

**SOCIAL NETWORKS AND GENDER DIMENSIONS IN USE OF
IRRIGATION BY FARMERS IN ALAMATA WOREDA, SOUTHERN
TIGRAY, ETHIOPIA**

M.Sc Thesis

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October, 2008

Haramaya University

**SOCIAL NETWORKS AND GENDER DIMENSIONS IN USE OF
IRRIGATION BY FARMERS IN ALAMATA WOREDA, SOUTHERN
TIGRAY, ETHIOPIA**

**A Thesis Submitted to the Department of
Rural Development and Agricultural Extension, School of Graduate
Studies**

HARAMAYA UNIVERSITY

**In Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE IN RURAL DEVELOPMENT AND
AGRICULTURAL EXTENSION**

(AGRICULTURAL COMMUNICATION AND INNOVATION)

By

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October 2008

Haramaya University

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As thesis research advisors, we here by certify that we have read and evaluated this thesis prepared, under our guidance, by Mikinay Hailemariam entitled **Social Networks and Gender Dimensions in Use of Irrigation by Farmers in Alamata Woreda, Southern Tigray, Ethiopia**. We recommend that it can be submitted as fulfilment of the thesis requirement.

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A decorative border resembling a scroll, with rounded corners and a vertical strip on the left side that looks like the edge of a rolled-up document. The scroll is outlined in black and has a light gray shadow on its left edge.

DEDICATION

I dedicate this thesis manuscript to my elder brothers, Ato Abera Hailemariam and Ato Selemon Hailemariam for their love, affection and unrestricted encouragement they gave me not only to accomplish this research, but also for every success in my life.

STATEMENT OF AUTHOR

First, I declare that this thesis is my original work and all sources of material used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements of M. Sc. degree at Haramaya University and is deposited at the University Library to be made available to borrowers under rules of the Library. I also declare that this thesis can be submitted to any other institutions, if the University found it necessary.

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ACKNOWLEDGEMENTS

First of all, I would like to thank my Lord God for being with me in all aspects of my life, especially in my academic life.

I would like to extend my heartfelt thanks to my major advisor Professor Ranjan S. Karippai for his valuable advice, insight and guidance from the initiation to the completion of the research. My thanks also goes to my co-advisor Dr. Tesfaye Lemma for his insight in the proposal writing, the moral support and encouragement, and for providing me important literatures for proposal and thesis write up. I would also like to express my sincere gratitude to Alamata Office of Agriculture and Rural Development for giving me chance to pursue my post graduate study. I further extend my gratitude to the ILRI / IPMS Project for funding tuition fee and other expenses during the study period. My thanks also go to Alamata research center for their cooperation in transportation facilities. I am deeply grateful to Ato Daniel Tadesse for his unrestricted help during the analysis of this research paper, by devoting his precious time. My special thanks also go to Tirame Godebo who helped me a lot starting from proposal until write up the thesis.

I also remain thankful to all the enumerators who assisted me in data collection with patience, commitment and dedication.

I am grateful to farmers of Alamata district who responded to all questions with patience and gave basic information for this research work.

My special thanks go to my family as a whole, especially to my late elder brothers: Ato Abera Hailemariam and Ato Selemon Hailemariam, who scarified a lot not only for me but also for the change of our family's life, and who taught me sharing responsibilities and living for others. And my special thanks go to my immediate elder brother for his moral support and encouragement in my every day life. The last but not the least, my deep appreciation goes to my beloved father Ato Hailemariam Seifu and my mother W/ro Simiret Negash for their encouragement and moral support through out my life.

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LIST OF ABBREVIATIONS

ADLI	Agricultural Development led industrialization
CFE	Committee of Feminist Economists
DAs	Development Agents
DSCI	Dedebit saving and credit institution
EVDSA	Environmental Conservation Studies and Research Desk
FAO	Food and Agriculture Organization of the UN
FDRE	Federal Democratic Republic of Ethiopia
FHH	Female Headed Household
HHs	Households
IFAD	International Fund for Agricultural Development
IPMS	Improving Productivity through Market Success
LPM	Linear Probability Model
Masl	Meter above sea level
MHH	Male headed Household
NeLH	National Electronic Library of Health
NGOs	Non-Governmental Organizations
PAs	Peasant Associations
PLWs	Pilot Learning Woredas
PPS	Probability Proportional to Size
PRSP	Poverty reduction strategy paper
REST	Relief Society of Tigray
S.D	Standard deviation
SNA	Social Network Analysis
Sq. Km	Square Kilo meters
SPSS	Statistical Package for Social Science
TLU	Tropical Livestock Unit
VIF	Variance Inflation factor
WooARD	Woreda office of Agriculture and Rural Development

SOCIAL NETWORKS AND GENDER DIMENSIONS IN USE OF IRRIGATION BY FARMERS IN ALAMATA WOREDA, SOUTHERN TIGRAY, ETHIOPIA

ABSTRACT

Access to input / technology, information / knowledge, credit / finance is very decisive for the development of a given society in general and irrigation based high value crop production in particular. The identification of the contribution of social networks in facilitating access to these resources and services and thereby influence crop choice among irrigation user farmers is vital to identify the important actors contributing in irrigation based vegetable production. This study was undertaken in Alamata woreda, Southern Zone, Tigray National Regional State and has been designed to give a clue on the existing formal and informal social networks and groups in facilitating access to resources and services, among irrigation based vegetable growers and non growers. The practical contributions of social networks and their gender implications in facilitating access to inputs / technologies, information / knowledge and credit / finance in irrigation based vegetable production; and identification of alternatives for enhancing the role and sustainability of these social networks for promoting vegetable production in the woreda was the focus of this study. Identifying the factors for choice of crops by farmers in using irrigation was also another additional objective of the study. Multistage sampling procedure was employed to select 4 PAs out of 10PAs in the woreda and 150 sample households from the 4 PAs. Both qualitative and quantitative data were collected to obtain reliable information from primary and secondary sources. Data analysis was done using descriptive statistics, mainly. Chi-square and ranking was used to see the contribution of social networks & their relative importance in facilitating access to resources and services among vegetable growers and non growers as well as FHHs & MHHs, separately. T-test, chi-square test, mean, percentage and frequencies were also used to identify preceding factors for growing or not growing vegetables, in addition to binary logistic regression model. This study revealed variations between vegetable growers and non growers as well as MMHs and FHHs in terms of membership in different economically oriented groups, frequency of use of different social networks as a source of different inputs and services and in terms of perceived relative importance of different social networks (formal and informal networks). The binary logistic regression model out put showed that marital status, education level, on farm income, DA contact, participation in extension events and number of relatives & close friends were found to have positive and significant influence on the choice of vegetable crops by farmers. The study also revealed that formal networks are the most frequently used and the most important sources of inputs and information for vegetable growers in general and MHHs in particular, on the other hand informal networks were found to be the most frequently used and the most important sources of inputs and information for vegetable non growers in general and FHHs in particular. Generally, both informal and formal networks are found to be important in the study area, hence recognizing the importance of informal networks (groups), and strengthening & organizing them in to self help groups is very important. In addition, after identifying influential social networks establishing linkage among formal and informal networks has paramount importance for better efficiency of the contribution of social networks, in enhancing culture of growing vegetable crops among the community members in particular, and rural development in general.

1. INTRODUCTION

1.1 Background

The total area of Ethiopia is estimated 1.1 million km². From this about 60% of the land area is considered potentially suitable for agricultural production of which 16.4 million (14.8%) of the total has been used for crop production (Belay, 2003). Agriculture is the mainstay of the Ethiopian economy contributing 50 % of the total GDP and 90 % of export items in which horticultural crops are the leading component. The challenge is that virtually all of those farmers involved in agricultural productions are subsistence farmers and, although the land is fertile, most agriculture is rain fed. Only 1 percent of cropland is irrigated and a period of drought can throw the whole country into crisis (FAO, 2007 as cited by Abebe, 2008).

Major constraints to agricultural growth of Ethiopia are population pressure coupled with the dominant traditional agricultural production technologies, including traditional farm tools and farming practices, low application of modern inputs like improved seeds and fertilizers, and poor animal breeds. The country's capacity to support agriculture through development of irrigation has been weak (Mengistu, 2000). For a country facing recurrent drought, with severe consequences for development, the need for irrigated agriculture cannot be overlooked. Ethiopia cannot hope to meet its large food deficit through rain-fed agricultural production; the country could still face millions of tons of cereal deficit for decades to come (Desta, 2004).

Ethiopia has a high potential for irrigated agriculture. It is known as 'water tower of Africa' and is endowed with abundant water resources; lakes covering 7400 km², 10 major rivers, and other water bodies, which are expected to provide extensive potentials for irrigation and fish farming (Mengistu, 2000). Although, water resource potential is said to be abundant in Ethiopia, it is clear that even by the low standard of African countries, Ethiopia's use of its water resources is limited.

Ethiopia cannot meet its large food deficits through rain-fed agricultural production alone. Cognizant to this fact, the government has taken initiatives towards developing irrigation schemes of various scales (Desta, 2004). The government of Ethiopia as stated in its Poverty Reduction Strategy Paper (PRSP), has recognized the importance of water and increased its focus on water resource development and utilization to achieve food security (FDRE, 2000). Its water policy stressed increased use of small-scale irrigation through diversion of rivers and building of small dams.

The importance of intervening irrigated agriculture in the economy of developing countries results from the fact that rain fed agricultural system is not capable of supplying the desired amount of production to feed the increasing population. Irrigation is not needed for any inadequacy in the total supply of water by rainfall only, but because of the inadequacy of this supply at certain times of the year. This inadequacy of moisture will surely lead to the reduction of plant growth (Briggs and Courtney 1989 as cited by Mintesinot *et.al*, 2004). Therefore, Irrigation is used in order to combat periods of moisture stress so as to fulfill the crop moisture requirement and increase the production. Irrigation practice is an expensive one, and in many cases can only be applied with profit to high value crops.

Currently the population of Ethiopia is about 76,511,887 (July, 2007 est.) and expected to double within the coming 30 years. Almost 80% of the population is living in the country side while the rest situated in urban area. An estimated five million people are suffering from lack of vitamins and essential minerals, of which 80% are children for the next generation. On the other hand, vegetables are indicated to be the major source of most micronutrients and the only practical and sustainable way to ensure their supply (Anonymous, 1998).

Ethiopia has highly-diversified agro-ecological conditions which are suitable for the production of various types of fruit and vegetables. However, the contribution of horticultural crops both to the diet and income of Ethiopians is insignificant. With the aim of enhancing agricultural development, the Government considers various projects, including small-scale irrigation mainly through rainfall harvesting and home gardening, to be of crucial importance. As a result, vegetable and fruit production is being more widely adopted, primarily to ensure

food security and promote production of high-value crops for the market and improving the living conditions of smallholders (Abebe, 2008).

Ethiopia has a variety of vegetable crops grown by small farmers in different agro-ecological zones, mainly as a source of income as well as for food. Commercial producers are also involved in the production, processing and marketing of vegetable. The crops are produced under rain fed and irrigated condition. It is produced both in cereals based cropping system and in monoculture. The warm season vegetables such as tomato, onion and *Capsicum* are grown in the lowland areas under irrigation, whereas the high land areas offer favorable condition to grow cool season vegetables like cabbage, garlic, shallot, carrot etc (Lemma *et al.*, 1994).

According to Abebe, (2008) although the potential is enormous, the development of horticultural crops production is still in infancy. The status of vegetable production in the country yet needs further improvement. Despite an enormous potential and a favorable environmental advantage in the country, vegetable farming is relatively under-developed. Nevertheless, even though there is limited production at a national level for most of the vegetable crops, the productivity levels achieved show the potential of vegetable production in the country.

However, new ideas and ways of doing things do not necessarily take hold all at once, but often spread gradually through social networks. Rogers (1995) concludes that: “The heart of the diffusion process consists of interpersonal network exchanges between those individuals who have already adopted an innovation and those who are then influenced to do so”.

According to Hogset (2005), social networks may influence technology adoption through their function as a source of informal finance (both credit and insurance), as channels of information and thus vehicle of learning, as a means for resolving externalities and collective action problems, or through enforcement of social norms. The role of informal networks in Africa has been extensively documented by sociologists and anthropologists. But, we have little understanding of the inter-linkages between them and formal government and

market activities. Informal networks are there, where much of rural insurance and credit activity is located. Networks, however, by their nature are personalized and exclusive and we have little understanding of why and under what circumstances some people might be excluded from social networks (Hoddinott *et.al.*, 2005).

Moreover, these functions of social networks may interact with gender to produce different outcomes for decision-makers of different gender. Different members of the same household may also participate in different social networks due to gender or generational differences. Several studies have found that men and women's personal networks differ in composition. Men's networks tend to be more formal since men are more often involved in formal employment. Male networks include more co-workers and fewer kin than women's networks (Moore, 1990). Moreover, this has its own effect on the process of decision making at household level, regarding to technology adoption, in relation to access to information and other resources.

Because mostly women have very low participation in important and decisive institutions and as a result they have low access to resources, new technologies, and also information/knowledge. According to Deribe (2007), majority of women farmers interviewed in, SNNP, Dale woreda, were having no involvement in any formal and informal institutions or organisations. The types of the institutions in which they are mostly involved are ekub, edir, or mahber, next to religious organisations and also they are mostly involved in women's associations. Despite these facts, most of the time development programs are not gender sensitive. In this regard, Quisumbing (2003) indicates that development programs are often criticized for failing to account for gender inequalities in decision making, task allocation and resource ownership and management, which has implications for policy recommendations.

In the context of knowledge management, social network analysis enables relationships between people to be mapped so as to identify knowledge flows. The results can be used to identify teams and individuals playing central roles as well as spot opportunities for information flow improvements and to bring equitable accessing of resource and services (NeLH, 2008).

So, it becomes essential to investigate and design policy and institutional options in relation to identifying important formal and informal social networks, in order to support and encourage farmers choice of high value crops and diversified income generating activities, as part of strategies used to meet challenges in food security and to bring better livelihood in the farming community.

No attempt has been made so far to study the contribution of formal and informal social networks in facilitating access to inputs / technologies, information / knowledge and finance / credit and thereby influence farmers to take up high value vegetable crops in irrigated fields, which is the major cash crop in the study area.

1.2. Statement of the Problem

Agricultural Development Led Industrialization (ADLI) policy briefs that in drought-prone areas, agricultural production, among others, can be increased through the development of small-scale irrigations by providing the necessary farm inputs, credit facilities and extension services by the government (Tafessee, 2007).

Alamata is one of the drought prone areas in Tigray region. Despite this fact, it has a very great potential of underground water. In addition, run off water from the surrounding mountains becomes the main sources of supplementary irrigation, even if there is no sufficient rainfall (IPMS, 2005). Considering this potential of the area, the government is trying to introduce farmers with cash crops, mainly vegetable crops, in addition to traditional crops. For this purpose the government is constructing different water structures and diversions to utilize the water flooding from high lands, so that farmers will be profitable and economically strong using this irrigation resource. For instance, the Tigray Commission of Water Resources, IFAD and REST have developed a series of 30 ponds that could enable supplementary irrigation of 133 ha in the woreda (IPMS, 2005).

In spite of the market oriented development program of the government and the irrigation potential of the area, there are many farmers who are still remained to be in subsistence

farming, confined to cereal crops, mainly for home consumption, while some of them are moving towards market oriented agriculture. This is true especially for FHHs in the study area. For this observable differences regarding crop choice in using irrigation among the farmers, social networks and their functional contribution in facilitating access to inputs / technologies, information / knowledge; and services are assumed to play vital roles, in addition to other preceding factors. Because in order to use irrigation water for high value market oriented cash crops such as vegetables, availability and accessibility of the needed resources and services is very important and this is possible only through formal and / or informal social networks among the community members.

Access to input / technology, knowledge / information and services could largely depend on the size of social networks of individuals, which depends on their participation in different formal and informal groups and / or their formal and informal relationships with individuals and organizations.

Hence, in a given social system it is important to identify influential networks and their functional contributions in facilitating access to resources and services in addition to their gender dimensions, so that it would be possible to know the most important actors influencing the community in relation to growing high value market oriented crops.

So far, there is no systematic investigation done in the study area, that shows the contribution of social networks (formal/informal) in agricultural knowledge/ information flow, access to resources/services and thus in taking up irrigation based high value crops, specifically vegetables. In the context of the recent approach of promoting commercialization of farming and improving market success, this study is expected to fill the gap in this aspect so as to formulate necessary policy recommendations for needed interventions.

1.3. Objective of the Study

The general objective of the study was to assess the contribution of social networks for facilitating access to different resources and services, along with their gender dimensions; and there by influence farmers to choose high value vegetable crops.

The specific objectives of the study were:

1. to assess the contribution of social networks in facilitating access to resources and services in the context of using irrigation for high value vegetable crops;
2. to study the gender dimensions of social networks in using irrigation for high value vegetable crops; and
3. to analyze the factors influencing the choice of crops by farmers with access to irrigation;

1.4. Research questions:

1. How do social networks contribute to access resources and services for irrigation based high value crop production?
2. How different are the social networks of women (FHHs) and men (MHHs) for accessing resources and services?
3. What are the determinant factors that influence the choice of crops of farmers, when there is access to irrigation?

1.5. Scope and Limitation of the Study

The study was conducted in one of the eight woredas in southern zone of Tigray region. The data were collected from a sample of 150 respondents from four PAs. Due to time and resource limitations the study covered the aforementioned respondents' from 4 PAs with access to spate irrigation.

The main focus of the study was to see flows of information, inputs / materials, finance/ credit, market linkage, know who has more access to resources/ services and to know why some farmers are becoming market oriented while, others are still remained producing cereal crops for consumption, and what the contribution of the social networks are in facilitating access to important inputs, resources and services, in using irrigation and taking up high value crops, giving due attention to gender. Finally, it is important to note that, Ethiopia is diversified in agro-ecological, socio-economic, cultural, and institutional environment, and the study being location specific in nature, its results could not be generalized to the zonal or regional level. However, the recommendations and policy implications of the study can be used for other areas of similar contexts and as a basis for further studies.

1.6. Significance of the Study

It is inevitable that using irrigation mainly for high value crops (vegetables) is the most recommended way for Ethiopia in order to alleviate poverty and generate income of the majority poor rural households using the limited and poor resource, especially in drought prone areas like the study area. In this case; merely introducing new practices such as producing vegetable crops will not give out the purpose of improving the livelihood of the farming community in general and the income level of the poor specifically. Along with introducing new practices, identifying important social networks for flows of information / knowledge, inputs / technologies and credit / finance is critical. This will give an insight regarding who has more access to services and resources, why some farmers are producing high value crops and become benefited, but others still produce consumption crops, when irrigation is available.

In order to explore these and other similar questions, studies which focus on social network and their contribution on flows of information, inputs/ materials, finance/ credit is essential. Because, once social relationships and resource flows can be seen, they can be evaluated and measured and its results can be used to identify teams and individuals playing central roles as well as isolated teams or individuals. Moreover, this will have its own contribution for future research and extension as well as for different developmental programs to be effective. Though it is known that social networks and social interactions have a decisive role in accessing information, resources and services, different studies so far gave little attention to it.

So, this study will provide information to different development actors involved in developmental works, especially for those who are involved in expanding irrigation and introducing high value crops, at different levels, on the contribution of social networks (formal and informal) for information/ knowledge dissemination and also facilitating access to different resource/ services.

2. LITERATURE REVIEW

2.1. Concepts and Definitions:

2.1.1. Irrigation

The first question in any discussion of irrigation, as stated by Turner (1994), is the concept and definition. Certainly irrigation is the application of water to living plants. According to FAO (1994), irrigation is defined as the artificial application of water to the crop for the purpose of food and fiber production overcoming deficiencies in rainfall and help in creating stabilized agriculture. Irrigation development could also be defined as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping (EVDSA, 1996). A wide definition such as the following is, therefore, more important. Irrigation is the practice of applying water to the soil to supplement the natural rainfall and provide moisture for plant growth (Uphoff, 1986).

2.1.1.1 Small scale irrigation system

With respect to the area irrigated, scale of operation and type of control or management, irrigation is categorized either as small, medium or large scale (Seid, 2002). Regarding the ways of supplying water, flood irrigation, furrow irrigation, sprinkling or spray irrigation and drip irrigation are identified (Nigussie, 2002). Irrigation may also be categorized using other criteria such as ownership, economic objective and modernity. Although tank irrigation, small dam irrigation and shallow or deep tube well irrigation are generally termed as small-scale irrigation schemes (Smith, 1998), some considerations of the criteria of classifying irrigation in terms of scale may vary from country to country. Turner (1994) also points out that irrigation systems can be classified according to size, source of water, management style, degree of water control, source of innovation and type of technology. Most authors, however, agree that concepts of local management and simple technology should be combined with size.

Moreover, small-scale irrigation can be defined as irrigation, usually on small plots, in which small farmers have the controlling influence, using a level of technology, which they can operate and maintain effectively. In terms of management, there are three broad types of smallholder schemes: government-managed, farmer-managed, and jointly-managed schemes. Farmer-managed schemes are developed either by community or by the government but owned and managed by the farmers' irrigation management committees or water users' associations with minimal government interventions. Small-scale irrigation is, therefore, farmer managed: farmers must be involved in the design process and, in particular, with decisions about boundaries, the layout of the canals, and the position of outlets and bridges (Yusuf 2004 as cited by Taffese, 2007). In similar fashion, FAO (1996) defined small scale irrigation as: Farmer-managed irrigation schemes of a few hundred square meters to a several thousand hectares, developed, operated and maintained by individuals, families, communities, or local rulers and landowners, independently of government, and generally for the production of basic food or fiber crops and vegetables for local markets. Indeed, small-scale schemes are defined as schemes that are controlled and managed by the users themselves.

2.1.2. Vegetable Production in the Country

Ethiopia has a variety of vegetable crops grown in different agro-ecological zones by small farmers, mainly as a source of income as well as for food. Commercial producers are also involved in the production, processing and marketing of vegetable. The crops are produced under rain fed and irrigated condition. It is produced both in cereals based cropping system and in monoculture. The warm season vegetables such as tomato, onion and *Capsicum* are grown in the lowland areas under irrigation, whereas the high land areas offer favorable condition to grow cool season vegetables like cabbage, garlic, shallot, carrot etc (Lemma *et al.*, 1994). The area of vegetable crops, cultivated land of the peasant farms is not well known. However, the production of all the vegetable crops is estimated to be about 2.8 million tons per year. In fact, the total area under major vegetable crops production excluding tuber crops in the country is estimated to be about 131,962 ha in 2005 with an increase of about 18.13% over 2004 (CSA, 2007).

According to CSA, 2006/07 irrigated land holders living near to urban centers largely practice vegetable farming. Most vegetables are not commonly practiced by the rural private peasant holders, hence the small volume of production recorded as well evidenced by the survey results. CSA also reported that, vegetables took up 0.84% of the area under all crops at national level. Of all the area under vegetables 59.74% and 24.62% was under red peppers and Ethiopian Cabbage, respectively. As to the volume of production of vegetables, 29.47% and 46.13% was that of the same crops, in that order.

2.2. Concept and definition of social capital and social networks

2.2.1. Social capital

“Social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition or in other words, to membership in a group which provides each of its members with the backing of the collectivity-owned capital, a “credential” which entitles them to credit, in the various senses of the word” (Bourdieu, 1986). In the 1990s, Robert Putnam emerged as a key user of the concept social capital. In 1993, he claimed that “Social capital refers to features of social organization, such as trust, norms and networks, that can improve the efficiency of society, facilitating co-coordinating actions for mutual benefit” However, in more recent writings Putnam (2000) has located trust as an outcome of social capital defined as social networks and associated norms of reciprocity.

Portes (1998), on the other hand, observed, ‘Whereas economic capital is in people’s bank accounts and human capital is inside their heads, social capital inheres in the structure of their relationships’. The uniqueness of social capital is that it is relational. It exists only when it is shared. According to Hancock (1999), social capital constitutes the ‘glue’ that holds communities together, with an informal aspect related to social networks and a formal aspect related to social, development and other programs. Likewise, social capital encompasses the formal and informal rules that enable coordinated action and goal achievement” (World Bank 2000). Deepa Narayan, who has attempted to apply the concept to field situations, refers to it

as “the glue that holds groups and societies together – bonds of shared values, norms and institutions” (Narayan and Pritchett, 1997)

Social capital refers to the norms and networks that facilitate collective action. Social capital is also referred to as the ability of men and women farmers to develop and use various kinds of social networks and the resources that become available as a result. It also means the voluntary action taken by a group to achieve common interests within this context (Woolcock 2001, as cited by Dessalegn, 2008).

