	64	9	73	18394.50
4	Irrigation cops	3	114	1	115	Not available
5	Fish cops	1	165	5	170	175100
total		29	14,750	1,294	16,044	

Source:- Dera Woreda cooperative office Amharic Version

Annex 3 . Rivers that can be used for irrigation and their potential

s/no	The name the river	Potential for irrigation in hectare
1	Gumara	905
2	Gelda	140
3	Gebete	5.25
4	Anqata	1
5	Sana dum	100

Source:- woreda finance and economy development bulletin May, 2009

Annex 4. The distribution of motorized water pump in the study is

year	Distributed in number
2006/2007	33
2007/2008	25
2008/2009	12
2009/2010	525
Total	595

Source woreda agriculture office

The pedal pump distributed in the study area until 282 and drip irrigation technology was

224

Annex 5. Amhara region irrigation development performance starting 2007-2011 by zonal

leve

Name of zone	2007		2008		2009		2010		2011	
	Irrigated land	Qut/y of product obtained in q/t	Irrigated land	Qut/y of product obtained in q/t	Irrigated land	Qut/y of product obtained in q/t	Irrigated land	Qut/y of product obtained in q/t	Irrigated land	Qut/y of product obtained in q/t
Eastgojam	45347	3391245	52056	5281496	56903	7306899	70505	7813646	76525	10916939
Awi	53491	3858631	59534	4872487	67571	7300945	74121	9873773	83168	10355133
weast gojam	23971	3084860	29473	3546695	41296	5634851	59963	7218242	68062	8971927
N/gonder	15948	1477250	16915	1294876	31307	2736695	40310	3726618	42744	4234710
S/gonder	28896	2252217	33195	2672003	38430	3489815	53412	5820046	58416	7438477
N/wollo	14923	1078907	16938	1224643	22341	3361618	27525	2943134	27215	3647389
S/wollo	34566	2178158	36454	2046879	41405	2060507	57045	4177985	63760	4818424
N/shoa	26288	1915891	29458	2621666	35631	4994573	40732	7733473	43026	7319357
oromiya	7756	442183	6772	458262	8762	1011497	15403	1843091	14773	1450504
Waghimra	2199	43643	2583	83441	4080	104108	5604	277898	4975	4477806
sum	253,330	19722985	283378	24102448	347725	38001508	444620	51427905	483059	59600666

Source:- Amhara region Bureau of Agriculture, in irrigated agriculture development core process 2012 indicator plan June, 2011 and agricultural input supply core process 2012 annual report, Bahirdar