Social network definition of social capital could be explained both at community level and at individual level. At community level, the structural component of social capital defined in terms of the density and diversity of associations (institutionalized social networks) within a community. At the individual level, structural definitions consider social capital as embedded in the network of friends, relatives and acquaintances (private social networks) an individual interacts with based on “norms of reciprocity”. Although institutional social networks could also compose of friends or relatives as members, they differ from private social networks in their structure and functioning (Katungi, 2007).

According to Grootaert *et al.*, 2002 as cited by Wennink, W. H. 1994, social capital refers to the value of connectedness and trust between people and as such to one of the five key assets (human, social, physical, financial and natural) for sustainable livelihoods and is defined as ‘the institutions, relationships, attitudes and values that govern interactions among people and contribute to economic and social development. Social capital can occur in different forms and scopes. Uphoff (2000) distinguishes two main forms i.e. ‘structural’ and ‘cognitive’ social capital. The former comprises the objectively and externally observable social structures such as networks, associations, institutions, rules and procedures. The latter is represented by the more subjective and intangible elements such as attitudes, norms of behavior, shared values and reciprocity and trust, as well as governance. The scope of social capital can be at micro- or local level (horizontal networks of individuals and households), meso-level (both horizontal and vertical networks).

2.2.2. Social networks

A social network is a set of individuals or groups who are connected to one another through socially meaningful relationships (Wellman & Berkowitz, 1988). This definition can be refined further: a social network is a finite set of actors who are connected to one another through relations. A social network can consist of groups and sub-groups of actors. Examples of such socially meaningful relationships include family, friends, or relations based on trust, giving advice, or sharing information (Stone, 2001).

Understanding the groups and networks that enable people to access resources and collaborate to achieve shared goals is an important part of the concept of social capital. Informal networks are manifested in spontaneous, informal, and unregulated exchanges of information and resources within communities, as well as efforts at cooperation, coordination, and mutual assistance that help maximize the utilization of available resources. Informal networks can be connected through horizontal and vertical relationships and are shaped by a variety of environmental factors, including the market, kinship, and friendship. Another kind of network consists of associations, in which members are linked horizontally. Such networks often have clearly delineated structures, roles, and rules that govern how group members cooperate to achieve common goals. These networks also have the potential to nurture self-help, mutual help, solidarity, and cooperative efforts in a community. “Linking” (vertical) social capital, on the other hand, includes relations and interactions between a community and its leaders and extends to wider relations between the village, the government, and the marketplace (Dudwick, *et.al*, 2006).

Finally it is understood that social networks is not considered as a single entity, rather it is multidimensional. There are many definitions, controversies over the definitions and ways of explaining this concept. But it is broadly understood, social networks are a network of people or institutions and organizations that can improve the efficiency of society in general and individual HHs in particular; and it may involve formal and informal groups. Hence social networks, for this study, means the formal and informal networks in which people have, (which may include individuals, institutions and organizations), to access resources and

services such as (information, inputs, credit, etc) and thereby influence the decision making of households to grow vegetable crops in particular and in improving the livelihood of HHs and the well-being of the society in general

2.3. Theoretical Background

2.3.1. Social learning theory

A social-psychological theory with direct applicability to diffusion networks is social learning theory. Most psychological approaches to human learning look within the individual in order to understand how learning occurs. But the social learning approach looks at information exchanges with others in order to explain how behavior changes. The central idea of social learning theory is that an individual learns from another by means of observational modeling: that is, one observes what another person is doing, and then does something similar, but not exactly the same thing (Rogers, 1983).

Understanding contexts for social learning merits special attention. In order to fully achieve learning in the real life situation, not only to a ‘person’ as learner, but more importantly to a ‘person’ as resource manager, learning to solve problems requires not only perception but also resources from the environment. The household or the community cannot just learn without the availability of the complementary resources for the learning to take place because they learn for immediate (Tesfaye, 2003).

Ellison and Fudenburg (1993) use the argument to justify simple rules of thumb where individuals learn from similar neighbors only, slowing down the rate of diffusion. The individual could in principle do better than that by controlling for differences between his own and his neighbors’ characteristics when learning from their experiences, but only to the extent that these characteristics are observed. Social learning breaks down if unobserved, or imperfectly observed, individual characteristics are important determinants of neighbors’ outcomes.

Recent research work on social learning in agriculture showed that farmers learn how to cultivate a new crop from past choices of others in their social network who are cultivating the same crop (Conley and Udry, 2000).

Social capital may influence social learning and information diffusion in a number of ways. First, social capital reduces the cost of information acquisition since it can be acquired passively during social interactions or actively from people who already know each other. Second, social capital reduces the uncertainty about the reliability of information. Information is likely to be given a higher value if it comes from trusted people. Third, social capital facilitates the willingness and cooperation to share information, thereby revealing the tacit information that would be difficult to exchange otherwise (Yli Renko *et al*, 2002).

The interrelationship between the individual and society facilitates social learning in a community. Whether the quest for an alternative originates from an individual or group or the entire society, practices that are consistent with the social system are likely to spread in the community. When more people are involved in practice, it is likely that it will be modified and developed to fit different members of the community (Tesfaye, 2003).

Social capital is increasingly recognized as an intervening factor in the process of social learning and information exchange. Social capital depicts the features of social organizations, such as social institutions, networks or associations, less institutionalized networks of friends, relatives and acquaintances (or private social networks) and civic engagement, that enable knowledge gathering and information exchange (Katungi *et al.*, 2006).

2.3.2. Information Exchange and Interpersonal Networks

Since every society is built around relationships, the behavior of an individual actor cannot be fully understood unless we relate it to the actions of others with whom the individuals are connected through various social ties (Granovetter, 1985).

Social and informational networks do exist within the farming community; they exert a significant influence on farm-level decision making; and such networks affect different decision domains in different ways.

Small-scale producers often rely on informal mechanisms of information exchange and knowledge sharing to address agricultural problems and challenges. Given the limited scope of formal extension programs, informal exchange is often the primary source of information about new technologies in sub-Saharan Africa. The increasing role of informal mechanisms for information sharing has been recognized in the literature through farmer-to-farmer models of agricultural development (Eveleens *et al.*, 1996).

2.3.3. Gender and Social Networks

In the developing world as a whole, women play the primary role in food production. Rural women, who undertake a major proportion of farm work, are responsible for family food security and home production, and are often involved in post harvest processing and marketing. However, they often enjoy lower levels of social status and economic security in the family (Ravula *et al.*, 2006).

Women and men also have different resource endowment when pursuing livelihood strategies, which could have far-reaching consequences on social capital formation and information exchange. Women are often more dependent on informal networks based on everyday forms of collaboration, such as collecting water, fetching fuel wood and rearing children. These services, together with the fact that women have a high opportunity cost of time, may motivate women to form networks with individuals who are geographically close to reduce the length of time required for travel for social interaction (Granovetter, 1973). According to Ravula *et al.*, (2006), as a result of differing social networks and correspondingly different levels of access to information, men and women experience different economic consequences

For women to build and maintain a social network is also costly in terms of both time and other resources imposing a barrier to social capital accumulation (Dasgupta, 2005). Women typically have a high opportunity cost of time that reduces their incentives to participate in certain social networks (Meinzen-Dick and Zwartveen, 2003). Women have been found to join groups that mobilize fewer resources than men because they are resource-constrained (Maluccio *et al.*, 2003).

Available evidence suggests substantial differences in men's and women's networks, particularly in composition. The evidence suggests that men belong to more formal networks reflecting their employment or occupation status, while women have more informal networks that are centred on family and kin. Findings show that women who are engaged in agriculture and allied activities develop bonding social capital characterized by strong bonds such as that found among family members or among members of an ethnic group. Men who are engaged in agriculture, on the other hand, develop bridging social capital characterized by weaker, less dense but more crosscutting ties such as with farmers, acquaintances, and friends from different ethnic groups and friends of friends (Moore, 1990).

2.3.4. Gender and access to resources

In many rural areas, where small-scale agriculture is practiced, gender differences have been found to have a significant impact on resource allocation and productivity in agriculture (Alderman *et al.*, 2003). Gender inequalities almost always favor men, with women often being disadvantaged both in the control over household assets and in the division of responsibilities in the household and in the community (Fafchamps and Quisumbing, 2003). Even when a woman heads the household and is in charge of household resources, gender differences emerge across female-headed households and their male-headed counterparts (Peters, 1983).

Women in rural areas are known for their very low access to different essential resources. Irrigation water is among the most important resources in rural community for agricultural production, especially for vegetable crops, in which women have less access in most cases.

Committee of Feminist Economists (CFE), (2007) during the formulation of the Eleventh Five Year Plan, pointed out in this regard that, it is necessary to enhance and protect water resources and invest in and protect women's access to water. Gender issues arise in relation to both domestic water use especially for drinking (which women primarily collect) as well as water for irrigation which women tend to have little access to). Rural women's access to water for their fields and their equal participation in water user's association are essential. Women must be made key actors in management of local water bodies and women should constitute at least 50% of the members of Water Users Associations set up for participatory management.

2.3.5. Gender and access to services

The contribution of women as food producers is less recognized because women's employment in the agricultural sector is mostly unpaid. Since the role of women as food provider in the household is considered domestic work, it is not included in the national economic account. Women's status as unpaid workers makes them invisible thus resulting in reduced access to services such as credit, new technology and information. Agricultural extension workers have neglected women's issues. According to Monthathip (1995), Agricultural extension primarily reaches male farmers because women generally are not invited to participate in training and extension meetings.

According to CFE (2007), Women, especially poor women, are increasingly excluded from formal sources of finance and, as a result, have to resort to borrowing from moneylenders at high interest rates. Financial inclusion requires increasing women's access to all types of credit sources, especially from commercial banks and cooperatives and not just micro-finance institutions, which has tended to overwhelm all other sources for women, even while acknowledging the important role of microfinance in providing for women's needs. Women need credit in much larger amounts than currently provided for. Financial inclusion should embody not just loans but include savings, various insurance services, as well as pensions.

2.3.6. Social networks and access to resources

Studies on gender have highlighted entrenched inequalities in control over assets, gender discrimination in labour markets and lack of a voice in the power struggles controlling resource allocation as major reasons for women's poverty and vulnerability (Buvinić and Gupta, 1994; Jackson, 1995; Kabeer, 1995; Lockwood, 1995). One dimension of vulnerability, especially of the poor in marginal areas, is a lack of power, voice and social networks that limits their access to resources, institutions, technology and markets.

Application of the concept in agriculture has shown that communities with higher levels of participation, social networks and local organizations are more efficient in information sharing and more receptive to extension projects, and therefore more likely to use modern agricultural inputs than those without. Social capital is the economic value obtained in institutional or individual networking, and its significant effects on development outcomes, both positive and negative. It improves access to resources like land, information and knowledge about new technology options and practices. Furthermore, it expands choices available to each household member – e.g. selecting and adopting seed technology of their choice, and alternative investment options – and influences the distribution of benefits from the technology because of the ways in which social networks and social relationships facilitate technology dissemination (Bantilant and Padmaja, 2008).

High quality supply seeds availability is determined by the connection of the farm to various social networks. The management of the biodiversity at the village scale through complex and intersected networks of exchanges supports the conservation, the renewal and the diffusion of varieties adapted to the needs of the local populations. Social networks play a key role in determining access to seeds and information. Relationships of trust and affection within the extended family, neighborhood or beyond are fundamental to the exchange process, while norms, laws, rules, procedures, traditions, customs and practices influence the choice of individuals. All of which affect the movement of genes within households, villages, between villages, and over larger geographic areas (Subedi, A. *et al.*, 2004).

Wellman (1979) showed that the larger the network, the greater the chance of finding at least one member able to provide resource (information, labor, inputs like seed etc to their members). In addition, the larger the network size the greater the chance that several individuals possess the same resource, thereby avoiding the need to refer constantly to the same individual for resource (information, labor, credit, inputs like seed etc). Wellman has also demonstrated that the more the members of a network are interconnected (network density), the greater the chance of similarity of the resources they exchange among themselves. In a dense network, exchanges occur more easily and are better co-ordinate, although the accessible resource may be less varied. The inverse is true for networks with weak interconnections among members. According to Narayan (2000), strong networks and membership based organizations extended beyond the family and immediate community are essential to help poor people gain access to other assets and resources.

Women are consequently more likely to rely on kin and social networks for access to resources. Because men and women belong to different social networks, the economic and social consequences of technological choices and developmental interventions impact their social networks and associations in different ways. Traditionally, women are responsible for household welfare and child rearing. Reliance on informal exchange networks is necessary among women and their households to share resources, stabilize incomes, and reduce risks. For women in female-headed households networks are also important for their economic activities (Ravula *et al.*, 2006).

2.4. Empirical Studies on the Roles of Social Networks in decision making of farmers to grow irrigation-based high values crop production

It was not easy to find sufficient studies which relate social networks with decision of choice of crops, which could be related to the recentness of the concept. Hence, in this part those studies that are directly or indirectly related to the variables of this study were reviewed.

Now a days the concept of social networks is becoming well-known, especially in relation to agriculture. It has shown that individuals with higher levels of participation, large social

networks and more involvement in local organizations are more efficient in information sharing and more receptive to extension packages, and therefore more likely to use modern agricultural technologies than those without. Several studies have documented that households who are actively involved in social networks are better insured against unforeseen risks of failures or financial losses than households who are less involved in social networks and have few relatives (Barlett, 1980).

Bantilan and Padmaja (2008) have explored the importance of social capital creation for agricultural research for development in general, and for the adoption of groundnut technology in particular, and the different processes and outcomes for women and men. They systematically document the process of empowerment, whereby the marginalized groups (including women and tribals) gained better access to resources, information, knowledge and some opportunities for political participation. Collective action was enhanced with the increased involvement and participation of women. Kinship ties were more common among women's networks than among men's. The study showed that technology uptake improved as rural Indian farmers were empowered through building social capital, in particular, where social networks crossed caste and class barriers. The process of build-up of social capital played an important role in influencing the distribution of benefits from the technology, because of the ways in which social networks and social relationships facilitated technology dissemination. Thus, social networks played a crucial mediating role in the process of technology uptake.

Studies have found that mechanisms for farmer-to-farmer seed flow are based mostly on traditional social networks and family relationships but as Tripp, (2000) pointed out that, one should be careful not to assume that seed flows are always the result of seed exchanges among them. In many instances, seed obtain from other as gifts, through purchase, or as exchanges for labor or grain. Even if seed is bought and sold among, these transactions may occur among people with close social ties and within the same village. The marketplace can also be an important source of seed, and might be included as part of the network (Tripp, 2000).

Bantilan and Padmaja (2008) in their study in titled; Empowerment Through Social Capital Build-Up: Gender Dimensions In Technology Uptake in India, pointed out that choices available to farm households which could be related to cropping pattern, investment strategies, and choices to better manage risk and instability are highly related to social capital conditions. They also recommend that understanding formal and informal organizations is necessary to perceive how people mobilize and acquire a wide range of assets and gain access to decision-making processes, technologies, resources and markets, and benefit from them.

Recently the role of social networks in facilitating access to different resources and services such as information, inputs, and credit is increasingly acknowledged. Generally it is gradually becoming known that social networks play a crucial mediating role in the process of technology uptake in rural farm communities. The researcher adhere to this view in studying the contribution of different formal and informal social networks may play in facilitating access to information, inputs and credit and thereby influence the choice of growing vegetable crops among rural households along with the gender implication of the networks in Alamata Woreda.

2.5. Conceptual Framework of the Study

The conceptual framework indicates that households' formal and informal networks are expected to influence the household's access to inputs / technologies, information / knowledge, and credit / finance and thus influence the crop choice decision at household level. This is because of the hypothesis that the involvement in different formal and informal organizations and /or the frequency of contact of the household head with formal and informal actors (networks) increases the probability of access to different resources & services and thus increases the possibility of the house hold head to decide to grow high value vegetable crops. In this study social networks (formal and informal actors) are taken as either suppliers or facilitators to access different inputs and service including information. In addition, other preceding factors such as personal and demographic factors, farm characteristics, and economic factors of the household head are also expected to have their own influence in the decision making process of the household to grow vegetables for market. The diagram also shows that the difference between social networks of FHHs and MHHs which in turn results in different access to resources and services. The bold arrow from MHHs to formal social networks indicates that, MHHs use more of formal networks for accessing resources and services; on the other hand the bold arrow from FHHs to informal groups shows that, FHHs use more of informal networks to access different resources and services.

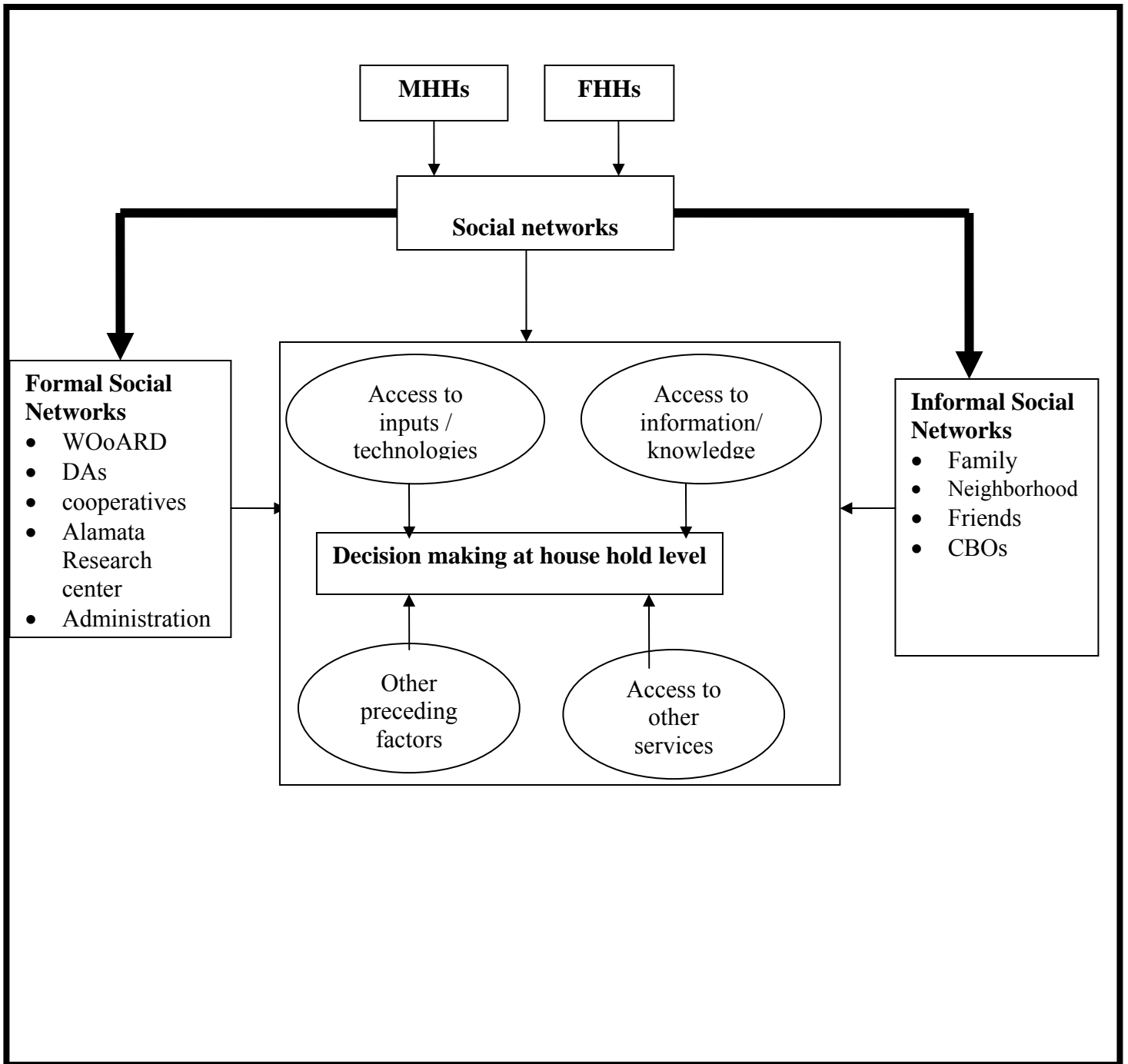


Figure 1 Conceptual Framework of the study

3. METHODOLOGY

3.1 Description of the Study Area

Alamata woreda is located 600 km north of Addis Ababa and about 180 km south of the Tigray Regional capital Mekelle. It is the south most woreda of the Tigray Region and borders with Amhara region from the south and west and Afar region from the east. There are 10 peasant associations and 2 town dwellers associations in the woreda. The number of agricultural households of the woreda is 17,597, in which about 28% of them are female headed. The total population of the woreda was 128,872 in 2003 / 04. Altitude in the area ranges from 1178 to 3148 m and 75% of the woreda is low land (1500 masl or below) and only 25% is found in intermediate highlands (between 1500 and 3148 masl). The small undulating mountains surrounding the woreda are very steep and with low vegetation cover (IPMS, 2005).

The mountains surrounding Alamata cover a large area and have a series of dissected gullies, which serve as a source of runoff water to the Alamata valley. The gullies join together and form rainy season rivers down the foot of the mountains. The dissected channels slowly spread over the valley depositing silts and water down to the valley. The fine silt is relatively fertile and the water becomes a source of supplementary irrigation. The Alamata valley is one of the most agriculturally potential areas in the Tigray. Farmers in the woreda extensively cultivate cereals and vegetable; and raise mainly sheep and cattle in the valley.

The total area of the woreda is estimated at 550 sq. km. However, the total area based on a digital data obtained from IPMS GIS Unit is 725.39 sq. km. Altitude and rainfall increase from south to north and east to west. Shortage of rainfall (moisture stress) is a major constraint of agricultural production in the woreda. Rainfall is usually intense and short duration. As a result of all these; Alamata is one of the 16 drought prone woredas in the Tigray region. It experiences bimodal rainfall, but since recently the rainfall pattern has

drastically changed that the main rains at times start around the mid of August and stops soon after and the small rains is very uncertain (IPMS, 2005).

The belg (short rains) is from January to February and Meher (long rains) from July to August. In this area, both the short and long rains were below average. Reliability of rainfall is increasingly becoming so low year after year that crop production is affected significantly. The short rains are used for land preparation for the main rainy season and also for growing grass for livestock. In addition, it is also used to grow vegetable seedlings in areas where irrigation is not available. The main rains are not also reliable because the rains do not last long enough for supporting crop growth. In the old days, the big rain usually used to start in April at which time farmers would plant sorghum (which lasts for 8 months) and harvest it in November. Farmers in the area still exercise the planting of the long seasoned sorghum but with difficulties of obtaining good harvest. Even if the crop does not fail totally because of the crop's drought tolerance, yield is substantially low. On the other hand, rainfall in the midlands is slightly reliable but because of poor soil fertility and shallow soil depth, productivity is also very low.

Currently, field pea, faba bean, lentils (highlands) teff and pepper (lowlands) are the most important marketable commodities in Alamata. The pulses are grown on rain fed while teff could be grown on rain fed but with supplementary irrigation (spate irrigation), and pepper is totally grown using irrigation. However, the woreda strategic plan has identified other newly introduced crop commodities for the lowland areas as the future focus using underground water as a source of irrigation. The newly introduced crop commodities and identified as future potential are cotton, tomato, pepper, onion, fruits (papaya, avocado, oranges, guava, mango, banana, and grape vine), haricot bean (rain fed) and groundnut, cowpea and popcorn (in order of importance). Among these crops, farmers traditionally grow pepper, papaya and guava in smaller plots in the valley bottoms (IPMS, 2005).

In relation to the Institutional back ground of the study area, a cooperative development desk, now under the Office of Agriculture and Rural Development (OoARD), is mandated for the

organization and development of cooperatives in the woreda. The cooperative desk is mandated to give legal entity to multipurpose cooperatives, to saving and credit, and irrigation cooperatives, and to unions. Each of the 10 PAs has one multipurpose cooperative.

The multipurpose cooperatives have a total membership of about 3541, of which 928 are female. In addition to the multipurpose cooperatives, there are 4 saving and credit cooperatives, all of which are based in rural areas; and 2 construction cooperatives which are based in urban areas.

Only four of the ten PAs have markets in their localities. In the PAs which have no market place, farmers sell almost all of their marketed grain produce to the multipurpose cooperatives. The cooperatives sell their purchased grain to traders at the town of Alamata, or sometimes in the capital town of Mekelle. Sometimes the cooperatives sell back to their members. The cooperative desk supply market information and provide technical assistance such as regarding quality of produce to the cooperatives. The fact that cooperatives are the major grain marketing outlet to farmers in the woreda indicate the important role that strengthening the cooperatives can play in improving grain marketing in the woreda.

The fledgling horticultural production using irrigation in the woreda is also selling to private trades or directly to consumers in the woreda. Farmers are seriously concerned about market availability and price stability for their horticultural produce, especially in view of the push to produce these crops using irrigation water by the woreda extension service. There seems to be a good potential to produce horticultural crops in the lowland plain of the woreda, which covers about 75% of the cultivated land. It is quite crucial to develop markets for these produce if farmers are to be involved in producing them in a sustainable way. Farmers concern of market availability for horticultural crops is much more serious than for cereal crops, because the latter can always be stored by the household and consumed as food later. Lack of market for horticultural crops can result in heavy loss if the produce is not sold in time or if prices plummet. It was reported that a farmer can get revenue of up to Birr 2000.00/year from a 0.2 ha of onion and Birr 4,000 from tomato production, if prices are reasonable.

Seed supply for teff, maize, wheat, cotton, and horticultural crops (onion, tomato, fruit crops etc.) were reported to be below the need and not arriving in time. There is a newly established fruit crops and vegetables nursery in the woreda, managed by the OoARD. There may be a need to convert that nursery into a federally managed nursery to supply seeds and planting materials to a wider area along the valley. Strengthening this nursery site and establishing similar nurseries can play important role in alleviating the problem. Moreover, farmer to farmer supply of seedlings and planting materials is another approach that needs to be explored in the future, since there are signs of private farmers selling seedlings and planting materials in the woreda. Technical training and support to farmers is crucial in this regard.

In relation to credit services, the Dedit Credit and Saving Institution (DSCI) is the major supplier of credit and saving services for the rural population in the woreda. The agricultural extension service in the woreda is provided by the woreda Office of Agriculture and Rural Development (OoARD). The OoARD is organized with four sectors: agricultural development; natural resources, environmental protection and land administration; and cooperatives development.

The extension service in the woreda can be classified into three: the minimum, regular and household packages. The minimum package stipulates that farmers can use improved seeds with traditional soil fertility management and moisture conservation practices. The regular package stipulates farmers to use improved seeds together with commercial fertilizer, chemicals and soil moisture management practices. The household package requires farmers to choose from a menu of extension packages centered on the use of a pond, ground well, or other forms of irrigation such as river diversion. Partial adoption of the household package is permissible, provided that the household proves that it has additional income sources to enable it get above the poverty line.

Many types of vegetables could easily be grown in the valley because of the conducive climate and easy access to water. Among these vegetables, growing pepper has a long history in the area. As a result, farmers have developed their own systems. But the preference is becoming changed into onion production because of the gradual decrease of productivity of

pepper in the area, due to diseases and pests. Efforts are underway through the OoA and REST to introduce different vegetables, in addition to pepper. Sometimes, the price of vegetables becomes discouraging; especially when there is surplus production. According to IPMS (2005), The current attempts of boosting irrigation in the area is likely to drive prices low and hence other innovative ways of producing and marketing need to be assessed.

Market potentials for vegetables may need to be assessed because there will be high number of vegetable growers in the future. Currently, marketing of vegetables is done on an individual basis. The marketing of vegetables will also depend up on the production of vegetables in other areas. However, the farmers in general lack market information and are severely affected by lower prices of their produces (IPMS, 2005). Generally, the major constraints in the area in relation to market are market fluctuation, lack of market information, weak capacity of service cooperatives, poor shelf life, especially for tomato and onion

In spite of the irrigation potential and favorable agro ecological condition for vegetable production in the area, there are a lot of constraints in relation to production, input supply and finance, in addition to marketing problems. Among the constraints identified by IPMS (2005) are; poor yield, lack of knowledge on proper agronomic practice of vegetables, diseases and pest problems, lack of proper knowledge on post harvest handling and unavailability of improved seeds, lack of sufficient planting materials for improved vegetables (seed, seedlings), high fertilizer and pesticide cost, unavailability of fungicide in Alamata, rigid credit system, group credit system discouraging farmers, and weak capacity of service cooperatives.

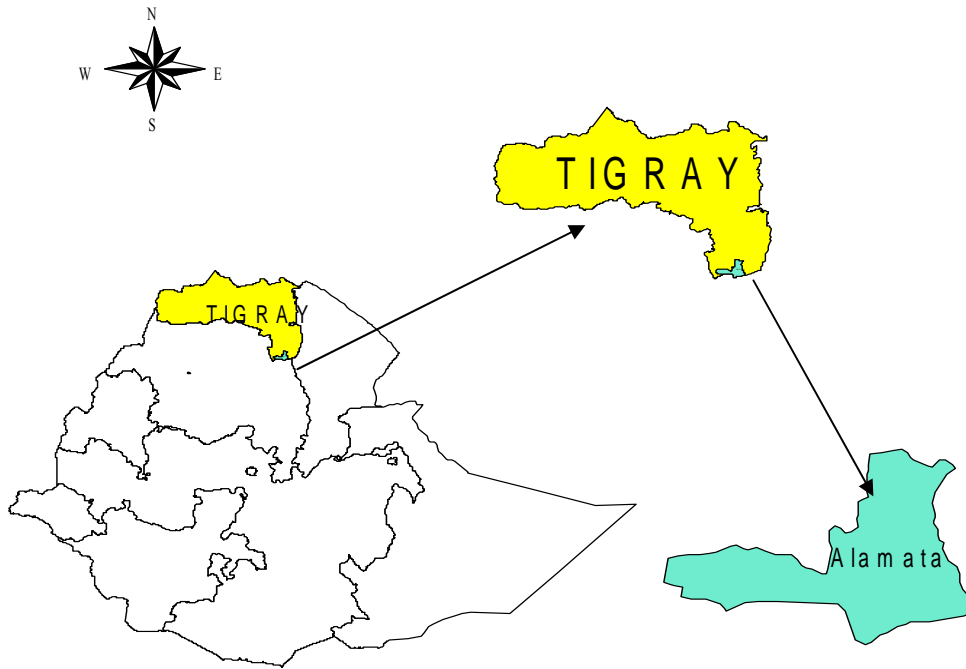


Figure 2 Map of the study area

3.2 Sampling Technique

Multistage stratified sampling design was used to select the respondents. First, Alamata wereda was purposively selected because of its potential for access to irrigation, and thus potential for high value vegetable crops production for market. In addition it is one of the pilot learning weredas (PLWs) of IPMS, the sponsor of this research.

There are 10 PAs in the wereda. Two PAs are in the high land part of the wereda and the other eight are lowlands. The highland was not included in this study because the irrigation land coverage is not as significant as in the low lands and also there is lack of transportation

facilities. Then, the PAs in the low lands were stratified into two groups in which the first stratum includes the PAs having access to spate irrigation, and the other one includes the PAs without spate irrigation. From the first group, with access to spate irrigation four PAs which have extensive cultivation of vegetables and cereals were selected purposively among which, two PAs are nearer and the other two are relatively far from the woreda town. This was done in consultation with woreda Office of Agriculture and Rural Development and available documents. Then each PAs was stratified by vegetable growers and non growers. In the next stage vegetable growers as well as non growers were stratified in to male and female headed households. Vegetable growers were purposively fixed to be 60% while the non growers to be only 40%. The sampling frame of the study was the farmers who grow either vegetables or cereals or both using spate irrigation, with or without other crops. Probability proportional random sampling design (PPS) was applied to select farmers who grow vegetables and who do not grow vegetables, but growing cereals from each kebele. Finally, 150 HHs were selected as the sample of the study. The sample has purposively included 26 % FHHs. This was made to implicit the needed data regarding gender based social networks and access to resources and services and their implications in decision making of households to grow vegetable crops using irrigation.

3.3. Data Source, Data Type and Method of Data Collection

To fulfill the objectives of the study, both qualitative and quantitative data were gathered from the primary sources. The qualitative data were gathered through focused group discussion, key informant's interviews, and informal discussions with farmers, and personal observations. Quantitative data were generated through survey method employing structured interview with the sample respondents. In addition; relevant secondary data were collected from available reports, records and other published and unpublished documents from the concerned offices. Emphasis was given to the qualitative data also, to capture all relevant information required to have an in-depth view of the gender dimensions of social networks and to find out constraints in relation to growing vegetable crops using irrigation.

From the household survey, the necessary information of sample household regarding their social networks for accessing inputs / technologies, information and credit services; and also their personal & demographics and socio-economic conditions, was collected. For the household survey, the enumerators who were familiar to the area were recruited from the study area and were trained on the objectives, methods of data collection and interviewing techniques. The interview schedule was semi-structured and pre-tested before the interviews took place. Besides the surveyed sample, different methods were used in order to elicit relevant qualitative information especially in relation to gender dimensions of social networks and to see major constraints to grow vegetables. There were four focused group discussions in each selected PA in which men and women have discussed separately. In addition, group interview was held in each PAs in which the group comprises elders, religious leaders, opinion leaders, and knowledgeable individuals. This helps to extract information about the different formal and informal social networks and their gender dimensions in relation to their contribution in facilitating access to resources and services, and to find out why farmers continue to cultivate cereal crops ignoring cash crops when there is access to irrigation giving due attention to women. The group interview checklist was prepared, before the actual work was started and the enumerators & the researcher were involved simultaneously. The role of the researcher was a facilitator and moderator.

3.4 Methods of Data Analysis

Primary data collected from individuals through the interview schedule were analyzed using descriptive statistics such as measures of central tendency, frequency, percentages, and ranking with the use of Statistical Package for Social Science (SPSS). To assess the contribution of social networks of a given household in facilitating access to resources and services and thus see the difference and similarity of social networks of vegetable growers and non growers, as well as FHHs and MHHs, chi-square was used. Ranking was also used to see the relative importance of social networks (formal & informal) in facilitating access to resources and services for vegetable growers & non growers and FHHs & MHHs separately. To identify factors influencing farmers' choice of growing vegetable crops, in addition to descriptive statistics, binary logistic regression model was used. Qualitative data gained from

FGDs and group interviews were described, analyzed and interpreted on spot during data collection to avoid missing relevant information.

Model specification

Binary logistic model

Responses to a question in relation to choice of crops, such as whether farmers grow vegetables or not could be 'yes' or 'no', a typical case of dichotomous variable. A variety of statistical models can be used to establish a relationship between factors and choice of growing vegetable crops by farmers. Conventionally, linear regression analysis is widely used in most economic and social investigations. This is because; it has some desirable properties for specific type of enquiry and data and is widely available in computer packages (Green, 1991). Moreover, it is easy to interpret and it is a reasonable procedure even if some of the assumptions underlying it are not met in the data. However, the same source further stated that while estimates derived from linear regression analysis may be robust in the face of errors in some assumptions, other assumptions are critical and their failure will lead to quite unreasonable estimates. To mention some weakness, the linear probability Model (LPM) may generate predicted values outside the 0-1 intervals, which violates the basic tenets of probability. The other problem with LPM is that the variance of the disturbance term is heteroschedastic. Furthermore, the assumption of normality in the disturbance term is no longer tenable.

The inadequacy of the linear probability model suggests that a non-linear specification may be more appropriate and the candidate for this will be an S-shaped curve bounded in the interval of 0 and 1 (Amemiya, 1981). This author suggested the S-shaped curves satisfying the probability model as those represented by the cumulative logistic function (logit) and cumulative normal distribution function (probit).

The choice between these two models revolves around practical concerns such as the availability and flexibility of computer program, experience and other facilities. In fact it

represents a close approximation to the cumulative normal distribution. Hosmer and Lemshew (1989) pointed out that a logistic regression has got advantage over others in the analysis of dichotomous outcome variables. There are two primary reasons for choosing the logistic distribution. These are 1) from a mechanical point of view, it is an extremely flexible and easily used function, and 2) it lends itself to a meaningful interpretation. The logit model is simpler in estimation than the probit model (Pindyck and Rubinfeld, 1981). Therefore, in this study a binary logistic regression model is used to analyze the factors influencing farmers' decision of choice of vegetable crops in irrigated fields, in Alamata district.

Following Hosmer and Lemshew (1989), the logistic distribution function for analyzing choice of growing vegetable crops can be defined as:

$$PB_{iB} = \frac{1}{1 + e^{-Z_i}} \dots\dots\dots (1)$$

Where PB_{iB} is the probability of being willing to participate for the i^{th} farmer and Z_{iB} is a function of m explanatory variables (XB_{iB}), and expressed as:

$$Z_{iB} = \beta_{0B} + \beta_{1B}XB_{1B} + \beta_{2B}XB_{2B} + \dots\dots + \beta_{mB}XB_{mB} \dots\dots\dots (2)$$

Where β_{0B} is the intercept and β_{iB} are the slope parameters in the model. The slope tells how the log-odds in favor of being willing to participate in vegetable production practices change as independent variables change.

Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean PB_{iB} , interpretation of the coefficient will be understandable if the logistic model can be rewritten in terms of the odds and log of the odds, (Gujarati, 1995). The odds to be used can be defined as the ratio of the probability that a farmer will practice (PB_{iB}) to the probability that he/she will not ($1-PB_{iB}$).

But

$$(1 - p_i) = \frac{1}{1 + e^{z(i)}} \dots\dots\dots (3)$$

Therefore, $\left(\frac{p_i}{1 - p_i}\right) = \frac{1 + e^{z(i)}}{1 + e^{-z(i)}} = e^{z(i)} \dots\dots\dots (4)$

And

$$\frac{p_{(i)}}{1 - p_{(i)}} = \frac{1 + e^{z(i)}}{1 + e^{-z(i)}} = e^{\beta_o} + \sum_{i=1}^m \beta_i Y_i \dots\dots\dots (5)$$

Taking the natural logarithms of the odds ratio of equation (5) will result in what is known as the logit model as indicated below.

$$\ln \left(\frac{P_{(i)}}{1 - P_{(i)}} \right) = \ln \left[e^{\beta_o} + \sum_{i=1}^m \beta_i \chi_i \right] = Z_{(i)} \dots\dots\dots (6)$$

If the disturbance term UB_{iB} is taken in to account the logit model becomes:

$$Z_{(i)} = \beta_o + \sum \beta_i \chi_i + U_i \dots\dots\dots (7)$$

Hence, the above econometric model was used in this part of the study to identify determinant variables that influence choice of growing vegetable crops by farmers.

3.5 Definition of Variables and Hypotheses

Dependent variable

The dependent variable of the model (binary logistic analysis) has dichotomous nature representing the observed status of the respondents in decision of growing vegetable crops for market, using spate irrigation. The variable takes the value 1 if the farmer grows vegetables for market, and 0 otherwise. Choice of crops of farmers while they use irrigation can be determined by different factors.

Independent variables: Explanatory variables are the variables hypothesized to affect farmers' decision of choice of growing vegetable crops. These are a combination of different types of variables, among which are household personal & demographic characteristics, economic characteristics, and the organizational and institutional support systems in which farmers operate, including social networks of the household. Based on theoretical background and empirical results of a few studies on vegetable production practices, and some other related crop choice studies carried out elsewhere as well as considering the information from the pilot study, the following variables are hypothesized to influence decision of farmers to grow or not to grow vegetable crops. Definitions and operationalization of these variables are given in Appendix 3.

Household's personal and demographic variables

Farmer's age (AGE): This refers to the age of the household in years, during the data collection. Choice of crops is mostly influenced by age, especially in relation to growing crops such as vegetables. Vegetable production is a knowledge demanding business; particularly it requires modern knowledge of production and marketing. Moreover, it is known that it is risky in relation to its high production cost and perishability nature. But elder people are usually risk averters. Because of this, they usually hesitate to try out capital intensive crops such as vegetables. On the other hand, elder people are more respected and trusted by the community, and have better opportunity to participate as leaders in different formal and informal institutions, which may facilitate them access to resources and services. Based on this controversial issues age is hypothesized to have negative or positive influence on choice of farmers to grow vegetable crops.

Education (EDUCLVL): It is a discrete variable measured in number of years of schooling of the household head. Households headed by better educated individuals are more likely to join economically oriented organizations, perhaps because of the higher productivity of these organizations when an individual is better educated. Education also enhances trust in others and hence the willingness to participate in organizations of a sensitive nature (Godquin and Quisumbing, 2005). Furthermore, education level increases farmer's ability to get process and

use information and increase farmer's willingness to try out different alternatives of crops. Therefore, it was hypothesized that education influences the decision making of farmers to grow vegetable crops positively.

Marital status (MARITAL): It is a dummy variable that refers to the marriage status of the household head. It was hypothesized that married respondents have a better social status in the community and being respected by the community members. They are expected to have larger networks. As a result they could have better access of information and other inputs. Hence, they are likely to decide to try out new practices. According to Dessalegn, (2008) married respondents have relatively more social networks and better access to improved seed than divorced and widowed and thus they have high probability to try out new practices.

Economic variables of the household

Farm income (ONFARM): It is a continuous variable measured in birr. It refers to the total annual earnings of the family from sale of agricultural produce such as sale of crop, livestock and livestock product after meeting family requirements. According to previous studies, this is believed to be the main source of capital for purchasing agricultural inputs. More over, households with better income level could be better respected and trusted and thus could have large network, which results in better access to information, input and other services. Hence, it was hypothesized that those households with a relatively higher farm income are expected to have higher probability to cultivate vegetable crops.

Off-farm income (OFFARM): It is a continuous variable measured in birr. It refers to annual income obtained from different agricultural activities (outside the farm) such as hired labor. According to Asfaw *et al.*, (1997) and Habtemariam, (2004), this type of income increases the farmers' financial capacity and increases the probability of investing in capital intensive agricultural practices. It is therefore, expected to affect farmers' decision to grow vegetable crops positively.

Non-farm income (NONFARM): It is a continuous variable measured in birr. It refers to the income gained from other than agricultural activities and other than off farm income also, such as participating in trading non agricultural goods. The same as to the off farm income, this is expected to have positive relationship with growing vegetable crops by farm households.

Irrigated land holding (TIRILAND): This refers to the total irrigated land that a farmer owns, or could be rented in or shared crop in land, measured in local measurement unit timad, (1hectares=4timad). Many agricultural practices require substantial economic resources, among which land is the most important one. This is because of the reason that, a farmer who owns larger size of land can allocate part of it to try out new practices. The hypothesis in this study was that field size, specifically irrigated land is positively related with the decision of the households to grow vegetable crops.

Labor availability (LABOUR): Labour was measured in terms of man Equivalent. Availability of labour is likely to influence the decision of farmers in relation to choice of crops. A household with larger labour force per hectare (unit) is expected to have high probability to decide to grow vegetable crops, which are known for their labour intensive nature. Based on this, it was hypothesized that labour availability influences decision of households to grow vegetable crops positively.

Number of Livestock (LIVEOWN): This refers to the total number of livestock measured in tropical livestock unit (TLU). Livestock is important source of income, food and draught power for crop cultivation in Ethiopian agriculture. Like many other similar studies, it was measured in terms of Tropical Livestock Unit (TLU). Livestock ownership is hypothesized to be positively related to choice of growing vegetable crops.

Institutional variables

Mass media exposure (MMSCOR): Respondent farmers' use of mass media (radio, TV and print media including the habit of listening of discussion of print media from kebele administrators) was rated on five-point scale taking responses from no use to very often use.

Accordingly, mass media exposure constituted a total score of 20. Farmers' total mass media exposure is the sum of the score value they obtained for their level of exposure to each mass medium considered. Mass media play a significant role in creating awareness about new ideas and practices in a fastest possible time. Therefore; mass media exposure was hypothesized to have positive influence on farmers' decision to grow vegetable crops.

Distance to the main road (DISTMR): It is a continuous variable measured in kilometer. It refers to the distance from farmers' farms to the main all weather roads. As farmers' home and farms gets closer to the main road, they can have access to transportation facilities and thus encourage farmers to grow crops such as vegetables, which definitely need huge market. Therefore, in this study, it was hypothesized that this variable is negatively related to the choice of growing vegetables by farmers.

Access to Credit (CREDIT): It is a dummy variable, which takes the value 1 if the farm household has access to formal credit in terms of availability of credit & credit sources; and possibility of getting credit and 0 otherwise. Vegetable production involves more use of inputs which has great cost implication. Credit is very much useful to purchase inputs such as improved seeds and other important inputs. Hence, access to credit was expected to influence farmers' cultivation of vegetable crops positively.

Extension contact (DACONTA) it was measured using the Frequency of contact with extension agents. This refers to the number of contacts per year that the respondent made with extension agents. The effort to disseminate new crops such as vegetables is within the field of communication between the change agent (extension agent) and the farmers at the grassroots level. Here, the frequency of contact between the extension agent and the farmers is hypothesized to be the most important and decisive factors which accelerates the effective dissemination of adequate agricultural information to the farmers, thereby enhancing farmers' decision to try out new practices. Hence, it was hypothesized to affect decision of farmers' choice of crops towards vegetables, positively.

Attendance in extension events (EVENTSCO): This variable considers participation of respondents in four extension events, namely field days, training, on-farm demonstration and extension exhibition. A study conducted by Kansana *et al.* (1996) indicated that participation in training, access to communication sources and number of information sources had significant association with level of knowledge of improved wheat varieties. In this study, the variable was hypothesized to influence choice of vegetable crops by farmers positively.

Cosmopolitaness (COSMOPLT): It is the frequency of contact the farmer has with external situations of the social system. This is assumed to influence the access to information on improved farming practices as compared to the other members of the group and it is expected to influence households' probability of cultivating vegetable crops positively.

Number of Relatives and Friends (FRNRLTV): it is a continuous variable which refers to the number of relatives and close friends the HH head has and can talk to freely and approach for help incase of any problem. The number of relatives may reduce the aversion to risk and hence increase the household's willingness to participate in groups and associations. According to (Katungi *et al.*, 2007), households that interact closely with more relatives are also likely to be better informed about the benefits of participating in organizations. Besides being better informed, individuals are likely to influence their relatives to join organizations/social networks of which they are members. This participation in different organizations helps them to be exposed to new ideas and practices; as a result they may decide to adopt new technologies. Based on these, it was hypothesized that households with relatively more number of relatives and friends have access to information, inputs and hence likely to decide to grow vegetable crops.

Social participation (SOCIALPA): Membership and involvement in social activities(formal) such as in administrative groups, agricultural related groups such as cooperatives and water use associations and other civic associations ,etc or in (informal organization) such as community based organizations ('Iqub', 'Edir' Religious clubs such as 'Mahber', etc) will give higher exposure to new information. According to Chilot *et al.*, (1996) and Habtemariam (2004), membership and leadership in community organization assumes that farmers who

have some position in peasant association and different cooperatives are more likely to be aware of new practices as they are easily exposed to information. It is, therefore, hypothesized that those farmers who participated in some social organization as member or leader are more likely to decide to grow vegetable crops. The variable is measured in terms of degree (0= no participation, 1= member, 2= leader) and frequency of participation (0= never, 1= sometimes, 2= whenever conducted) in different social organizations. The sum of both frequencies was used to arrive at a social participation score.

4. RESULTS AND DISCUSSION

4.1 Introduction

This part is mainly concerned with the description and interpretation of the findings of the survey. As already noted, a structured interview schedule was administered to 150 sample households in the study area, Alamata wereda. The main aim was analyzing the contribution of formal and informal social networks and their gender dimensions in facilitating access to resources and services, such as technology / input, credit / finance and information / knowledge and thereby influencing farmers' choice of growing high value vegetable crops. Identifying the preceding factors which determine farmers' choice of crops in using spate irrigation was also another additional objective of this study. The interview schedule was designed in such a way that it enables to collect data on the contribution of formal and informal social networks in terms of their frequency of use by the individual sample respondents and their relative importance as a source of each resources and services, according to the respondent farmers and also data on Personal & demographic, economic and institutional characteristics of sample respondent farmers, which are expected to influence the decision of choice of crops of farmers to grow or not to grow vegetables. In addition, 16 focus group discussions with vegetable growers and non growers and with different gender composition (men and women separately) were conducted. Moreover interviews of key informants in each sample PAs were used to elicit the maximum information.

In this section, the results of descriptive statistics using chi-square and ranking, in relation to social networks of vegetable growers & non growers and FHHs and MHHs are discussed. In addition, the results of both descriptive statistics and econometric model for decision of choice of growing vegetable crops are discussed in detail. In order to understand the existing characteristics of sampled households with respect to decision of growing vegetable crops or not, the descriptive analysis is summarized and discussed under household personal and demography, economic and institutional characteristics. The results are presented using descriptive statistical tools such as mean, percentage, and frequencies. Independent t- test and

chi-square test were employed to see the relationships between selected variables. Qualitative data was also analyzed and interpreted.

4.2 Social Networks and Their Gender Dimensions

There are different types of formal and informal groups (networks) in the study area. Among the formal groups: modern irrigation cooperatives, water use association, saving and credit cooperatives, multipurpose cooperatives, collection of sand & stone cooperatives, agricultural development groups, youth club, women association, farmers association and political leadership groups are the major ones. Among the informal groups; Edir, Equb, and religious based and / or relatives based Mahbers are the most common.

In this study, social groups are categorized in to five according to the nature and function of the groups. The categories according to this study are administrative groups (PA administration, village administration, court , etc...), agricultural related groups (service cooperatives, saving and credit groups, water use associations, and agricultural development groups, etc...), different civic associations (farmers association, women association, youth club, etc...), community based organizations (Edir, Equb, Mahber), and participation in different worth places such as weeding, market places, village meetings. This helps to identify which social participation & groups are the most important to the farming community in the process of decision making of farmers to reject or accept new ideas and practices, specifically decision in relation to taking up high value vegetable crops using irrigation. Concerning the results of this research, the survey result according to the crop production categories is presented in Table1.

Table1 Relationship between social participation in different formal and informal organizations and choice of crops (N=150)

Types of participation	Response	Crop production category						χ^2 -value
		Cereals & others (n=60)		Vegetables (n=90)		Total (N=150)		
		No	%	No	%	No	%	
Administrative groups	Yes	13	21.7	23	25.6	36	24	.298NS
Associational groups	Yes	42	70	59	65.6	101	67.3	.323NS
Agricultural related groups	Yes	21	35	48	53.3	69	46	4.871**
CBOs	Yes	44	73.3	70	77.8	114	76	.390 NS
Worth places	Yes	58	96.7	89	98.9	147	98	.907 NS

Source: own survey, 2008 ** = Significant at 5% probability level, NS=Non significant

Among the sample respondents, 24, 67.3, 46, 76 and 98 % of them participate in administrative groups, different associations, agricultural related groups, community based organizations and in worth places, respectively.

Regarding the crop production categories, as it can be seen from Table 1, there is no significant difference in participation of the respondents in administrative groups, associations, community based organizations and in worth places, except participation in agricultural related groups, which is significant ($\chi^2= 4.871$, $P=.027$) at 5 % probability level of significance.

In relation to the sex categories, as it can be seen clearly from Table 2 there is a significant difference between FHHs and MHHs regarding their participation in administrative and agricultural related groups in which 5.1% of FHHs and 30.6% of MHHs participate respectively in the former and the variation is significant at 1 % probability level ($\chi^2= 10.290$, $P=.001$) and 33.3 % of FHHs and 50.5 % of MHHs participate respectively in the later and the variation is significant at 10 % probability level of significance ($\chi^2= 3.404$, $P=.065$).

Table 2 Relationship between social participation in different formal and informal organizations and choice of crops, across sex categories (N=150)

Types of participation	Response	Sex category						χ^2 -value
		Female (n=39)		Male (n=111)		Total (N=150)		
		No	%	No	%	No	%	
Administrational groups	Yes	2	5.1	34	30.6	36	24.0	10.290***
Associational groups	Yes	27	69.2	74	66.7	101	67.3	.086 NS
Agricultural related groups	Yes	13	33.3	56	50.5	69	46.0	3.404*
Community based organizations	Yes	26	66.7	88	79.3	114	76.0	2.517NS
Worth places	Yes	37	94.9	110	99.1	147	98.0	2.631NS

Source: own survey, 2008 ***, * = Significant at 1%, 10% probability level, NS=Non significant

Relating this result to the concept of social networks, this has an indication that farmers who are more involved in different social networks or groups, specifically in those groups which are related to agricultural activities and which are mostly economic oriented; are better involved in growing high value vegetable crops. This could be because of the reason that, through these groups' farmers can have better access to inputs, information and other needed resources.

The result of this study clearly revealed that FHHs are less involved in the most important economic oriented groups. This indicates that FHHs may face difficulties in relation to access to inputs, information and other needed resources as a result of their exclusion from such networks which has its own implication on their decisions to grow vegetable crops.

In this regard, key informants were interviewed to get clear information about different groups and social networks and involvement of women in the groups. According to the discussion held among the key informants, there are groups in which women do not participate because of many reasons. Women do not participate in the cooperatives of sand and stone collection, water use association and farmers association. The only association in

which women exclusively participate was the women association. The reason for this difference regarding participation in different formal and informal groups according to the key informants is summarized as follows:

The reason for this difference regarding participation in different formal and informal groups can be related to attitude problems which may be stemmed from cultural and religious beliefs in the community, including among women themselves. For instance, in the case of collection of sand & stone for example, it is because of believing that they may not fit physically and thus may not be able to compete with the men regarding the collection of sand & stone. Regarding water use association; the association is more of traditional and culturally it is not common to involve women in such associations, hence this time also women do not participate in this very important association. As a result it is usually common to observe abuse of the right of women regarding use of irrigation water.

In the other formal organizations such as irrigation cooperatives, saving and credit, multipurpose cooperatives, agricultural development groups and political groups, women participate but their level of participation is not significant compared to the level of participation of men. In terms of their number women who participate in these groups are not considerable compared to men. The reasons based on the key informants discussion is interpreted as follows:

The main problem is the wrong attitude towards women, as a result of culture and norms of the society. Culturally women are not encouraged to have contact with men and to participate in public issues. Especially if the woman is married, her husband will not allow her. This wrong attitude towards women is observed among individuals who are in leadership status also. One of the leaders of the PA articulates this as follows:

'We don't want our wives to participate in political leadership issues. Even those who are FHHs, we don't usually encourage them to participate in different organizations especially at leadership status. We don't believe in women equity heartily and we always want them to be inside the house and take all responsibilities there. We are not willing to share their responsibilities in side our homes and help them to be exposed to different organizational participation. Most of us don't accept the capacity of women to perform what the men can perform and we always doubt to bring women to leader ship status.'

Another key informant clarifies the attitude towards women's' participation in different groups as follows:

'It is impossible for husband and wife to be involved in different groups at the same time. There should be sharing of responsibilities between them. Other wise who is going to take care of the issues in side our houses if is it is said that both husband and wife should participate equally? Practically it is difficult even though it have been said for a long time.'

The other very important thing is their own attitude towards participation in such groups. Women normally don't want to participate in such groups because of the cultural and religious constraints. Time constraint as a result of their reproductive role in their houses in addition to their major role in productive activities is another issue for women to participate or not participate in social organizations.

Group discussion was held among women, FHHs and wives of the MHHs separately.

According to the FHHs:

‘Women have multiple responsibilities in our houses. The burden of work is worse among FHHs. As all the burden of the household, including the agricultural production activities and other social affairs are relied on us, it is difficult to give time and participate in some social groups or organizations, especially if the groups are those which need considerable time, such as long and frequent meetings and resource sharing.’

According to the wives of the MHHs:

‘We have equal contribution with our husbands regarding agricultural production activities, especially in vegetable production, in addition to our reproductive role in our homes such as cooking food for our family members, rearing children, washing clothes, fetching water, collecting fuel wood, keeping our livestock and many other related tasks, so how could be expected from us to be participant in different social organizations? It is enough if our husbands participate in such groups in order to get some benefits such as access to inputs from service cooperatives for example.’

However, all the groups and social networks may not be important, specifically in relation to their contribution in facilitating access to different resources and services in irrigation based vegetable production, in the study area. Hence based on the group discussions and interviews held during the study time, only the most important groups or social networks were taken and analysis was made regarding their contribution in facilitating access to inputs/ technologies, information, and credit / finance.

Based on this study, social networks is network of individual farmers that could be formal, which is created as a result of participation in different formal groups and associations or as a result of close and frequent contact with formal development actors such as extension agents;

or could be informal which is created as a result of participation in different informal groups or network created as a result of friendship or blood relationship; and thereby being able to access different resources and services as a result of the participation and / or the formal and informal relationships.

4.3. The Roles of Social Networks in Accessing input / technology, information and credit

In this part, actors who are contributing in facilitating access to technology / input / information and in providing services such as credit are considered as agricultural technology, / information and financial sources of sample respondents. Therefore, contribution of different social networks (actors) in technology / input, information exchange and in providing financial services will be emphasized. The contribution of the actors will be operationalized in terms of their frequency of use by the respondents to get input / information and services; and how the respondents perceived the relative importance of actors as a source to each resource will also be included. The results will be displayed based on crop production, and sex category to see the gender implication of the social networks.

4.3.1. Technology / Input source and its use pattern

Technology source and its use pattern were analyzed to assess who is contributing more in facilitating access to agricultural inputs / technologies, in terms of frequency of use of each actor by the respondent farmer. Distribution of frequency of use of actors as technology source to the respondents is presented in Tables below.

Table 3 Distribution of actors as technology source to the respondents (across crop production category) in terms of their frequency of use (N=150)

Sources of input	Frequency of use	Category by crop production						χ^2 - value
		Cereals and others		Vegetable		Total		
		No	%	No	%	No	%	
DAs	Never	21	35.0	24	26.7	45	30.0	1.423NS
	Sometimes	26	43.3	47	52.2	73	48.7	
	Always	13	21.7	19	21.1	32	21.3	
Cooperatives	Never	10	16.7	16	17.8	26	17.3	8.684**
	Sometimes	18	30.0	10	11.1	28	18.7	
	Always	32	53.3	64	71.1	96	64.0	
Input supplier organizations	Never	44	73.3	43	47.8	87	58.0	9.770***
	Sometimes	13	21.7	36	40.0	49	32.7	
	Always	3	5.0	11	12.2	14	9.3	
Neighbors or friends	Never	16	26.7	60	66.7	76	50.7	26.290***
	Sometimes	20	33.3	20	22.2	40	26.7	
	Always	24	40.0	10	11.1	34	22.7	
Other farmers	Never	35	58.3	55	61.1	90	60.0	.207NS
	Sometimes	24	40.0	33	36.7	57	38.0	
	Always	1	1.7	2	2.2	3	2.0	

Source: own survey, 2008 ***, ** = Significant at 1%, 5% probability level, NS=Non significant

As it can be seen from Table 3, there is difference between vegetable growers and non growers in terms of frequency of using the actors service cooperatives, input supplier organizations (private input providers) and neighbors or friends. According to the result of the study, in terms of frequency of use, the vegetable growers are using the service cooperatives and input supplier organizations more frequently than the non growers. More over, the chi-square test result ($\chi^2= 8.68$, $P= .013$) for service cooperatives and ($\chi^2=9.770$, $P=.008$) for input supplier organizations assured that there is significant difference between vegetable growers and non growers of vegetables in terms of frequency of use of service cooperatives and input supplier organization, as a source of technology, at 5 % and 1% probability level of significance respectively. The probable reason for this significant difference especially in

relation to the private input providers is that, vegetable growers commonly purchase different inputs from private suppliers, because input supply from the cooperatives is not on time in most cases.

On the other hand, the non growers are using neighbors / friends as a source of technology/inputs more frequently than growers. The chi-square value ($\chi^2=26.290$, $P=.000$) also indicated that there is significant difference between the two categories in terms of frequency of use of the actor as input/ technology source at 1% probability level of significance. This could be because of the tradition of sharing of seed of cereals and other food crops among neighbors / friends, which is not common in high value (cash crop) seed, may be because of the expensive price of the seed. Significant difference was also found between sex categories (Table 4).

Table 4 Distribution of actors as technology / input source to the respondents (across sex category) in terms of their frequency of use (N=150)

Actors	Frequency of use	FHH		Sex category MHH		Total		χ^2 - value
		No	%	No	%	No	%	
DAS	Never(0)	24	61.5	21	18.9	45	30.0	27.709***
	Sometimes(1)	7	17.9	66	59.5	73	48.7	
	Always(2)	8	20.5	24	21.6	32	21.3	
Cooperatives	Never(0)	22	56.4	4	3.6	26	17.3	72.134***
	Sometimes(1)	12	30.8	16	14.4	28	18.7	
	Always(2)	5	12.8	91	82.0	96	64.0	
Input supplier organizations	Never(0)	26	66.7	61	55.0	87	58.0	1.631NS
	Sometimes(1)	10	25.6	39	35.1	49	32.7	
	Always(2)	3	7.7	11	9.9	14	9.3	
Neighbors or friends	Never(0)	15	38.5	61	55.0	76	50.7	5.640*
	Sometimes(1)	10	25.6	30	27.0	40	26.7	
	Always(2)	14	35.9	20	18.0	34	22.7	
Other farmers	Never(0)	26	66.7	64	57.7	90	60.0	1.746NS
	Sometimes(1)	13	33.3	44	39.6	57	38.0	
	Always(2)	0	.0	3	2.7	3	2.0	

Source: own survey, 2008 ***, **, * = Significant at 1%, 5%, 10% probability level, NS=Non significant

As it is clearly shown in Table 4, there is significant difference between FHHs and MHHs in using the actors agricultural development agents, cooperatives and neighbors / friends as a source of technology or input, with chi- square value of ($\chi^2=27.709$, $P=.000$), ($\chi^2= 72.134$, $P=.000$), and ($\chi^2=5.640$, $P= .060$) respectively, at 1% significant level for the first two actors, favoring for MHHs and at 10 % significant level for the last actor (neighbors/ friends) favoring for FHHs. From this result we can conclude that women, most of the time, use informal networks such as friends and relatives to access resources unlike men who use formal networks such as DAs and agricultural cooperatives.

Group discussions were conducted among women to get detailed information regarding this issue, and according to the majority of women:

'Normally, DAs don't come to our houses; the farmer has to go to the DAs to get information and other services. On the other hand, we have multiple responsibilities inside our houses. In addition to our high contribution in agricultural production activities, there are other tasks expected to be done by us only, among which are fetching water, collecting wood, preparing food, washing clothes, rearing children and nursing older people (if there is any in the household). So, the opportunities of women to have frequent contact with DAs and other leaders are commonly less. As a result, most of the time we don't even get the information about the availability of the required inputs in the first place, for example seed, chemical and even some equipments to use chemicals with. Sometimes we get the information from neighbors or friends after all available inputs, for example seed, are finished by other farmers. Unlike women, men have the advantage to participate in meetings and some important occasions in which we can not afford time to participate. On the other hand, men can afford the time, especially if it is not land preparation, production or harvesting time. Moreover they also have access to different places; they have frequent contact with the DAs as well as the administrators in the kebele including the leaders of the cooperatives. They could also be members themselves. Hence, they are able to get first hand information and as a result they will have better opportunity to access inputs and other resources, than women.'

4.3.2. Credit source and its use pattern

Credit source and its use pattern were analyzed to assess which actor is contributing more in facilitating access to finance in terms of frequency of use of actor by the respondents. Distribution of frequency of use of actors as credit source to the respondents is presented in Table 5.

Table 5 Distribution of actors as credit source to the respondents (across production category) in terms of their frequency of use (N=150)

Sources of credit	Frequency of use	Category by crop production						χ^2 -value
		Cereals and others		Vegetable		Total		
		No	%	No	%	No	%	
Service cooperatives	Never	30	50.0	52	57.8	82	54.7	3.027NS
	Sometimes	18	30.0	29	32.2	47	31.3	
	Always	12	20.0	9	10.0	21	14.0	
Dedebit saving and credit	Never	36	60.0	41	45.6	77	51.3	4.561NS
	Sometimes	23	38.3	42	46.7	65	43.3	
	Always	1	1.7	7	7.8	8	5.3	
Neighbors or friends	Never	49	81.7	75	83.3	124	82.7	.070NS
	Sometimes	11	18.3	15	16.7	26	17.3	
	Always	0	.0	0	.0	0	.0	

Source: own survey, 2008, NS=Non significant

According to the result of the study, there is no difference between vegetable growers and non growers in terms of frequency of using the actors Service cooperatives, Dedebit Saving and Credit Institution and neighbors / friends as credit source. According to the result of the study, the actors are giving service almost fairly for both vegetable growers as well as non growers as a source of credit. On the other hand significant difference was found between sex categories, as it is displayed below.

Table 6 Distribution of actors as credit source to the respondents (across sex category) in terms of their frequency of use (N=150)

Sources of credit	Frequency of use	Sex category						χ^2 -value
		FHH		MHH		Total		
		No	%	No	%	No	%	
Service cooperatives	Never	27	69.2	55	49.5	82	54.7	7.133**
	Sometimes	11	28.2	36	32.4	47	31.3	
	Always	1	2.6	20	18.0	21	14.0	
Dedebit saving and credit	Never	26	66.7	51	45.9	77	51.3	5.092*
	Sometimes	12	30.8	53	47.7	65	43.3	
	Always	1	2.6	7	6.3	8	5.3	
Neighbors or friends	Never	35	89.7	89	80.2	124	82.7	1.842NS
	Sometimes	4	10.3	22	19.8	26	17.3	
	Always	0	.0	0	.0	0	.0	

Source: own survey, 2008 **, * = Significant at 5%, 10% probability level, NS=Non significant

Regarding the sex categories, as it can be clearly seen from Table 6, there is statistically significant difference between FHHs and MHHs, favoring MHHs, in terms of the frequency of use of the actors service cooperatives and Dedebit saving & credit as a source of credit, which shows women have less access to formal credit services than men, which may be because of their low socioeconomic conditions, thus fear of taking risk and their low participation in economically oriented groups such as service cooperatives.

4.3.3. Information source and its use pattern

Information source and its use pattern were analyzed to assess which social networks (actors) are contributing more in providing information, in terms of frequency of use of each actor by the respondents. Distribution of frequency of use of actors as information source to the respondents is presented in Table 7.

Table 7 Distribution of actors as information source to the respondents (across Crop production category) in terms of their frequency of use (N=150)

Actors	Frequency of use	Category by crop production						χ^2 - value
		Cereal and others		Vegetable		Total		
		No	%	No	%	No	%	
WOoARD	Never	21	35.0	18	20.0	39	26.0	6.961**
	Sometimes	31	51.7	46	51.1	77	51.3	
	Always	8	13.3	26	28.9	34	22.7	
DAS	Never	16	26.7	12	13.3	28	18.7	4.617*
	Sometimes	9	15	20	22	29	19.3	
	Always	35	58.3	58	64.4	93	62	
Service cooperatives	Never	25	41.7	35	38.9	60	40	.295NS
	Sometimes	26	43.3	43	47.8	69	46	
	Always	9	15.0	12	13.3	21	14	
Farmers development groups	Never	23	38.3	34	37.8	57	38.0	1.958NS
	Sometimes	15	25.0	31	34.4	46	30.7	
	Always	22	36.7	25	27.8	47	31.3	
Neighbors or friends	Never	1	1.73	26	28.9	27	18.0	21.026***
	Sometimes	21	35	14	15.6	35	23.3	
	Always	38	63.3	50	55.6	88	58.7	
Input supplier organizations	Never	43	71.7	58	65.2	101	67.8	.705NS
	Sometimes	15	25.0	27	30.3	42	28.2	
	Always	2	3.3	4	4.5	6	4.0	

Source: own survey, 2008 ***, **.* = Significant at 1%, 5%, 10% probability level, NS=Non significant

As it can be seen from Table 7, there is difference between vegetable growers and non growers in terms of frequency of using the actors WOoARD, DAs, and neighbors or friends as a source of information. According to the result of the study the vegetable growers use WOoARD and DAs more frequently than the non growers. Moreover, the chi- square test result ($\chi^2= 6.961$, $P= .031$) for WOoARD and ($\chi^2=4.617$, $P=.099$) for DAs assured that there is significant difference between vegetable growers and non growers in terms of frequency of use of DAs WOoARD, as a source of information, at 5 and 10 % probability level of significance, respectively. On the other hand, the non growers are using neighbors / friends as a source of information more frequently than growers. The chi-square value ($\chi^2=21.026$, $P=000$) also indicated that there is significant difference between the two categories in terms of frequency of use of the actors (neighbors / friends)as information source at 1% probability

level of significance. This result indicates that vegetable growers use formal networks as a source of information, while the non growers' source of information is mostly the informal networks such as neighbors and friends. Similar result was found regarding sex categories, as it is presented in Table 8.

Table 8 Distribution of actors as information source to the respondents (across sex category) in terms of their frequency of use (N=150)

Actors	Frequency of use	sex categories						χ^2 - value
		FHH		MHHs		Total		
		No	%	No	%	No	%	
WOOARD	Never	13	33.3	26	23.4	39	26.0	1.473NS
	Sometimes	18	46.2	59	53.2	77	51.3	
	Always	8	20.5	26	23.4	34	22.7	
Agricultural development agents	Never	13	33.3	15	13.5	28	18.7	7.475**
	Sometimes	6	15.4	23	20.7	29	19.3	
	Always	20	51.3	73	65.8	93	62.0	
Service cooperatives	Never	24	61.5	36	32.4	60	40.0	10.913***
	Sometimes	10	25.6	59	53.2	69	46.0	
	Always	5	12.8	16	14.4	21	14.0	
Farmers development groups	Never	17	43.6	40	36.0	57	38.0	0.702NS
	Sometimes	11	28.2	35	31.5	46	30.7	
	Always	11	28.2	36	32.4	47	31.3	
Neighbors or friends	Never	3	7.7	24	21.6	27	18.0	9.501***
	Sometimes	5	12.8	30	27.0	35	23.3	
	Always	31	79.5	57	51.4	88	58.7	
Input supplier organizations	Never	29	76.3	72	64.9	101	67.8	2.969NS
	Sometimes	9	23.7	33	29.7	42	28.2	
	Always	0	.0	6	5.4	6	4.0	

Source: own survey, 2008 ***, **, * = Significant at 1%, 5%, 10% probability level, NS=Non significant

The result of this study revealed that there is significant difference between FHHs and MHHs in using the actors such as development agents, service cooperatives, and neighbors or friends as a source of agricultural information. According to the result of this study, MHHs use DAs and service cooperatives as information source more frequently than the FHHs. The chi-square test ($\chi^2 = 7.475$, $P=.024$) for DAs and ($\chi^2 = 10.913$, $P=.004$) for service cooperatives indicates that the variation is significant at 5 % and at 1% probability level of significance. But in the case of neighbors or friends, according to the study, FHHs use these actors more

frequently than MHHs. As the chi-square test ($\chi^2 = 9.501$, $P = 0.009$) indicates that the variation between the sex categories in terms of using these actors as source of information is significant at 1% probability level. This indicates that FHHs are highly reliant on informal networks for information source, than MHHs which indicates their low level of contact with development agents and their low level of participation in cooperatives.

4.4. Relative importance of social networks as a source of inputs / technology, information and credit services

Relative importance of different actors as a source of inputs / technologies, information and credit services were analyzed in order to know the relative importance of different actors as a source of each resource or service for vegetable growers & non growers and FHHs and MHHs comparatively. The score of frequency of use of each actor by the respondent farmer was taken and ranking was made based on that. In this case, the actor which has higher score is taken to be the most important.

4.4.1. Relative importance of social networks as a source of inputs/ technology

The response analysis of Table 9 indicates that cooperatives, neighbors / friends and DAs respectively, were the most important actors as a source of technology for non growers. Whereas, in the case of vegetable growers cooperatives, DAs, input supplier organizations are found to be the most important source of technologies, respectively. As it can be clearly seen, neighbors or friends were among the most important sources of technology for the non growers compared with those of vegetable growers.

Table 9 Distribution of actors as technology source to the respondents (based on crop production category) in terms of their score and rank (N=150)

Actors	Frequency	Cereals and others				Vegetable			
		No	%	Score	Rank	No	%	Score	Rank
DAS	Never(0)	21	35.0			24	26.7		
	Sometimes(1)	26	43.3			47	52.2		
	Always(2)	13	21.7	52	3 rd	19	21.1	85	2 nd
Cooperatives	Never(0)	10	16.7			16	17.8		
	Sometimes(1)	18	30.0			10	11.1		
	Always(2)	32	53.3	82	1 st	64	71.1	138	1 st
Input supplier organizations	Never(0)	44	73.3			43	47.8		
	Sometimes(1)	13	21.7			36	40.0		
	Always(2)	3	5.0	26	4 th	11	12.2	58	3 rd
Neighbors or friends	Never(0)	16	26.7			60	66.7		
	Sometimes(1)	20	33.3			20	22.2		
	Always(2)	24	40.0	68	2 nd	10	11.1	40	4 th
Other farmers	Never(0)	35	58.3			55	61.1		
	Sometimes(1)	24	40.0			33	36.7		
	Always(2)	1	1.7	25	5 th	2	2.2	35	5 th

Source: own survey, 2008

Based on the qualitative information gained from different group discussions in this regard, the reasons for the difference of the rank of importance could be, regarding the neighbors / friends, because of the tradition of sharing of seeds of cereals or other food crops among farmers, which is not common in the case of seed of vegetables, because of its expensive cost. On the other hand, private input supplier organizations were found to be important for vegetable growers than non growers, because farmers commonly purchase different inputs needed for vegetable production from private input suppliers in the study area, because of the absence of on time input supply by the service cooperatives, as it is discussed previously. As a result, farmers are forced to buy the needed inputs from private shops. According to the farmers, purchasing different inputs from private shops is not advisable, and there are problems in relation to the quality(sometimes expired) and unfair price of inputs, but in order to use the critical time, for example sowing or planting (especially, during rainy season), they usually use private shops as a source of different inputs.

Regarding the sex categories, as it can be clearly seen from the table below, (Table 10), neighbors/ friends, DAs and cooperatives are the most important three actors in that order for FHHs as a source of technology. But for MHHs cooperatives, DAs and neighbors / friends are the most important three actors in that order mentioned as a source of technology. This variation of order of ranking indicates that women most of the time use informal networks to access resources, and thus they are the most important source of inputs for them, while men commonly use formal networks.

Table 10 Distribution of actors as technology source to the respondents (across sex category) in terms of their score and rank (N=150)

Actors	Frequency of use	Sex category							
		FHH				MHH			
		No	%	Score	Rank	No	%	Score	Rank
DAs	Never(0)	24	61.5			21	18.9		
	Sometimes(1)	7	17.9			66	59.5		
	Always(2)	8	20.5	23	2 nd	24	21.6	114	2 nd
Cooperatives	Never(0)	22	56.4			4	3.6		
	Sometimes(1)	12	30.8			16	14.4		
	Always(2)	5	12.8	22	3 rd	91	82.0	198	1 st
Input supplier organizations	Never(0)	26	66.7			61	55.0		
	Sometimes(1)	10	25.6			39	35.1		
	Always(2)	3	7.7	16	4 th	11	9.9	61	4 th
Neighbors or friends	Never(0)	15	38.5			61	55.0		
	Sometimes(1)	10	25.6			30	27.0		
	Always(2)	14	35.9	38	1 st	20	18.0	70	3 rd
Other farmers	Never(0)	26	66.7			64	57.7		
	Sometimes(1)	13	33.3			44	39.6		
	Always(2)	0	.0	13	5 th	3	2.7	47	5 th

Source: own survey, 2008

4.4.2. Relative importance of actors as a source of credit service

As it is clearly displayed in Table 11, the actors serving as credit providers for the sample respondents are service cooperatives, Dedit saving and credit institution and neighbors or friends. The most important actor for vegetable non growers is service cooperatives but in the

case of vegetable growers Dedebit saving and credit institution is very important, according to the sample respondents. This could be because of the reason that service cooperatives provide some inputs such as seed of Teff for example on credit, in the case of vegetables, there is no any input given on credit. The probable reason for vegetable growers to mention DSCI as the most important source of credit could be, vegetable growers have the tendency to take credit because they have the capacity to repay it back, given that they have better income than the non producers of vegetables. As a result, they can take credit from Dedebit saving and credit institution and purchase inputs they need.

Table 11 Distribution of actors as credit source to the respondents (across crop production category) in terms of their score and rank (N=150).

Sources of credit	Frequency of use	Crop production category							
		Cereals and others				Vegetable			
		No	%	Score	Rank	No	%	Score	Rank
Service cooperatives	Never(0)	30	50.0			52	57.8		
	Sometimes(1)	18	30.0			29	32.2		
	Always(2)	12	20.0	42	1 st	9	10.0	47	2 nd
Dedebit saving and credit	Never(0)	36	60.0			41	45.6		
	Sometimes(1)	23	38.3			42	46.7		
	Always(2)	1	1.7	25	2 nd	7	7.8	56	1 st
Neighbors or friends	Never(0)	49	81.7			75	83.3		
	Sometimes(1)	11	18.3			15	16.7		
	Always(2)	0	.0	11	3 rd	0	.0	15	3 rd

Source: own survey, 2008

Regarding the sex categories, as it can be clearly seen from Table 12, service cooperative is the most important source of credit for the MHHs, but for the FHHs Dedebit saving and credit institution is the most important actor as a source of credit. The probable reason for this could be that cooperatives give priority for their members for any service, and as it is found out by many researches, women have less participation in cooperatives than men. But in the case of Dedebit saving and credit institution, there is no any criteria to get credit if the farmer don't have any black list of credit previously.

Table 12 Distribution of actors as credit source to the respondents (across sex category) in terms of their score and rank (N=150)

Sources of credit	Frequency of use	Sex category							
		FHH				MHH			
		No	%	Score	Rank	No	%	Score	Rank
Service cooperatives	Never(0)	27	69.2			55	49.5		
	Sometimes(1)	11	28.2			36	32.4		
	Always(2)	1	2.6	12	2 nd	20	18.0	76	1 st
Dedebit saving and credit	Never(0)	26	66.7			51	45.9		
	Sometimes(1)	12	30.8			53	47.7		
	Always(2)	1	2.6	13	1 st	7	6.3	60	2 nd
Neighbors or friends	Never(0)	35	89.7			89	80.2		
	Sometimes(1)	4	10.3			22	19.8		
	Always(2)	0	.0	4	3 rd	0	.0	22	3 rd

Source: own survey, 2008

4.4.3. Relative importance of social networks as information sources

There can be many sources of information for different types of information, in relation to governmental or non governmental programs and activities along with their progress and future plan. Formal organizations and informal social networks are usually the most trusted sources of information. They are perceived by individuals to provide the most relevant information. The information provided by these networks is also perceived as being up to date. This sub section indicates how sample households perceived the importance of social networks (different actors) as sources of information. The result of this study in this regard is displayed in the Table below.

Table 13 Distribution of actors as information source to the respondents (across crop production category) in terms of their score and rank (N=150)

Actors	Frequency	Crop production category							
		Cereal and others				Vegetable			
		No	%	Score	Rank	No	%	Score	Rank
WOoARD	Never(0)	21	35.0			18	20.0		
	Sometimes(1)	31	51.7			46	51.1		
	Always(2)	8	13.3	47	4 th	26	28.9	98	3 rd
DAS	Never(0)	16	26.7			12	13.3		
	Sometimes(1)	9	15			20	22		
	Always(2)	35	58.3	71	2 nd	58	64.4	136	1 st
Service cooperatives	Never(0)	25	41.7			35	38.9		
	Sometimes(1)	26	43.3			43	47.8		
	Always(2)	9	15.0	44	5 th	12	13.3	67	5 th
Farmers development groups	Never(0)	23	38.3			34	37.8		
	Sometimes(1)	15	25.0			31	34.4		
	Always(2)	22	36.7	59	3 rd	25	27.8	81	4 th
neighbors or friends	Never(0)	1	1.73			26	28.9		
	Sometimes(1)	21	35			14	15.6		
	Always(2)	38	63.3	97	1 st	50	55.6	114	2 nd
Input supplier organizations	Never(0)	43	71.7			58	65.2		
	Sometimes(1)	15	25.0			27	30.3		
	Always(2)	2	3.3	17	6 th	4	4.5	35	6 th

Source: own survey, 2008

As it is displayed in Table 13, comparing the two production categories, neighbors/ friends, DAs and farmers development groups were found to be the most important sources of information for vegetable non growers. On the other hand, for the growers of vegetables, DAs, neighbors/ friends, and WOoARD were found to be the most important sources of information. The probable reason for the DAs to be the first important source of information could be that growing vegetables is an innovation for the area, there might be a need of frequent information to get better knowledge and produce more.

Regarding sex categories, the result of the study revealed that, there is a difference between sex categories in terms of the rank given to actors used as a source of information, as it can be seen from Table 14.

Table 14 Distribution of actors as information source to the respondents (across sex category) in terms of their score and rank (N=150)

Actors	Frequency	Sex of the respondent							
		FHH				MHH			
		No	%	Score	Rank	No	%	Score	Rank
WOoARD	Never(0)	13	33.3			26	23.4		
	Sometimes(1)	18	46.2			59	53.2		
	Always(2)	8	20.5	34	3 rd	26	23.4	111	3 rd
Agricultural development agents	Never(0)	13	33.3			15	13.5		
	Sometimes(1)	6	15.4			23	20.7		
	Always(2)	20	51.3	46	2 nd	73	65.8	169	1 st
Service cooperatives	Never(0)	24	61.5			36	32.4		
	Sometimes(1)	10	25.6			59	53.2		
	Always(2)	5	12.8	20	5 th	16	14.4	91	5 th
Farmers development groups	Never(0)	17	43.6			40	36.0		
	Sometimes(1)	11	28.2			35	31.5		
	Always(2)	11	28.2	33	4 th	36	32.4	107	4 th
Neighbors or friends	Never(0)	3	7.7			24	21.6		
	Sometimes(1)	5	12.8			30	27.0		
	Always(2)	31	79.5	67	1 st	57	51.4	144	2 nd
Input supplier organizations	Never(0)	29	76.3			72	64.9		
	Sometimes(1)	9	23.7			33	29.7		
	Always(2)	0	.0	9	6 th	6	5.4	45	6 th

Source: own survey, 2008

Based on the result of this study, neighbors / friends, DAs, and WOoARD are the most important sources of information for FHHs, while for MHHs DAs, neighbors/ friends and WOoARD are the most important sources of information in that order. This is because of the reason that FHHs are mostly reliant on informal networks to get information. Deribe (2007) also reported the same result that friends relatives are the most important source of information, since these sources are not only the most frequently used but also, the closest source of information for rural women.

4.5. The Influence of Social Networks on Decision to Grow Vegetable for Market by Households

Social networks could exert some social pressure on their members regarding their choice of crops to grow, in relation to their decisive role of being major source of resources and services

Networks with some members who have tried growing vegetables and benefited from it can give accurate information based on his / her experience and can definitely influence their members to try out the crops. On the other hand governmental or non governmental agents can also persuade and influence community members through different methods.

Table 15 Influence of others on decision to grow vegetable crops (N=90)

Actors	Mean rank	Ranked 1 st (%)	Ranked 2 nd (%)	Ranked 3 rd (%)	Ranked 4 th (%)	Ranked 5 th (%)	Ranked 6 th (%)	Overall rank
WOoARD	3.07	20.0	23.3	20.0	16.7	6.7	13.3	3
Service cooperatives	4.04	4.4	7.8	25.6	22.2	21.1	18.9	4
Farmers development groups	5.37	1.1	6.7	10.0	18.9	63.3	0	6
Agricultural development agents	1.62	62.2	26.7	5.6	1.1	1.1	3.3	1
Neighbors or friends	2.38	46.7	16.7	8.9	12.2	11.1	4.4	2
Input supplier organizations	5.08	0	0	10.0	11.1	40.0	38.9	5

As it can be clearly seen from Table 15, majority of the vegetable growers (62.2 %) reported that the major influence in order to grow vegetables by them was from agricultural development agents. Next to agricultural development agents, neighbors and / or friends were the second who influence them to grow vegetables. The remaining actors, WOoARD, service cooperatives, input supplier organizations (private shops) and agricultural development groups were mentioned as the 3rd, 4th, 5th, and 6th source of influence to grow vegetables.

According to the group discussions held among farmers, especially at the initial stage of the introduction of vegetable technologies, the role of agricultural extension agents were very great, as there were high resistance in the farming community regarding cultivation of vegetable crops. However, latter farmers started to learn from each other (from their neighbors and friends) and produce vegetables by their own decisions. More over there is high computation regarding producing vegetables for market this time.

4.6. Market linkage

Market is one of the most important preconditions in any technology take up in particular and economic development in general. Hence, investigating where the farmers sell their produces and knowing who their potential buyers are; along with the constraints faced by farmers in relation to market is very important to promote growing irrigation based high value vegetable crops. The result of this study is displayed in the table below.

Table 16 Market linkages (where and for whom the farmers sell their crops) by crop production categories. (N=150)

Potential buyers	Village / PA market		Woreda market		Mekelle	
	Cereals	Vegetables	Cereals	Vegetables	Cereals	Vegetables
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Not used	40(66.67)	32(35.6)	30(50)	73(81.1)	57(95)	83(92.2)
Farmers	-	-	1(1.7)	-	1(1.7)	-
Retailer(urban)	4(6.7)	3(3.3)	19(31.7)	4(4.4)	1(1.7)	-
Retailer (rural)	3(5.0)	6(6.7)	-	-	-	-
Wholesalers(urban)	1(1.7)	27(30)	1(1.7)	10(9)	-	-
Wholesalers(regional)	-	19(21.1)	-	-	-	7(7.7)
Consumer(urban)	-	2(2.2)	9(15)	3(3.3)	1(1.7)	-
Service cooperatives	12(20)	1(1.1)	-	-	-	-
Total	60(100)	90(100)	60(100)	90(100)	60(100)	90(100)

Source: own survey, 2008

As it is indicated in Table 16, sample respondents sell their produces in PA market or village, woreda market (Alamata) and regional market (Mekelle). According to the result of this study, 33.3 % of cereal producers in PA market and 64.4%, (the majority) of vegetable producers, sell their produces in village. In PA market, service cooperatives was mentioned as major market for 20% of cereal producers, while, in village wholesaler from urban and from regional were mentioned as the potential buyers market for 30% and 21.1% of the vegetable producers respectively. Only 6.7%, 5% and 1.7% of cereal producers reported that they sell their produces to retailer from urban, retailer from rural and wholesaler from urban in PA market respectively. On the other hand, only 3.3%, 6.7%, 2.2% and 1.1% of vegetable producers reported that they sell their produces to retailer in urban, retailer in rural, consumer in urban and service cooperatives respectively.

However, 50% of cereal producers and only 18.9 % of the vegetable producers were selling their produces in woreda market (Alamata). In this market center (woreda market), retailer in the urban was mentioned as potential buyer for 31.7% of cereal producers, while, wholesaler from urban was mentioned as a relatively potential buyer for 9 % of the vegetable producers. Only 1.7% of cereal producers reported that they sell their produces to farmers and wholesaler in urban in Alamata. On the other hand, only 4.4% and 3.3% of the vegetable producers reported that they sell their produces for retailer in urban and consumer in urban respectively. Moreover, only 5% of the cereal producers and 7.8% of the vegetable producers were found to be using the regional market as a major market. And the regional wholesalers were their buyers for both. In this study, it was found out that farmers sell their agricultural products not only in the aforementioned three major markets, but also in other alternative markets, such as in other neighboring woredas, including region three(Amhara region), although the number of respondents who use the alternative market places are very few.

4.7. Major constraints in relation to accessing input, information and credit for producing vegetables using irrigation

4.7.1 General constraints in relation to irrigation use

As it is displayed in Table 17 lack of access to irrigation was mentioned as a major problem by the majority of sample respondents (38.67%), in which it includes 45% of non growers and 34.4% of growers of vegetables.

Table 17 Constraints in relation to irrigation use.(N=150)

Constraints	Crop production categories					
	Cereals and others		Vegetable		Total	
	No	%	No	%	No	%
No constraint	18	30.0	10	11.1	28	18.7
Lack of access to irrigation water	27	45.0	31	34.4	58	38.67
Lack of marketing	4	6.66	27	30	31	20.67
Lack of transportation facilities	7	11.67	11	12.2	18	12
Lack of supply of chemicals on time	2	3.33	5	5.5	7	4.6
Lack of supply of appropriate seed variety on time	2	3.33	6	6.67	8	5.3

Source: own survey, 2008

Based on the group discussions and interviews held among different groups, lack of irrigation water is a serious problem in which it needs attention by the concerned bodies. Especially when the amount of rainfall in the rainy season is not sufficient, the amount of water from the highlands will be less in which it is difficult to distribute equally among the users of the water. Although the water is governed by the locally elected water use association leaders called “ABOMAY”, which means fathers of water in the local language, conflict occurs whenever lack of water for irrigation exists. According to the participants of the group discussion:

'The water use association (ABOMAY) is not functioning well and every farmer is not treated equally. This is due to the fact that the association has a corrupted network where favor and priority is given to farmers who are friends, relatives and/or to any farmer who is informally related to the members or leaders of the association. Otherwise, it is difficult to use the water any time our crop is in need of water, even if it's our turn to water our crop. Moreover the time which is allowed for each of us may not be sufficient.'

This problem is serious especially to women, specifically FHHs. Because, first as it can be understood from its naming, women are not included in the water use associations, even as a member. The primary reason justified by them is that, culturally, it is not common to include women in water use associations and secondly because it may be difficult for them to manage some jobs regarding water use, as there exists conflicts. Moreover, there is also a need to control the water use day and night which may not be accomplished by women. The focus group discussion among FHHs is summarized as follows:

'Being a women and producing vegetable is challenging at this time because in order to get the water at the time your crop is in need , you may require to pass through conflicts with other farmers and also follow up even at nights. Normally, because the amount of water increases during the night, most MHHs use this time preferably. Unfortunately, this is not suitable time for FHHs due to risks. For FHHs, watering even at the day time is difficult because of conflicts that usually happen as a result of blocking of water supply by other farmers who happen to be closer to the main source. At this point, our right to use the water is highly violated. So, in the first place we should participate in the water use association at least as a member, so that we may be able to protect our rights of water use evenly as the men do. Moreover, the water should be governed by government body so that every farmer will access it without any discrimination, including women.'

The other problem mentioned by them as a reason for the scarcity of water was technical problem. According to the focus group discussion of vegetable growers:

'There is technical problem with most of the check dams and channels done by the government bodies, especially at their head works. Most of the time there is a need to clean the sand dumped in the channels from the highlands. However, the sand is usually not cleaned at the right time, means before the rainy season comes, which makes difficult to use the water efficiently. This is a result of the absence of concerned body, which can collaborate and help us to do this task on time. This is also another issue in which the functionality of the water use association, 'ABOMAY' becomes questionable. But the major problem is the absence of participatory design and construction of the structures and as a result farmers are restructuring the out lays according to their convenience that the out lays should be.'

Marketing problems were also mentioned by some of the sample respondents (20.67%) in which, 6.66% and 30% of vegetable non growers and growers are included respectively. As it can be clearly seen in Table 17, majority of the sample households who mention lack of marketing as a constraint are vegetable producers. This could be because of the reason that vegetable needs huge market in addition to the local market and it is perishable as well. To elicit more information regarding marketing issues different group discussions were made. This will be discussed in the next part, constraints related to market, in order to avoid repetitions.

4.7.2. Constraints in relation to input use

As it can be clearly seen from the Table 18, according to the respondent farmers, among the constraints faced by the farmers in accessing different inputs, unavailability of the inputs on time was mentioned as the major one by the sample respondents (27.3 %) among which 10 % were vegetable non growers and 38.9 % were vegetable growers.

Table 18 Constraints faced by vegetable growers in using any package inputs for irrigation use (N=90)

Constraints	No	%
No constraint	28	31.1
Poor quality of seed	9	10
Unavailable on time	35	38.9
Source from far distance	8	8.9
Less extension support	5	5.5
Lack of equipment	5	5.5

Source: own survey, 2008

Group discussion was held among farmers regarding this issue and according to them:

‘Most of the time inputs, specifically those which are needed for vegetable production are not supplied to us at the critical time in which we have to sow / plant our crop. As a result, we are forced to buy inputs from private shops, which have its’ own impact in relation to quality. Sometimes, it may not be even available there unless we bring it from other far places including Addis Abeba. The same case happens regarding chemicals, where we face the risk of buying expired chemicals from the private inputs suppliers. These all are happening because of the inefficiency of the service cooperative to supply necessary inputs with the required quality, quantity and at the required time’.

4.7.3. Constraints in relation to credit use

As it can be clearly seen from Table 19, majority of the sample respondents reported that they don’t have constraint in relation to access to credit. However among the respondents who mentioned constraints, unable to pay down payment and high interest rate was the most important constrains among others, for the non growers, in which it contains 21.7% and 16.7%, respectively. This could be because these farmers are not involved in the production of

cash crops, and the interest rate may be too much for them and as a result they are not able to repay it. On the other hand, lack of credit was the most important constraint in relation to vegetable producers, which indicates that the vegetable producers are in need of additional credit. In the group discussion regarding this issue, farmers who produce vegetables complain that there is no credit service in the cooperatives for seed and other inputs needed for vegetable production, but there is indeed for cereals and other pulse crops.

Table 19 Constraints in accessing credit by the respondent farmers (N=150)

Constraints	Crop production categories					
	Cereals and others		Vegetable		Total	
	No	%	No	%	No	%
No constraint	20	33.3	55	61.1	75	50
Unavailable on time	7	11.7	9	10.0	16	10.7
Unable to pay down payment	13	21.7	8	8.9	21	14.0
lack of credit	4	6.67	16	17.8	20	13.3
High interest rate	10	16.7	2	2.2	12	8
Others	6	10.0	0	.0	6	4.0

Source: own survey, 2008

4.7.4. Constraints in relation to market

As it is presented in Table 20 majority of the vegetable non growers (88.3%) reported that they don't have marketing problems, although some of them mentioned far distance from market, market fluctuation and lack of market information as constraints. Regarding the vegetable growers', majority of them (66.7%) reported that they have constraints in relation to marketing issues. Among the constraints, unable to get alternative market and unable to get market information were mentioned by 24.4% and 16.67% of the growers, as the major problem.

Table 20. Constraints in relation to market (N=150)

Constraints	Crop production categories					
	Cereals and others		Vegetable		Total	
	No	%	No	%	No	%
No constraint	53	88.3	30	33.3	83	55.3
Unable to get market information	2	3.3	15	16.67	17	11.3
Far distance of market place	5	8.3	13	14.4	18	12
Unable to get alternative market	0	.0	22	24.4	22	14.67
Market fluctuation	0	6.7	10	11.1	10	6.67

Source: own survey, 2008

Different group discussions were held to get the maximum information in relation to market, especially regarding vegetable production. The group discussion among vegetable growers is analyzed and interpreted as follows:

‘Unable to get alternative market for our production is the most challenging problem we face when we produce vegetables. Most of us sell our vegetables in our fields, to wholesaler / middle men, mostly from far distance. They come with their vehicles and try to deal with us, but our bargaining capacity is very minimal when compared with those wholesalers, because first we will not have recent market information, even if we have the information we do not have the capacity to sell our product taking to the place in which we can get better market, because of lack of transportation facilities and also absence of storage technologies for the easily perishable nature of vegetables. Hence we don’t have choice other than selling by the price specified by the buyers, because of the nature of perishability of vegetables.’

According to the group discussions of the key informants:

'Selling price of vegetables is better now a days than the previous years mainly because concerned bodies such as union cooperatives, NGOs (ILRI/IPMS) and also administration office of the woreda are trying to do some activities in relation to market. For instance, they are working on creating awareness about the middle men among the farmers and also providing market information to farmers so that they will not be cheated by the middle men (brokers). But still, the middle man / wholesalers are the one who are benefiting more compared to the farmers, when the benefit is calculated in terms of the cost of the production the farmers expend, including their labour and time. All this is the consequence of the absence of alternative market'.

In addition, farmers face many challenges whenever they take their vegetable produces to other places in search of better market. Among the challenges faced by farmers in search of alternative market, according to the key informants, are summarized as follows:

'Last year (1999 E.C), there were some farmers who took the option of taking their vegetable to other alternative markets, so that they can earn better profit. For this purpose, they rented Isuzu truck and took their produces to Mekelle market. But, unfortunately, the reverse happened in such away that farmers were forced to sell with the price of the interest of the buyers. This happened because the brokers as well as wholesalers were already networked and they exchange information about the arrival of the farmers and wanted to discourage them from bringing their produces to cities. They did this to control the market price based on their own interests. As a result, every buyer was calling the same and unfair price and at last farmers were left with no option than selling it with the unfair price, where they came back with out any profit while some of them with loss. Therefore, farmers were discouraged and were forced to sell their vegetables in their fields at lower price to avoid such risks, even if they believe that they deserve better profit than the profit they are earning now.'

The above discussion indicates that farmers are facing many challenges in the production of vegetable crops for market purpose, but the need of alternative market is the most important burning issue and it shouldn't be left for tomorrow to solve. Otherwise, many farmers may become discouraged and discontinue the production of different vegetable crops.

Discussion was also held among non growers to find out why they prefer to produce only cereals with out any cash crops. Their discussion is summarized as follows:

'We know that vegetables are high value crops and they can give better profit from small piece of land compared to cereals. But there are a number of reasons for choosing cereal crops. In the first place, the water is not enough even for producing cereal crops. It is very risky to decide to grow vegetables with the water resource available now. Moreover vegetables are capital and labour intensive. They need technical knowledge and management skill to produce more. They have many risks in relation to production, storage and also marketing. Even after a lot of expenses, it is a matter of chance whether to get profit or not from producing vegetables. But in the case of cereals, even if loss happens, the level of risk is not the same as in vegetable production, because of many reasons. For instance, production cost is not comparable with the cost needed for vegetables; we can store cereals for a longer period and sell it when ever we like to sell, as there is no risk of perishability. Moreover cereals are useful for family food and animal feed. We can not live without cereals, but it is possible to live without vegetables, as we can not live eating vegetables and as well our animals. Generally, it is not bad producing vegetables in addition to cereals or other food crops, provided that there is permanent source of water for irrigation, easily access to inputs including chemicals and if we can be sure with the accessibility of market with fair price, otherwise it is difficult to decide to grow vegetables.'

4.8. Influence of Independent Variables on choice of Growing Vegetable Crops

4.8.1. Household personal and demographic variables

Age is one of the demographic factors that is helpful to illustrate households' personal situation and give indication about the age structure of the sample, along with the population. It is generally assumed that elder people have more farming experience which enables them to easily adopt new technologies and also because they have better involvement in different formal and informal groups, which helps them to easily access services and resources. On the other hand, vegetable production is capital and labour intensive enterprise. In addition, its nature of perishability and market fluctuations make it more riskier business. Because of their risk averting nature, elder people are usually hesitant to decide to adopt new technologies such as vegetable production. Based on the above controversial facts, age was hypothesized to have negative or positive relationship with vegetable production in irrigated fields.

Table 21 Association between age and choice of crops

Crop production category	N	Mean	S.D	t-value
Cereals and others	60	45.6	11.18	
Vegetable	90	39.86	8.47	
Total	150	42.15	10.01	3.59***

Source: own survey, 2008 *** = Significant at 1% probability level

As indicated in Table 21, the mean age of sample households was 42.15yrs with standard deviation of 10.01yrs. The maximum age for the sample farmers was 67 yrs while the minimum was 27 yrs. Result of mean test using independent sample test indicated that there was significant mean difference ($t=3.59$, $p=0.000$) among crop production categories at 1% probability level of significance implying the significant association of age with cultivation of vegetable crops. This result implies that, vegetable growers were found to be younger with the mean age of 39.86 years than non growers who were on average 45.6years.

The probable reason for this could be younger people are usually more likely to change their mind sets with new practices or ideas and thus they are better in making decisions, to try out

new technologies / practices, unlike the elder ones which usually are known for their conservative behavior.

Education of household head

Behavioral change is vital in making decisions to take up new technologies. In order to make a right decision, adequate information is needed. Education increases the likelihood of participating in formal organizations and thus acquiring information from formal sources, and it can lower the likelihood of relying on informal mechanisms of information exchange. In this study, education was expected to have positive relationship with decision of farmers to grow vegetable crops.

Table 22 Association between education level and choice of crops across crop production and sex categories.(N=150)

Cop production category	N	Mean	S.D	T-value
Cereals& others	60	1.67	2.36	
Vegetables	90	2.97	2.9	-2.877**
Sex category				
Female	39	1.05	2.03	
Male	111	2.94	2.86	-4.468***

Source: own survey, 2008 ***, ** = Significant at 1%. 5% probability level

The maximum educational achievement for the sample farmers was grade 12 while the lowest was 0. Considering the crop production categories, the mean years of schooling was 1.67 and 2.97 years with standard deviation of 2.36 and 2.9 for non growers and growers respectively. Result of t- test showed that there was significant mean difference ($t = -2.877$, $P = 0.005$) in education level between crop production categories at 5 % significance level. Similar result was revealed regarding sex categories. The mean years of schooling were found to be 1.05 and 2.94 years with standard deviation of 2.03 and 2.86 for FHHs and MHHs, respectively. Result of t- test showed that there was significant mean difference ($t = -4.468$, $P = 0.000$) in education

level between sex categories, favoring MHHs at 1% probability level of significance (Table22).

This clearly shows that, women are less educated than men, which have its own implication in their ability to communicate and the possibility to get information; and thus their decision making on choice of crops.

The finding of this study is in agreement with many of the previously conducted studies. For example, Ataklti (2008) have reported that better educated farmers are found to be involved in vegetable production.

Relating this result with social networks, education is the most significant correlate of social networks. Better educated people have more opportunities to participate in different formal and informal social networks which help them to have better access to information and other important resources and services. Putnam (1995) indicates that there is a strong positive relationship between levels of education and levels or stocks of social capital at individual and community levels.

Marital status of the household head

Marital status could have influence on participation in different social networks. Because married farmers will have social networks, not only with their own relatives / friends, but also with the relatives and friends of their husbands or wives, which could have its own contribution in encouraging individuals to participate in different formal and informal institutions. For instance, according to Dessalegn (2008), married women are likely to be active in collective decision-making meetings because they are better trusted and respected. They are also expected to influence higher-level decisions indirectly through their husbands and their own informal networks. Their marital status allows them access to more networks and thus enables them to generate more social capital. Hence, they could have better access to information and other relevant resources and thus to take up new practices such as vegetable crops production.

Table 23. Marital status of sample respondents across crop production (N=150)

Marital status	Crop production category				Total		χ^2 - value
	Cereal & others(n=60)		Vegetable(n=90)				
	No	%	No	%	No	%	
Single	28	46.7	28	31.1	56	37.3	3.723*
Married	32	53.3	62	68.9	94	62.7	

Source: own survey, 2008 * = Significant at 10% probability level

According to the result of this study (Table 23), there was significant difference between the marital status of vegetable growers and non growers. The chi-square test value ($\chi^2 = 3.723$, $P=.054$) assured that the variation is significant at 10 % probability level, which indicates married farmers are involving more in vegetable production than those of who are singles.

This could be because of the reason that, married respondents have relatively more social networks and better access to improved seed and other resources, services and also labour availability and exchange; than single, divorced and widowed respondents. As a result, those respondents with married household heads are likely to grow vegetable crops as compared to those with single, divorced and widowed household heads. Dessalegn (2008) found the same result in this regard.

4.8.2. Farm characteristics

Irrigable land size

Land is one of the most important resources for any economic activity mainly in rural areas for agricultural production since their livelihood is reliant on it. Farm size influences households' decision on choice of crops. The land which is on the hand of farmer could be of different types, of which total land owned is the major one. Total land owned is the land which is registered on the name of the farmer. Total cultivable land, in this study is total land size which is under cultivation by the farmer and could be owned, rented in or shared in land.

On the other hand, farmers could have irrigable land, which could be owned or rented in / shared crop in from others.

In the study area, vegetable production is carried out mainly under spate irrigation. However, a farmer's total owned land may not be irrigable, but some farmers may have large portion of their land in the fields where irrigation water can be accessed and vice versa. In this study, considering its importance to vegetable cultivation, only irrigable land size was taken and hypothesized. Hence, land holding specifically; irrigable land size was hypothesized to have positive and significant relationship with decision of households to grow vegetable crops.

Table 24 Association between mean land holding size and choice of crops (N=150)

Landownership	Categories	N	Mean	S.D	t-value
Crop categories					
Total land size owned	Cereals and others	60	3.53	2.04	
	Vegetable	90	3.36	1.97	.505NS
Total cultivable land	Cereals and others	60	6.063	3.32	
	Vegetable	90	6.79	4.19	-1.136NS
Total irrigable land	Cereals and others	60	3.78	2.54	
	Vegetable	90	3.76	3.52	.053NS
Sex categories					
Total land size owned	Female	39	3.45	2.09	
	Male	111	3.36	1.70	.252NS
Total cultivable land	Female	39	4.63	3.02	
	Male	111	7.16	3.93	-3.658***
Total irrigable land	Female	39	2.68	1.70	
	Male	111	4.149	3.45	-2.547**

Source: own survey, 2008 ***, ** = Significant at 1% and 5% probability level

The average land holding of sample population was found to be 3.43 timad (1 ha=4 timad). The minimum and maximum owned land for both growers and non growers were 0 timad and 8 timad, respectively. According to the result of this study, there is no statistically significant variation between crop production categories regarding the size of owned and total cultivable land.

Regarding sex categories, the result indicates that there is no variation in total land owned. But variation was found regarding the total cultivable land (owned, shared crop and rented in land size), which is found to be 4.63 and 7.16 timad for FHHs and MHHs respectively. The t-test result ($t=-3.658$, $P=0.000$) also revealed that the variation is strongly significant at 1% probability level of significance. This could be because of the reason that, total cultivable land in this study includes; land owned in addition to the shared crop in and rented in land by the household. Moreover sharing crop in and renting in land is not common by FHHs, rather they usually shared crop out or rent out their land because of lack of important resources such as labour, capital and oxen (Table 24).

Concerning irrigable land holding size, the average land size revealed from the study was 3.76 and 3.788 timad for vegetable non growers and growers respectively. This clearly shows that there is no significant difference between the two categories of crop production, which indicates irrigable land size is not decisive factor to grow vegetables. Similar result was found by Tadesse (2008).

Regarding the sex categories variation was found between the mean of total irrigable land, in which it was found to be 2.68 and 4.15 timad for FHHs and MHHs, respectively. The t-test result ($t=-2.547$, $P=0.012$) also indicate that there is significant difference at 5 % probability level of significance, between the mean of irrigable land size of MHHs and FHHs. This could be because of the reason that FHHs don't normally share in or rent in land, in case if they do not have their own irrigated land, which is common for MHHs (Table 24).

Land transaction

Land renting and crop sharing is a common practice to get irrigable land for cultivation of vegetable crops. Those farmers who have adequate amount of irrigable land are free from land rent costs. Likewise, a farmer who has large irrigable land can rent out part of his irrigable land to others to fetch money that can be used to purchase farm inputs for vegetable production. On the other hand, a farmer who does not have his/ her own irrigable land may

rent in irrigable land from others to cultivate vegetables. Share cropping is also another strategy used by the farmers who have no irrigable land for vegetable production.

Table 25 Relationship between land transaction and choice of crops (N=150)

Land transaction types	Responses	Crop production category				Total	
		Cereals & others		Vegetable		No	%
		No	%	No	%		
Shared crop out & rented out land	Yes	13	21.7	5	5.6	18	12.0
	No	47	78.3	85	94.4	132	88.0
	Total	60	100.0	90	100.0	150	100.0
Shared and rented in land	Yes	35	58.3	65	72.2	100	66.7
	No	25	41.7	25	27.8	50	33.3
	Total	60	100.0	90	100.0	150	100.0

Source: own survey, 2008

According to the result of this study (Table 25), 12% and 66.7% of the total sample households were found to be involved either in sharing crop out / rent out their land or shared crop in/ rented in others' land. Among the non growers, 21.7% of them were found either shared crop out or rented out their land and 58.3% of them were involved either in sharing crop or rent in others' land. On the other hand, among the vegetable growers, only 5.6% of them either shared crop out or rent out their lands, and 72.7% of them are involved in either sharing crop or rent in others' land. This result shows us clearly that vegetable producers share in or rent in others lands, while cereal producers are involved more in sharing crop out or rent out their own land. This could be because of the reason that vegetable growers are in a better economic condition and they can afford the cost for renting in and also for sharing crop in as a result of better livestock ownership. On the other hand, the non growers may prefer to be benefited from renting or sharing out their lands because of scarcity of capital and other important resources.

4.8.3. Household economic variables

Livestock holding

Livestock holding is an important indicator of household's wealth status in rural areas. It also serves as an important source of cash. Since vegetable production is capital-intensive business, initial financial capacity is vital and livestock could be used as one of the important financial sources to begin with. Based on this assumption, this variable was hypothesized to have positive and significant relation with decision of farmers to cultivate vegetables.

Table 26 Association between mean livestock ownership (in TLU) and choice of crops

Categories	N	Mean	S.D	t-value
Crop production category				
Cereals and others	60	4.59	3.38	
Vegetable	90	5.21	4.42	
Total	150	4.96	4.03	-.912NS
Sex category				
Female	39	2.87	2.57	
Male	111	5.70	4.20	
Total	150	4.96	4.03	-3.938***

Source: own survey, 2008 ***= Significant at 1 %probability level, NS=Non significant

As it can be seen in Table 26, based on the result of this study, the mean livestock holding of the sample population was 4.96 in TLU. On average vegetable growers have more number of livestock population, 5.21 in TLU as compared to the non growers who have about 4.59 in TLU. However, independent sample test showed that the mean difference of livestock number was not significant between vegetable growers and non growers. But with regard to sex categories, there was variation among households regarding possession of livestock. According to the results revealed by this study, the average livestock holding of MHH was 5.70, where as that of FHH was found to be 2.87 in TLU. This figure clearly shows that there is high disparity between MHH and FHH in their ownership of livestock. The t-test revealed that ($t=-3.938$, $P=.000$) there is significant variation between sex categories at 1% probability level of significance, regarding livestock ownership. This could be because of the low economic level of women farmers to own such important assets in the rural households.

Labor availability

Vegetable production is a labor-intensive agricultural sector. A household with large working labor force can easily manage this agricultural sector with a relatively minimum production cost, as there may not be extra cost for hiring additional labour force. Therefore, it was hypothesized to have positive and significant relationship with decision of choice of cultivation of vegetable crops by farmers.

Table 27 Association between mean score of labor availability (in man equivalent) and choice of crops.

Categories	N	Mean	S.D	t-value
Crop production category				
Cereals and others	60	1.71	1.91	
Vegetable	90	1.92	1.09	
Total	150	1.84	1.03	-1.237NS

Source: own survey, 2008, NS=Non significant

In this study, household labor availability had no significant relationship with vegetable farming. This is evident from non- significant mean difference between vegetable growers and non growers in availability of household labor, in which it was found to be 1.71 and 1.92, respectively in man equivalent. The t- test result assured the absence of significant association of the variable with vegetable cultivation. Table27. The same result was found by Ataklti (2008) also.

Labour shortage

Farmers may face labour shortage problem in vegetable production. They use different solutions to solve this problem, among which hiring labour, asking for cooperation are the most common in addition to household labour.

Table 28: Distribution of sample respondents by labour shortage and solution practiced

Labour shortage problem	No	%
No	14	9.3
Yes	136	90.7
Total	150	100.0
Solution to labour shortage problem		
Hiring labour	48	35.3
Mutual for cooperation	32	23.5
Both hiring and cooperation	54	39.7
Others	2	1.5
Total	136	100.0

Source: own survey data, 2008.

Concerning this study (Table 28), the result from the survey shows that from the total sample respondents only 9.3% responded that they don't face labour shortage problem. While the majority, which is 90.7% responded that they face labour shortage problem, in which 35.3, 23.5, 39.7 and 1.5% of them use hiring labour, mutual for cooperation, both hiring labour as well as asking for cooperation and other solutions are taken respectively for the labour shortage problem. In the area, use of hired labor is a common practice not only in vegetable production but also in other crop production activities. Regarding vegetable production, the involvement of household labor is minimal as compared to the huge amount of labor force that vegetable production requires, which indicates that there is a lot of task to do to change the culture of farmers in the area to use their own available labour efficiently.

Farm income

Income level is one of the most fundamental factors determining farmers' decision to choose vegetable production. Income of the household obtained from sale of crops, livestock and livestock products, after the household consumption requirement is met could be used for purchasing different farm inputs. Cultivation of vegetable crops is known for its high production cost. Due to this, vegetable grower households need to have the required financial capacity to run the activities. Therefore, a household with relatively higher farm income was expected to better involve in vegetable cultivation.

Table 29 Association between annual income and choice of crops of the respondent farmers (N=150)

Income	Categories	N	Mean	S.D	t-value
Crop production category					
Farm income	Cereals and others	60	2323.5	2084.29	
	Vegetable	90	8651.55	6996.34	-8.061***
Off farm income	Cereals and others	60	670.17	572.95	
	Vegetable	90	796.17	1628.56	-0.575NS
Non farm income	Cereals and others	60	169.00	753.59	
	Vegetable	90	2208.21	15178.009	-1.039NS
Total income	Cereals and others	60	3114.17	2403.12	
	Vegetable	90	11524.82	17105.73	-4.597***
sex category					
Farm income	Female	39	4129.32	4694.89	
	Male	111	6819.88	6747.27	-2.300**
Off farm income	Female	39	671.77	775.13	
	Male	111	771.77	1454.98	-4.09NS
Non farm income	Female	39	307.18	963.69	
	Male	111	1773.86	13681.09	-6.67NS
Total income	Female	39	4825.96	4711.44	
	Male	111	9332.17	15811.31	-1.749*

Source: own survey, 2008 ***, **, * = Significant at 1%, 5%, 10% probability level, NS= Non significant

According to the result of the study, the average annual farm income of the sample households was 6120.33 ET birr. The maximum annual farm income was 37, 250.00 ET birr while the minimum was 0. As it is indicted in Table 29, on average vegetable growers had higher annual farm income, 8651.55ET birr as compared to non growers who on average had only 2323.51 ET birr. T-test of mean of annual farm income had also indicated that there was significant mean difference ($t=-8.061$, $P=.000$) between growers and non growers, at 1 % probability level of significance (Table 29).

Regarding FHHs and MHHs sample respondents, the mean annual farm income were 4129.32ETB and 6819.88 ETB respectively. As it is clearly seen in Table 29, MHHs mean annual on-farm income was greater and there was significant mean difference between the annual farm income of both sex categories ($t= -2.300$, $P= .023$) at 5% probability level of significance.

Off-farm income

Based on the result of this study, the average annual off farm income of the sample households was 745.77 ET birr. The maximum annual off farm income was 14,600.00ET birr while the minimum was 0. As it is indicted in Table 29, the annual off farm income of vegetable growers was found to be 796.17ET birr, while that of non growers was found to be 670.17 ET birr. The t-test of mean of annual off farm income had indicated that there was no significant mean difference ($t=-0.575$, $P=.566$) between growers and non growers, which shows that contribution of off farm income is not as such decisive factor for growing vegetables.

Regarding FHHs and MHHs sample respondents, the mean annual off farm income was 671.77 ETB and 771.77 ETB for FHHs and MHHs respectively. However the t- test result revealed that there was no significant difference between both sex categories (Table29).

Non- farm income

Considering the non farm income, according to the result of this study, the average annual non farm income of the sample households was 1392.53ET birr. The maximum annual non farm income was 144,000.00 ET birr while the minimum was 0. As it can be seen from Table 29, on an average, vegetable growers had higher annual non farm income 2208.21ETB as compared to non growers who on an average had only 169 ETB. However, t-test of mean of annual non farm income had indicated that there was no significant mean difference ($t=-1.039$, $P=.301$) between growers and non growers, which shows that contribution of non farm income is not critical issue for growing vegetables.

Regarding FHHs and MHHs sample respondents, the mean annual non farm income were 307.18ETB and 1773.86 ETB, respectively. MHHs mean annual non farm income was greater however; the t- test result revealed that there is no significant difference between both sex categories in this regard (Table 29).

Generally, according to the result of the study, the average annual total income of the sample households was 8160.56 ET birr. The maximum annual total income was 155760.00 ET birr while the minimum was 0. On average vegetable growers had higher annual total income (11524.81ET birr) as compared to non growers who on average had only 3114.17ET birr. T-test of mean of annual total income had also indicated that there was significant mean difference ($t=-4.597$, $P=.000$) between growers and non growers, at 1% probability level of significance. Regarding sex categories, the mean annual total income was 4825.96 ETB and 9332.17ETB for FHHs and MHHs respectively. The t- test result ($t= -1.749$, $P= .082$) also revealed that the difference between sex categories, regarding total income is significant at 10 % probability level of significance (Table 29).

From the results of the study, we can conclude that lower income group of the society face difficulty to grow vegetable crops. This implies the need to support lower income groups through different mechanisms such as through targeted credit schemes in the study area.

4.8.4 Institutional factors

Institutional factors are one of the major factors that influence decision of choice of crops of farmers. Institutional factors in the context of this study include support provided by various institutions and organizations to enhance the adoption of cultivation of vegetable crops, such as extension and credit services.

Contact to extension agent

Farmers' decision making regarding crop choice is influenced by access to information amongst other things. There may be multiple sources of information to farmers. However, extension agents are one of the most known actors as a source of information. Hence, contact with extension agents along with its frequency of contact was expected to positively influence farmers' decision to grow vegetable crops. The score for frequency of contact with extension agent was calculated on the basis of scores given for the frequency of contact in which farmers have with extension agent. Score of zero was given for having no contact with extension agent, score of 1 was given for those who have contact once in a year, 2 was given

for those who have monthly contact with extension agent, score of 3 was given for those who have bi-weekly contact with the agents and a score of 4 given for those having weekly contact with the agent. Accordingly, the maximum score to be achieved by a farmer was 4. The result of this study is displayed in Table 30.

Table 30 Relationship between frequency of contact with extension agents & choice of crops across crop production categories (N=150)

Frequency of DA Contact	Crop production						χ^2 - test
	Cereals & others		Vegetable		Total		
	No	%	No	%	No	%	
Never	23	38.3	7	7.8	30	20.0	
One times per year	27	45.0	52	57.8	79	52.7	
Monthly	5	8.3	8	8.9	13	8.7	
Two times per month	5	8.3	10	11.1	15	10.0	
Weekly	0	0.0	13	14.4	13	8.7	26.879***

Source: own survey, 2008 ***= Significant at 1% probability level

The relationship between frequency of extension contact and choice of cultivation vegetable crops was found to be significant as shown in Table 30. From the total sample households, 20 % reported that they don't have contact with extension agent, while 80 % of sample households were reported having contact with the extension agent at different level of frequency. From the non grower groups, 38.3 % of respondents did not have any contact with extension agents. While from the growers only 7.8 % reported the same case. The chi-square analysis result ($\chi^2 = 26.879$, $P=.002$) shows significant association between frequency of contact of extension agent and vegetable farming at 1% probability level of significance. The probable reason for this could be vegetable cultivation is an enterprise which needs frequent information and technical know how, compared to other cereal crops, in relation to its production, storage, marketing and other related management tasks. Hence frequent contact with experts is decisive to be involved in vegetable production.

Table 31 Relationship between frequency of contact with extension agent & choice of crops across sex category (N=150)

Frequency of DA Contact	Sex category						χ^2 - test
	FHHs		MHHs		Total		
	No	%	No	%	No	%	
Never	18	46.2	12	10.8	30	20.0	
One times per year	16	41.0	63	56.8	79	52.7	
Monthly	1	2.6	12	10.8	13	8.7	
two times per month	2	5.1	13	11.7	15	10.0	
Weekly	2	5.1	11	9.9	13	8.7	23.658***

Source: own survey, 2008 ***= Significant at 1% probability level

Regarding the sex categories (Table 31), a significant difference was found between FHHs and MHHs, in relation to frequency of contact with extension agents. The chi-square result ($\chi^2 = 23.658$, $P = 0.000$) shows the variation between the sex categories is strongly significant at 1% probability level of significance favoring MHHs.

The probable reason for this significant difference could be because; FHHs use informal networks such as friends and relatives to access information, in most cases. Moreover, development agents are not giving special attention to improve involvement of FHHs in agricultural extension activities. Deribe (2007) found similar result regarding the use of informal network for accessing information, by women.

Distance to the main road

It is a continuous variable and measured in kilometer. It refers to the total distance between the farmers' residence and the nearest main road. It indicates access to market to buy input and/or sell out put. As the household is near (closer) to a main road, the higher will be the chance of getting better market. As a result farmers who are nearer to main road are expected to grow vegetable crops, which are known for their easily perishable nature. It is also about securing information at market place. Therefore, it is hypothesized that distance from home to the nearest road to market will influence the probability of decision of farmers' to cultivate vegetable crops negatively. The survey result is as presented in Table 32.

Table 32 Association between distance to the nearest main road and choice of crops (N=150)

Variable	Categories	N	Mean	SD	t- value
Distance to the nearest road to main market	Cereals and others	60	4.12	3.13878	.516NS
	Vegetables	90	3.8	3.67012	

Source: own survey, 2008, NS= Non significant

According to the result, there is a mean difference of distance to the nearest road to market, which was found to be 4.12 and 3.8 kms for non growers and growers of vegetables respectively. However, the t-test revealed that there was no significant difference between the crop production categories.

Cosmopoliteness

This is the degree of orientation of the respondents towards outside the social system to which the individual belongs. It is measured in terms of frequency of visits to the nearby town. Cosmopoliteness is expected to have positive relationship with the dependant variable since it provides more chance of exposure to external information, resources and services.

Table 33 Relationship between cosmopolitnness & choice of crops by sample respondents (N=150)

Cosmopolitnness	Crop production category						Sex category					
	Cereals		Vegetables		Total		Female		Male		Total	
	N _o	%	N _o	%	N _o	%	N _o	%	N _o	%	N _o	%
Never	1	1.7	0	0	1	0.7	1	2.6	0		1	.7
Sometimes	37	61.7	54	60	91	60.7	29	74.4	62	55.9	91	60.7
Once a week	20	33.3	29	32.2	49	32.7	9	23.1	40	36	49	32.7
Most often	1	1.7	5	5.6	6	4	-	-	6	5.4	6	4
Daily	1	1.7	2	2.2	3	2	-	-	3	2.7	3	2
Total	60	100.1	90	100	150	100.1	39	100	111	100	150	100
X ² -value	2.947NS						9.121*					

Source: own survey, 2008 * = Significant at 10 % probability level, NS= Non significant

It can be seen from Table 33 that 0.7% of the respondents never visited the near by town while the rest 60.7, 32.7, 4, and 2% of total sample households visited the nearby town sometimes, once a week, most often and daily respectively. However the chi-square test ($\chi^2=2.947$, $P=.567$) was not significant for crop production categories. But between sex categories, there was significant variation regarding their habit of visiting to the nearest town. The chi-square test ($\chi^2= 9.121$, $P=.058$) revealed that their relation ship is significant at 10 % probability level significance. The probable reason for this could be because of the multiple responsibilities of women in side their houses, which limits the possibility of their exposure to external environment and thus the possibility of getting new information.

Attending Extension events

This variable considers participation of respondents in different extension events. Farmers need to be equipped with knowledge and skill about a specific technology / practice, to use the technology efficiently and effectively. There are different methods of transferring knowledge to farmers, to make them well skilled and have better performance about that specific technology. Training, field days, demonstration and extension exhibition are the most common types of extension events to introduce farmers about new practices. A study conducted by Kansana *et al.* (1996) indicated that participation in training, access to communication sources and number of information sources had significant association with level of knowledge of improved varieties. Result of this study is presented in Table 34 below.

Table 34 Relationship between participation in different extension events and choice of crops (N=150)

Categories		Trainings		Farmers field days		Extension demonstration		Extension exhibition	
		Yes		Yes		Yes		Yes	
		No	%	No	%	No	%	No	%
Crop production category	Cereals & others	12	20.0	6	10.0	2	3.3	5	8.3
	Vegetable	34	37.8	27	30.0	22	24.4	19	21.1
	Total	46	30.7	33	22.0	24	16.0	24	16.0
	χ^2 -value	5.351**		8.392***		11.938***		4.373**	
Sex category	Female	8	20.5	4	10.3	2	5.1	4	10.3
	Male	38	34.2	29	26.1	22	19.8	20	18.0
	Total	46	30.7	33	22.0	24	16.0	24	16.0
	χ^2 -value	2.556NS		4.236**		4.635**		1.294NS	

Source: own survey, 2008 ***, ** = Significant at 1%, 5%, probability level, NS=Non significant

Training is one of the most important methods to improve farmers' performance. A farmer who has more opportunity to get training will be able to expose him / her to new and relevant information along with the technical know how about a specific technology, which helps him/her to try out new innovations. If farmers are well trained about new practices, they can properly implement the recommendation. According to the results of this study, out of total 150 farmers interviewed, only 30.7% of them were found to attend training and the rest 69.3% did not attend in the program. Comparing the non growers with the growers 20% and 37.8% were found to be participated in the program respectively. The chi-square test was used to see the significance of the relationship of the variable with vegetable cultivation and the result ($\chi^2 = 5.351$, $P = 0.021$) indicated that there is significant difference between the two crop production categories at 5% probability level.

Field days

Field day is undertaking field trial on ones farm and it is one of the most known methods of transfer of information about certain new practices or technologies. Arranging field days on farmers' field is influential way of convincing other farmers about certain practices such as growing vegetable crops, since farmers can clearly observe and easily understand about the new practice from their neighboring farmers in the field days.

Table 34 clearly indicates that, from the total sample households 22 % of farmers have attended field days while majority of the farmers 78 % did not attend in field day program. Across the crop production categories, 10 and 30 % of the non growers and growers of vegetables respectively had opportunity to participate in field days. The chi-square analysis showed ($\chi^2=8.392$, $P=.004$) that there existed a significant relationship between participation in field days and growing vegetable crops at 5 % probability level. Across the sex categories, the result of the study revealed that only 10.3% of FHHs had the opportunity to participate in field days. Whereas among the MHHs 26.1% of them were able to participate in field days. This clearly shows the gap of participation in field days between the sex categories. Furthermore the chi-square test ($\chi^2= 4.236$ $P=.040$) also revealed that there is a significant difference between FHHs and MHHs at 5% probability level of significance, with regard to participation in field days.

Demonstration is creating a specific learning site for a community in which farmers are able to learn from practical trials undertaken by extension experts. As an extension event, demonstration is a very effective way of transferring knowledge and skill to farmers, because farmers can learn by seeing practically from the trial. This helps new technologies to be diffused easily with a relatively better pace. Concerning the results of this study, only 16 % of the total sample respondents had participated in extension demonstration, the rest 84 % had not got the opportunity to participate in the program. Comparing vegetable growers and non growers 24.4 % and 3.3 % of them respectively had an opportunity to participate in extension demonstration. This figure clearly shows the significant difference between the two groups. The chi-square test ($\chi^2 =11.938$, $P=.001$) also indicates that there is significant difference between growers and non growers of vegetables regarding participation in extension demonstration, at 1 % probability level of significance. Regarding the sex categories, among the FHHs only 5.1 % of them were able to get the opportunity to participate in demonstration, while among the MHHs 19.8 % of them were participated in this event. This can evident the gap between the two sex categories. The chi-square test ($\chi^2=4.635$, $p=.031$) also indicates there is significant difference between MHHs and FHHs with regard to participation in demonstration, at 5 % probability level of significance.

Extension exhibition

This is also one of the most relevant extension events which is helpful for creating awareness and introduce new agricultural practices to farmers. According to the results of the study, majority of the sample respondents 84 % were not able to participate in extension exhibitions. Among the vegetable growers 21.1 % of them were participated in extension exhibition, but only 8.3 % of the non growers were able to participate in the program. Based on the chi-square value ($\chi^2=4.373$, $P=.037$), there is a significant different between vegetable growers and non growers at 5 % probability level of significance, concerning the participation in extension exhibition, which implies the importance of the event for farmers to decide to try out new practices. Regarding sex categories, there was no statistically significant difference between MHHs and FHHs in relation to participation in extension exhibition.

To see the total score of participation of sample respondents in extension events, the variable was measured by giving scores to respondent farmers' participation in the four extension events namely training, field visit, conducting demonstration and participating in extension exhibition. Farmers' attendance was valued out of the total score of 4 which was assigned for each event. Accordingly, total attendance in extension events constitutes a total score of 16. A farmer who had attended four times in each extension event was given maximum score of 4, while those who attended three times in an event was given score of 3, those who attended twice in the extension event were given score of 2, those who attend once were given 1 and those of farmers who did not attend in any of the events were given a score of 0. Finally, respondent farmers' total attendance in extension events was taken as a sum of a score for each event. The result on mean score achieved from attendance in extension events across crop production and sex categories is provided in Table 34.

Table 35 Association between mean score of participation in extension event and choice of crops

Crop production					
Variable	category	N	Mean	S.D	t-value
Score of extension event	Cereals & others	60	1.67	3.14975	
	Vegetable	90	4.5	4.91547	-4.352 ***
Sex category					
Score of extension event	Female	39	1.8462	3.76646	
	Male	111	3.9279	4.63918	-2.524**

Source: own survey, 2008 ***, ** = Significant at 1% 5% probability level

As it can be clearly seen from table 35, there is significant difference between non growers and growers regarding the total mean score of participation in different extension events, which is found to be 1.67 and 4.5, respectively. The t- test result ($t = -4.352$, $p = 0.000$) indicates there is significant difference between non growers and growers of vegetables, regarding participation in extension events at 1 % probability level of significance. This shows the relevance of such extension events to facilitate decision of farmers to grow high value crops, such as vegetables. Similarly, regarding the sex categories, significant difference was found ($t = -2.524$, $p = 0.013$), at 5 % probability level of significance. This indicates that, the concerned bodies are not giving attention to FHHs, while providing such services to farmers.

Different actors were mentioned by the respondents with regard to arranging the events. The result of the study is displayed in Table 36, below.

Table 36 Actors mentioned by the sample respondents in the arrangement of extension events

Actors who arrange the events	Training		Field days		Demonstration		Extension exhibition	
	No	%	No	%	No	%	No	%
WOoARD	27	58.69	27	81.8	14	58.3	17	70.8
Alamata Research center	1	2.1	2	6.3	1	-	-	-
DAs	2	4.3	-	-	9	4.2	-	-
NGOs	-	-	1	3.1	-	37.5	2	8.3
Others	2	4.3	3	9.4	-	-	5	20.8
1 and 3	14	30.04	-	-	-	-	-	-
Total	46	100	33	100	24	100	24	100

Source: own survey, 2008

Regarding the actors mentioned by the respondent in arranging this training, among the sample respondents who had access to the event, 58.69 % mentioned WOoARD as a training provider for them. Moreover, 30.04% of the sample respondents mentioned both WOoARD and DAs as at training provider for them. The remaining actors which are Alamata Research Center, agricultural development agent were mentioned as training providers only by 2.1 %, 4.3 % of the respondents, respectively. The remaining, 4.3 % of the sample respondents were given training by other actors such as regional bureau of agriculture and rural development.

In the case of field days, among the sample respondents who had access to participate in the event, WOoARD was mentioned by 81.8% of them as a provider of the event. Alamata Research Center, NGOs and other actors such as regional bureau of agriculture and rural development were mentioned only by 6.3%, 3.1%, and 9.4% of the respondents respectively.

Among the sample respondents who had an opportunity to participate in demonstration, 58% and 37.5% reported that they participated in a demonstration arranged by WOoARD and agricultural development agent respectively. Alamata Research Center was also mentioned by 4.2% of the sample households.

Regarding the extension exhibitions and the contribution of the actors, according to the result of the study, WOOARD, NGOs and others such as regional bureau of agriculture and rural development were mentioned by 70.8 %, 8.3 % and 20.8 % of the sample respondents in which they had a chance to participate in extension exhibitions.

Generally this study shows that WOOARD is the most important actor in arranging different extension events for the sample respondents, on the other hand the other actors such as for example Alamata research center are not contributing as much as it is expected from them, regarding improving the skill and capacity of farmers.

Mass media exposure

Farmers' decision of choice of crops is influenced among other things by access to information. There can be multiple sources of information to farmers in which mass media are one of them. Mass media play an important role in providing information in a relatively shorter time period and can cover a large area at the same time. It may not be effective method to bring behavioral change but can be used to create awareness about new technologies and ideas which is a prerequisite for behavioral change. In this study farmers' exposure to mass media was measured by considering four different types of media, which are, reading news paper, listening to radio, watching television, and listening to news paper discussion from kebele administrators. Hence, respondent farmers' exposure to mass media was measured on five-point scale with a maximum 4 point value of each media. Total mass media exposure constituted a total score of 16 which is a sum total of the value of the four medias. Mass media exposure was expected to positively influence decision of farmers to cultivate vegetable. Result of this study in this regard, is displayed in Table 37.

Table 37 Relationship between mass media exposure and choice of crops by sample respondents

Type of mass media	Response	Crop production category						χ^2 -value
		Cereals & others		Vegetables		Total		
		No	%	No	%	No	%	
Reading news paper	Yes	22	36.7	30	33.4	52	34.7	.177NS
Radio	Yes	9	15.0	27	30.0	36	24.0	4.441**
Television	Yes	4	6.7	8	8.9	12	8.0	.242 NS
Listening news paper discussion	Yes	25	41.6	25	27.7	50	33.3	.043NS

Source: own survey, 2008 ** = Significant at 5% probability level, NS=Non significant

As it can be seen from Table 37; 34.7, 24, 8 and 33.3 % of the total respondents have the habit of reading news paper, listening to radio programs, watching television and listening news paper discussion from kebele administrators respectively. Regarding crop production categories significant difference is revealed only in the case of listening radio programs in which only 15% of non growers & 30 % of vegetable growers are found to be listeners of the program. The chi- square was used to see the significance of the relationship. Likewise the result ($X^2= 4.441$, $P=.035$) was found to be significant at 5 % probability level of significant.

Table 38 Association between mean score of mass media exposure and choice of crops.

Crop production category	N	Mean	S.D	t- value
Cereals and others	60	2.38	2.27	
Vegetables	90	3.11	3.30	-1.490NS

Source: own survey, NS= Non significant

Regarding the total score of mass media exposure, as it is presented in Table 38; there is a difference between the mean score of mass media exposure of non growers and growers of vegetable. The mean score is found to be 2.38 and 3.11, respectively, at respective standard deviations of 2.27 and 3.296. However, t-test was used to see the significance of the relationship between mass media exposure and vegetable farming. The result ($t=-1.490$, $P=.138$) shows that the relationship is not statistically significant. The probable reason for this

non significant result could be absence of media which contain relevant information for the farming community especially; in relation irrigation based vegetable crops production.

Access to credit service

In rural areas, financial limitation is one of the common problems facing farmer's decision of choice of crops. This problem is relatively more critical particularly for vegetable grower farmers because, vegetable production is highly capital intensive than other crops. A farmer who has access to credit can overcome his/her financial constraints and can purchase various inputs required for his farm production. A farmer without cash and at the same time have no access to credit will find it very difficult to produce capital intensive crops such as vegetable crops. Based on this argument, access to credit was hypothesized to have positive relationship with choice of vegetable crops by farmers.

Table 39 Relationship between access to credit and choice of crops

Access to credit	Crop production category						χ^2 -value
	Cereals & others		Vegetables		Total		
	N _o	%	N _o	%	N _o	%	
No	33	55	38	42.2	71	47.3	2.358 NS
Yes	27	45	52	57.8	79	52.7	
Total	60	100.0	90	100.0	150	100.0	
Access to credit	Sex of respondent:						
	Female		Male		Total		
	N _o	%	N _o	%	N _o	%	
No	26	66.7	45	40.5	71	47.3	7.902*
Yes	13	33.3	66	59.5	79	52.7	
Total	39	100.0	111	100.0	150	100.0	

Source: own survey, 2008 * = Significant at 10 % probability level, NS Non significant

In this study as it is indicated in Table 39 the result was found to be against the hypothesized proposition. The result of the chi-square test ($\chi^2=2.358$ $p= 0.125$) revealed that there is no

significant difference between crop production categories, in relation to access to credit. On the other hand, significant difference was found between household categories, in which the chi-square result was ($\chi^2 = 7.902$, $P = 0.005$) found to be significant at 5 % probability level of significance. This indicates that FHHs have less access to get credit services may be because of their low socio economic conditions to repay down their loan and also to take risks.

Social participation

Participation in social organization is expected to have an indirect influence on decision behavior of choice of crops of farmers. It helps individuals to be exposed to new ideas and practices. This exposure make them positively predisposed towards innovative ideas and practices.

The total score of social participation was taken to see the general influence of social participation in choice of crops by farmers. The total scores of the farmers were calculated on the basis of scores given for their membership status, score of zero was given for non participant, score of 1 was given for those who are members only, 2 was given for those who are leaders of organization. To see each farmer's level of social participation in different formal and informal groups, 21 organizations were included in the interview schedule. A farmer's maximum total score to achieve accordingly was 42. The result of this study is displayed in Table 40.

Table 40 Association between total mean score of social participation & choice of crops

Categories	N	Mean	S.D	t-value
Crop production category				
Cereals & others	60	10.8	5.89110	
Vegetables	90	12.5	6.08045	-1.698*
Total	150	11.82	6.04	
Sex category				
Female	39	9.72	5.41	
Male	111	12.56	6.10	-2.572***

Source: own survey, 2008 ** = Significant at 1%, 10 % probability level

The mean score of social participation presented in Table 40, shows that there is a significant difference across crop production categories in which, the mean score of non growers of

vegetables is 10.8 at standard deviation of 5.9 and those of vegetable growers is 12.5 at standard deviation of 6.08 at 10 % probability level of significant ($t=-1.698$, $P=.092$). Across sex categories, there is significant difference between the mean score of FHHs, 9.72 at standard deviation of 5.41 and MHHs, 12.56 at the standard deviation of 6.1 and at 1 % probability level of significant ($t=-2.572$, $P= .001$).

Generally the result of the study revealed that social participation has a great influence in facilitating decision of farmers to grow vegetable crops. This could be as a result of the better access to information, inputs and other important resources, as a consequence of participation in the organizations. FHHs are less involved in such organizations and thus less exposed to new practices as a result of lack of timely information and other needed resources.

Number of relatives or close friends

Households that have more friends and relatives are likely to be better informed about the benefits and characteristics of new technologies. Moreover, better informed households are likely to persuade and influence decision of their relatives, friends and neighboring farmers regarding choice of crops. Hence, number of relatives / close friends was hypothesized to influence household's involvement in vegetable production.

Table 41 Association between mean number of close friends & relatives and choice of crops (N=150)

Variable	Crop production categories				
		N	Mean	S.D	t-value
Number of friends and relatives	Cereals & others	60	6.38	3.16	
	Vegetables	90	9.78	7.14	-3.968***
Sex categories					
Number of friends and relatives	Female	39	6.7949	5.01	
	Male	111	8.9910	6.35	-1.954*

Source: own survey, 2008 ***,* = Significant at 1%. 10 % probability level

Regarding the result of this study, the t-test result in Table 41 ($t=-3.968$, $P=.000$) shows that, the number of relatives and close friends interacting with the household has a positive and

highly significant association with farmers' involvement in vegetable production at 1% probability level of significance. Similar result was revealed among the sex categories, in which the t- test result ($t=-1.954$, $P=.053$) shows that there was significant difference between mean number of relatives and close friends of FHHs and MHHs at 10 % level of significance.

The probable reason for this result could be farmers who have relatively more number of friends and / or relatives are in a better position of avoiding risks. Hence, they have better confidence to try out capital intensive practices.

Similar result was found by Dessalegn (2008), in his study entitled social networks and diffusion of agricultural technology.

4.9. Summary of Results of Descriptive Analysis

Before passing to the econometric part of the analysis it is important to summarize the results of the descriptive statistics. In general, 17 explanatory variables were considered out of which 8 of them had shown significant association with decision of farmers to grow vegetable crops. Summary of the overall findings of the descriptive analysis is presented in the following Tables (42&43).

Table 42. Summary of Results of Continuous / Discrete Explanatory Variables

Variable	Mean across crop production categories		t-value
	Cereals & others	Vegetables	
Age of HHH(Yr)	45.6	39.86	3.594***
Education level (Yr)	1.67	2.97	-2.877**
Irrigated land holding(Timad)	3.78	3.76	0.53NS
Livestock ownership (TLU)	4.59	5.2	-0.912NS
Labor availability(mE)	1.7	1.9	-1.237NS
Farm income(Birr)	2323.5	8651.55	-8.061***
Off farm income(Birr)	670.17	796.17	0.575NS
Non farm income(Birr)	169	2208.2	-1.039NS
Social participation(Score)	10.8	12.5	-1.698*
Attendance in extension events(Score)	1.67	4.53	-4.352***
Mass media exposure(Score)	2.383	3.111	-1.490NS
Distance to main road(Km)	4.12	3.8	0.516NS
Number of relatives and close friends(No.)	6.38	9.78	-3.723***

Source: Own survey data, 2008. ***, **, * significant at 1, 5 and 10 percent probability level, respectively. NS = Non significant.

Table 43. Summary of Results of Dummy / Categorized Explanatory Variables

Variables	Responses	Proportion across crop production categories		χ^2 - value
		Cereals & others	Vegetables	
Marital status	Single	28	28	3.723*
	Married	32	62	
Cosmopolitiness	Never	1	0	2.947NS
	Sometimes	37	54	
	Once a week	20	29	
	Most often	1	5	
	Daily	1	2	
Frequency of contact with DAs	Never	23	7	26.879***
	Once a year	27	52	
	Monthly	5	8	
	Bi-weekly	5	10	
	Weekly	0	13	
Credit access	Yes	33	38	2.358NS
	No	27	52	

Source: Own survey data, 2008. ***, * significant at 1 and 10 percent probability level NS = Not significant.

4.10. Results of the Econometric Model

Binary Logistic Regression Model was used to identify determinant variables in decision making of farmers to grow vegetable crops. Therefore, in this section, procedures followed to select independent variables and results of logistic regression analysis conducted to identify determinants of choice of crops of farmers in Alamata woreda are presented.

Before using the logit model for hypothesized variables, it is necessary to test the problem of multicollinearity or association among the potential independent variables. There are two measures that are often suggested to test the existence of multicollinearity. These are: Variance Inflation Factor (VIF) for association among the continuous variables and contingency coefficients for dummy / categorized variables. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity (Gujarati, 2003).

A statistical package known as SPSS was employed to compute the VIF values. Once VIF values were obtained the RP^{2P} values can be computed using the formula. As a rule of thumb, if the VIF of a variable exceeds 10, there is multicollinearity. To avoid serious problems of multicollinearity, it is quite essential to omit the variable with value 10 and more from the logit analysis (Gujarati, 2003). Thus, the variance inflation factor (VIF) was employed to test the degree of multicollinearity among the continuous / discrete variables (Table 44).

Table 44 Variable Inflation Factor for the continuous explanatory variables.

Variables	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
Education level	.672	1.489
Age	.740	1.351
Farm annual income	.671	1.491
Score of extension event participation	.810	1.235
Number of close friends and relatives	.835	1.197
Total score of social participation	.751	1.331
Total score of mass media	.531	1.882
Total cultivable land	.286	3.501
Total irrigable land	.383	2.611
Tropical livestock unit	.631	1.584
Non farm income	.943	1.060
Off farm income	.908	1.102
Distance to the nearest road to market	.859	1.164
Labour availability	.830	1.204

Source: computation from field survey data

As shown above in Table 44, the values of the VIF for twelve continuous variables were found to be small (i.e. VIF values less than 2) and for the rest was less than ten, indicating the data have no serious problem of multicollinearity. However, only the significant values were entered into the binary logistics analysis. Similarly, the contingency coefficient, which measures the association between various dummy / categorical variables based on the Chi-square, were computed in order to check the degree of association among the dummy / categorical explanatory variables or the existence of multicollinearity problem. The decision rule for contingency coefficients states that when its value approaches 1, there is a problem of association between the dummy / categorical variables, i.e., the values of contingency coefficients ranges between 0 and 1, with zero indicating no association between the variables and the values close to 1, indicating a high degree of association.

Table 45 Contingency Coefficients for Dummy Variables of Multiple Linear Regressions

	MARITAL	DACONTA	COSMOPLT	CREDIT
MARITAL	1	0.388	0.241	0.123
DACONTA		1	0.304	0.280
COSMOPLT			1	0.163
CREDIT				1

Source: computation from field survey data

Based on the correlation coefficient results, the computation (Table 45) reveals that there was no problem of association among the dummy / categorical explanatory variables. Hence, after screening of the best variables among the hypothesized variables multicollinearity problems were checked for continuous / discrete and dummy / categorical variables as indicated above in Table 44 and 45, respectively. Accordingly there was no multicollinearity problem in both cases. After checking of multicollinearity problems, model analysis was conducted.

In this study dependent variable is either grower or non-grower. In order to explain this binary variable, it is necessary to construct a model that relates the dependent variable to a vector of independent variables. The logit model was employed in this study to estimate the effects of the hypothesized independent variables on choice of growing vegetable crops by farmers.

Eight independent variables which are found to be significant in the descriptive statistics were included in the model. These are age, education level, marital status, on farm income, frequency of contact with extension agents, participation in extension events, social participation, and number of relatives and close friends of the respondent in the village. These variables were selected by testing the existence of multicollinearity using Variance Inflation Factor (VIF) and contingency coefficients, in addition to their significance in the descriptive statistics.

The various goodness of fit measures were checked and validate that the model fits the data. The likelihood ratio test statistics exceeds the Chi-square critical value at less than 1 probability level. This implies that the hypothesis, which says all coefficients except the

intercept is zero, was rejected. The value of Pearson Chi-square test shows the overall goodness of fit of the model at less than 1% probability level.

Another measure of goodness of fit of the model is based on a scheme that classifies the predicted value of events as one if the estimated probability of an event is equal or greater than 0.5 and 0 otherwise. From all sample farmers, 87.3 were correctly predicted in to grower and non-grower categories by the model. The correctly predicted growers (sensitivity) and correctly predicted non-growers (specificity) of the model were 90 and 83.3 respectively. Thus the model estimated groups of growers and non-growers of vegetable crops accurately. The maximum likelihood estimate of the parameters and the effect of independent variables on the decision of growing vegetable crops by farmers were analyzed and presented in Table 46.

Determinants of choice of crops by farmers in using irrigation

The results of this study confirm a priori expectation in that the decision to grow or not to grow vegetable crops was influenced by the simultaneous interaction of several personal & demographic, socio-economic and institutional factors. As it is presented in Table 46, out of 8 explanatory variables found significant in the descriptive statistics and hypothesized to determine farmers' decision to grow vegetable crops, 6 were found to be statistically significant in the model. The result shows that marital status of the household (MARITAL), extension contact (DACONTA), education level (EDUCN), on farm income (ONFARM), participation in extension events (EVENTSCO) and number of relatives and close friends (FRNRLTV) were positively and significantly related with the growing vegetable crops by farmers. The other two variables were not significant. The effects of the model estimates were interpreted in relation to the significant explanatory variables in the model as follows:

Table 46 Maximum Likelihood Estimates of logit Model

Variables	B	S.E.	Wald	Df	Sig.	Exp(B)
MARITAL	-1.862	.701	7.062	1	.008(***)	.155
EDUCNLVL	.203	.113	3.240	1	.072(*)	1.225
DACONTA	.670	.298	5.043	1	.025(**)	1.955
AGE	-.027	.029	.868	1	.352NS	.973
ONFARM	.001	.000	25.004	1	.000(***)	1.001
EVENTSCO	.132	.077	2.889	1	.089(*)	1.141
FRNRLTV	.209	.089	5.511	1	.019(**)	1.233
SOCIALPA	-.059	.046	1.606	1	.205NS	.943
Constant	-2.965	1.636	3.283	1	.070	.052
-2 Log likelihood		94.099				
Chi-square		107.805(***)				
Sensitivity		90%				
Specificity		83.3%				
Over all prediction		87.3%				

Source: model output. ***, **, * represents 1%, 5% and 10 % probability level of significance, respectively, NS=Non significant

Marital status (MARITAL)

Marital status was found to influence the decision of choice of vegetable crops by sample respondents positively and significantly (at 1% level of significance). Married respondents have relatively more social networks and thus better access to information, inputs and other services than those who are single, divorced and widowed. As a result, those households who are married are likely to cultivate vegetable crops as compared to those who are single, divorced and widowed household heads. This result is in complete agreement with the finding reported by Dessalegn (2008).

Frequency of visit by extension agents (DACONTA)

For farmers decision of choice of crops, advisory services and technical assistances are very necessary. In Ethiopia, where the extension service is provided dominantly by the government organization, the extension agents of this organization are the major sources of information to farmers. It was hypothesized that farmers who have more contact and visited frequently by extension agents have better probability to cultivate vegetable crops than others. The result of the study also shows that the frequency of visit by extension agents influences the decision making of farmers to grow vegetable crops positively and significantly at 5 % level of significance.

Education level (EDUCNLVL)

Education level is found to have positive and significant influence on choice of farmers to grow vegetable crops, at 10 % level of significance. Households who have a better education are assumed to be geared to cash crop orientation where food crop production is a second priority. This shows that being literate would improve access to information, capable to interpret the information, easily understand and analyze the situation better than illiterate farmers and thus help to try out new practices. The result of this study shows that farmers who have better education are involved more in vegetable production. Similar result was found by Taddese (2008).

On farm income (ONFARM)

Household's income position and resource ownership was found to be important in cultivation of vegetable crops. This may be due to the resource demanding nature of vegetable production activity particularly when the production purpose is beyond the home consumption and is for commercial purpose. As it was expected annual farm income of the household was found to be positively and significantly influenced decision of farmers to grow vegetable crops at 1% significance level. This means that a farmer who has better income will be more likely to be involved in vegetable crops cultivation, while on the contrary; low income and resource poor

farmers face difficulty to grow vegetables. This suggests the need to support resource poor farmers to help them produce cash crops, so that they will be able to improve their income level in particular and their livelihood conditions in general.

Attending in extension events (EVENTSCO)

Participation in extension events is the other means through which farmers get information and make decisions regarding improved practices. Such events include extension arrangements such as training, demonstration, field days or visits and extension exhibitions. In the model, participation of farmers in these events was considered as one aggregate variable. Result of the finding indicated participation in extension events was positively and significantly related to growing vegetable crops at 10 % probability level. The implication is that emphasis has to be given to farmers' training, participation in demonstration, field days and extension exhibitions to enhance vegetable cultivation by farmers.

Number of relatives and close friends (FRNRLTV)

Number of close friends and relatives that the households can talk to about private matters or call on for help in a long term emergency was found to be positively and significantly affecting choice of growing vegetable crops, at 5% level of significance. The probable reasons may be better access to inputs and information; avoiding risk and uncertainties that may occur as a result of involvement in capital and labour intensive practices such as vegetable production.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

With the aim of enhancing agricultural development, the government considers various projects, including small-scale irrigation mainly through rainfall harvesting and home gardening, to be of crucial importance. As a result, vegetable production is being more widely adopted, primarily to ensure food security and to promote production of high-value crops for the market to improve living conditions of smallholders.

The study was conducted in Alamata district, southern zone of the Tigray National Regional State. In the district there are different water sources for irrigated agriculture, which includes permanent and temporary diversions (spate irrigation), shallow wells and ponds. The spate irrigation covers a larger area of the woreda. In spite of this irrigation potential of the area and the favorable condition for vegetable production in the area, considerable number of farmers still continued to produce cereals only (with out any cash crops such as vegetables).

The objectives of the study were, assessing the contribution of social networks (formal and informal groups) in facilitating access to resources and services in addition to their gender implications, and there by influence decision of farmers to grow vegetable crops. Analyzing the factors influencing the choice of crops by farmers with access to irrigation was also another additional objective of this study.

Multistage sampling procedure was employed to make up the study sample at individual level, in which 26% female headed households were included purposively. To address the objectives of the study, both qualitative and quantitative methods were used to generate relevant data. Data were collected from primary and secondary sources. The primary data necessary for the quantitative study were collected through personal interviews from 150 farmers who use spate irrigation to grow vegetable (with or with out cereals) and vegetable non growers, drawn from four PAs (which have relatively more producers of cereals as well

as vegetables, using spate irrigation). Qualitative data were collected through field visits, observations, informal interview with key informants, Village leaders, DAs, SMSs, extension officials; discussion with separate focus groups of women and men farmers.

The analysis was done with the help of descriptive and econometric tools employing SPSS software. Different analytical techniques were applied to analyze the available information. To analyze the comparative contribution of social networks as source of information, input, and credit; across crop production categories and sex categories, chi- square test was mainly used. And to see the relative importance of social networks ranking was used. The econometrics model binary logit was also employed, in addition to the descriptive statistics such as chi- square, t- test, mean, frequencies and percentages; to estimate the effects of hypothesized independent variables on decision of farmers to grow vegetable crops. The summary of the study results are discussed here below.

Concerning the contribution of social networks and their relative importance, the major actors in the area which are believed to be serving the rural community in facilitating access to inputs, credit and information were taken. Based on the result of the descriptive statistics, in terms of frequency of use of different actors as a source of technology significant variation was found between vegetable growers and non growers, in relation to use of the actors cooperatives, and input supplier organizations, in favor of vegetable growers, on the other hand significant difference were found in use of neighbors / friends as a source of technology, on favor of the non growers. Regarding the sex categories, significant difference was found in frequency of use of DAs and cooperatives as a source of technology in favor of MHHs and neighbors/ friends in favor of FHHs.

With regard to the frequency of use of different actors as a source of credit no significant difference was found between growers and non growers, however there was significant difference between the sex categories, in which both Dedebit saving and credit institution and cooperatives is favoring MHHs.

In relation to use of the different actors as a source of information, significant difference was found between vegetable growers and non growers regarding the actors WOoARD, and DAs in favor of vegetable growers, on the other hand, the actors neighbors/ friends in favor of non growers. Regarding the sex categories, significant variation was revealed in relation to the actors DAs and service cooperatives in favor of MHHs and neighbors/ friends in favor of FHHs.

Based on this, the rank of relative importance of nodes of social networks as sources of technology/input indicated that service cooperatives, friends and neighbors, DAs, input supplier organizations (private input providers) and other farmers, in terms of their order of importance were the most important sources of input/technology for the non growers. On the other hand; service cooperatives, DAs, private input supplier organizations, neighbors and other farmers are the most important sources of technology for the vegetable growers, in their order of importance. Regarding sex categories neighbors / friends, DAs, cooperatives, input supplier organizations and other farmers are the most important sources of technology/ input for FHHs, in their order of importance. While, cooperatives, DAs, neighbors, input supplier organizations (private input providers) and other farmers are the most important actors for MMHs as a source of technology, in their order of importance.

As a source of credit, service cooperatives, Dedebit saving and credit institution, and friends / neighbors for non growers; Dedebit saving and credit, service cooperatives and friends / neighbors for vegetable growers, in their order of importance, were found to be the most important actors. Regarding the sex categories, Dedebit saving and credit, service cooperatives and friends / neighbors for FHHs; whereas service cooperatives, Dedebit saving and credit and friends / neighbors for MHHs, in their order of importance, were the most important actors.

As an information source neighbors, DAs, farmers' development groups, WOoARD, service cooperatives and input supplier organizations for non growers; whereas DAs, neighbors / friends, WOoARD, farmers' development groups, service cooperatives and input supplier organizations for the growers, in their order of importance, were the most important actors.

Regarding the sex categories, neighbors, DAs, WOoARD, farmers development groups, service cooperatives and input supplier organizations for FHHs; DAs, , neighbors, WOoARD, farmers development groups, service cooperatives, input supplier organizations for MHHs, in their order of importance, were the most important actors.

The descriptive analysis result showed that some of the variables hypothesized to influence farmers' decision behavior were significantly related with choice of growing vegetable crops. Age, marital status and education status from household's personal and demographic factors; farm income of the household head from economic variables; participation in social organization, attendance in extension events and frequency of contact with extension agents from institutional factors, were found to have positive and significant relationship with choice of growing vegetable crops, at different probability level of significance. Significant difference in education level, farm income, participation in social organization, attendance in extension event and in frequency of contact with extension agents were also found across the different household (sex) categories, at different probability levels of significance, in favor of MHHs.

Based on the results of descriptive statistics, variations were observed between vegetable growers and non growers as well as male and female headed household in terms of participation in different groups and associations in which they are divided in to five groups in this study. In relation to agricultural related groups which are most of the time economical oriented organizations such as service cooperatives, saving and credit groups, water use associations, and agricultural development groups, significant difference was found out between vegetable growers and non growers, in favor of vegetable growers at 5 % probability level of significance. In case of sex categories, significant difference was found with regard to agricultural related groups and administrative groups at 1% and 10% probability level of significance.

Number of relatives or close friends was also found to have positive and significant relationship with choice of vegetable crops by farmers. In this study, it was observed that, there was significance mean difference between vegetable growers and non growers in

relation to the number of relatives and close friends, at 1% probability level of significance. Similarly significant difference was found out in this regard between household categories, at 10 % level of probability. This result indicates that informal social networks contribute a lot to decision making of farmers to grow vegetables.

The binary logistic regression model output showed that marital status and farm income; frequency of contact with development agent and number of relatives & close friends; and education level and participation in extension events were found to have positive and significant influence on the choice of growing vegetable crops by farmers, at 1%, 5% and 10% probability level of significance respectively.

In general, the study revealed that social networks, whether informal or formal, contributes a lot in facilitating access to information, input / technology, credit and other services, and thus has significant role in influencing the decision of households to grow vegetable crops. However, informal networks are not only the most frequently used but also the most important source of inputs / technologies and information for FHHs.

The study also tried to assess some marketing related issues. According to the study, majority of vegetable growers sell their produces in village, and their potential buyers were found to be wholesalers from regional market or the middle men. The major problem of farmers in relation to market was absence of alternative market, followed by lack of market information.

Generally farmers face many problems in using irrigation for their crops, specifically in the production of vegetables. Among the challenges, lack of irrigation water as a result of lack of appropriate management & technical problems in relation to the way the head works and channels are constructed, unavailability of inputs on time, were the most important constraints.

5.2 Conclusion and Recommendation

Based on the research findings of this study, the following points are recommended to improve the performance of the contribution of different social networks in facilitating access to resources and services and there by influence farmers decision to grow vegetable crops.

This study has analyzed the contribution of social networks (formal and informal) and their gender implication in accessing resources and services and there by their influence in decision making of farmers to grow vegetable crops. Accordingly, it was discovered that agricultural related groups, which are mostly economical oriented social groups such as cooperatives, water use association and; saving and credit groups, were mostly serving the vegetable growers generally and MHHs specifically. The non growers in general and FHHs in particular are most of the time not involved in such economical oriented groups, and thus not served equally compared to the growers. Such social groups are essential components in the process of agricultural development because of their contribution of facilitating access to resources and services and also resource exchange. Therefore, efforts should be made to establish such groups and also to strengthen the existing ones. In addition, efforts should be made to involve as many farmers as possible in these groups and special attention should be given to FHHs, to increase their participation in different groups and associations especially in economic oriented groups, so that their access to inputs and services will be increased and as a result their income level will also be improved.

Regarding the frequency of use of different actors, cooperatives and input supplier organizations were found to be the most frequently used actors for vegetable growers, as a source of technology; hence there is a need to involve other private input supplier organizations, but with critical follow up and supervision activities, so that the farmers will not be cheated and they will be able to get necessary inputs on time. Regarding the sex categories, this study revealed that DAs and service cooperatives are the most frequently used actors for MHHs as a source of technology, as compared to FHHs, hence there is a need to make purposive intervention in order to encourage FHHs to participate in cooperatives and extension programs, and for this the extension agents and other development workers should

be well convinced and should have heartily believe in the necessity of involvement of women in any development programs for economic and social development of any country, so that they will work hard too improve the livelihood of women, specifically FHHs.

As an information source, WOoARD and DAs were frequently used by the growers but for the non growers neighbors were the frequently used actors. Regarding the sex categories, DAs and service cooperatives were frequently used by MHHs, but for FHHs neighbors were the most frequently used actor, hence due attention should be given, to make relevant and timely information accessible for those farmers who are not participating in market oriented production system generally and FHHs in particular.

Generally both formal and informal networks have their own contribution in facilitating access to resources and services, hence recognizing the importance of informal networks and intervening to strengthen them by forming self help groups and also establishing linkage with the formal channels of information, inputs and credit is very important.

Finally, integration between different concerned formal organizations such as WOoARD, Alamata research center, credit provider organizations ,administration office of the woreda and NGOs on one hand; recognizing informal networks and creating important groups for accessing resources and services and information sharing on the other hand and creating strong linkage between the two (formal and informal networks) will be important not only to enhance vegetable cultivation practices but also for research and improvement of innovation capacity of farmers.

Decision of farmers to grow vegetable crops was found to be influenced, among other things, by households' income position. This shows the need of initial capital to involve in vegetable production. Therefore, giving special attention to provide credit to the poor, especially, FHHs has to be considered as a central and core component of any development intervention in the sector.

Vegetable production involves the use of different practices which require knowledge and skill of application and management. Education was found to have a positive relation with choice of growing vegetable crops, as it increases the probability of behavioral change of individuals and thus enhances ability to acquire and use information required for production and marketing. Therefore, due emphasis has to be given towards amplification of education in rural area, so that overall livelihood of the farm households will be improved.

Farmers' attendance in extension events like field visit, training, hosting demonstration and extension exhibition; and frequency of contact with development agent was found to be highly related to growing vegetable crops by farmers. Hence, concerned organizations should give due attention in organizing and facilitating such events. Likewise, extension service provision has to be strengthened in order to improve farmers' access to information and extension advice, because vegetable production compared to other cereals crops is complex in which it needs modern technical knowledge and know how of application of different inputs. As the result of this study indicates, WOOARD is the most frequently mentioned actor by sample respondents as a provider of most of the extension events, especially training. Hence, other actors such as Alamata research center and concerned NGOs should contribute their role in this regard.

Based on the result of descriptive statistics and different group interview & focus group discussions, the major problem facing vegetable growers were absence of alternative market. Hence the concerned bodies should give emphasis to organize marketing cooperatives as well as giving recognitions to newly established cooperatives. Moreover, efforts should be made to create market linkages among vegetable producers and potential market area, so that farmers will be able to sell their produces with fair price. In addition, storage technologies and processing activities such as production of canned and bottled vegetables should also be introduced; so that the bargaining power of farmers will be improved and as a result their income level and livelihood conditions will be improved.

Lack of irrigation water, as a result of lack of appropriate management & technical problems in relation to the way the head works and channels are constructed was also another problem,

hence efforts should be made to find better way to manage the water, so that it will be possible for farmers to use the water uniformly and thus it will be used efficiently. Moreover, farmers must be involved in the design process particularly in decisions about boundaries, the layout of the canals, and the position of outlets and bridges to make the use of the structures sustainable and cost effective, in addition timely maintenance is very crucial. Purposive intervention should be made to increase the participation of farmers, specifically FHHs in the management issues and other related activities regarding water use. The other major constraints were lack of availability of inputs on time and lack of market information; hence efforts should be made to strengthen the service cooperatives in terms of capital and man power, so that it will give the needed service in providing inputs on time as well as relevant and timely information.

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7. APPENDICES

Appendix 1 Conversion factor used to compute man equivalent (Labor Force)

Age group (years)	Male	Female
Less than 10	0.0	0.0
10-13	0.2	0.2
14-16	0.5	0.4
17-50	1.0	0.8
Greater than 50	0.7	0.5

Source: Stork, *et al.*, 1991.

Appendix 2 Conversion factors used to estimate tropical livestock unit

Animal Category	TTLU	Animal Category	TTLU
Calf	0.25	Donkey (young)	0.35
Weaned Calf	0.34	Camel	1.25
Heifer	0.75	Sheep & Goats (adult)	0.13
Cow and Ox	1.00	Sheep & Goats (young)	0.06
Horse	1.10	Chicken	0.013
Donkey (adult)	0.70		

Source: Stork, *et al.*, 199

Appendix 3. Description of independent variables

Variable name	Description	Variable type	Value
CRPRDNCAT	Crop production category	Dummy	Take a value of 1 if the farmer grows vegetables, 0 otherwise
MARITLA	Marital status	Dummy	Takes a value of 1 if married & 0 otherwise
COSMOPLT	Cosmopolitness	Ordinal scale	0=never, 1=sometimes, 2= once a week, 3= most often, 4=daily
DACONTA	DA contact	Ordinal scale	0=never, 1= once per year, 2= monthly 3= bi-weekly 4=weekly
CREDIT	Credit Access	Dummy	Take 1 if yes, 0 otherwise
EDUCNLVL	Education level	Continuous	Measured in number of years of schooling
LIVEOWN	Livestock ownership	Continuous	Measured in TLU
LABOUR	Labour availability	Continuous	Measured in man equivalent
TIRILAND	Total irrigable land	Continuous	Measured in timad
AGE	Age of respondents	Continuous	Measured in years
SOCIALPA	Social participation	Continuous	Measured in scores
DISTMR	Distance To main road	Continuous	Measured in Km
ONFARM	On farm income	Continuous	Measured in birr
OFFFARM	Off farm income	Continuous	Measured in birr
NONFARM	Non farm income	Continuous	Measured in birr
MMSCOR	Mass media exposure	Continuous	Measured in score
FRNRLTV	Number of close friends	Continuous	Measured in number
EVENTSCO	Participation in extension event	Continuous	Measured in score

Source: Own survey, 2008

Appendix 4 Summary of Results of Explanatory Variables

Variable	Expected sign	Observed sign in descriptive	Observed sign in model
Marital status	+	+	+
Cosmopolotiness	+	+	
Frequency of contact with DAs	+	+	+
Credit access	+	+	
Age of HH	-	-	-
Education of HH	+	+	+
Total land holding	+	+	
Livestock holding	+	+	
Labor availability	+	+	
Farm income	+	+	+
Off farm income	+	+	
Non farm income	+	+	
Extension event score	+	+	+
Mass media exposure score	+	+	
Distance to main road to market	-	-	
Social participation	+	+	+
No of relatives and close friends	+	+	+

Source: Own survey, 2008

Appendix 5 Interview Schedule

I PERSONAL FACTORS

1. Name of the respondent _____

2. Age of respondent _____

3. Marital status 1= Single 2= Married 3= Divorced 4=Widowed

4. Education level a. Formal Education _____

b. Informal Education _____

c. illiterate _____

5. Labor availability

5.1 Household labour availability

No	Age category	Number(#)	
		Male	Female
1	<10 years		
2	10-13 years		
3	14-16		
4	17-50 years		
5	>50 years		

5.2 Do you face labour shortage problem in vegetable production? 1) Yes 2) No

5.3 If yes, how do you solve labour shortage problem? 1) By hiring 2) asking for Cooperation (Debo) 3) All 4) Others (Specify) -----

Do you face labour shortage problem in cereal production? 1) Yes 2) No

5.5 If yes, how do you solve labour shortage problem? 1) By hiring 2) asking for Cooperation (Debo) 3) All 4) Others (Specify) -----

II SOCIO-ECONOMIC CHARACTERISTICS

6. Land arrangement

SN	Land Arrangement	Area(timad)	Access to irrigation(Yes, No)	Land allocation (ha)		
				vegetables Type of vegetable	Cereals Type of cereal	total
1	own					
2	Shared crop in					
3	Rented in					
Total						
4	Shared crop out					
5	Rented out					
Total						

7. Number of livestock owned at present

SN	Kind of livestock Owned	Number of livestock
12.1	Oxen	
12.2	Cow	
12.3	Young bulls	
12.4	Calves	
12.5	Heifers	
12.6	Sheep	
12.7	Goats	
12.8	Chicken	
12.9	Horse	
12.10	Mule	
12.11	Donkey	
12.12	Camel	

8. Household annual incomes

8.1 Household's annual farm income from sale of crops /1999 E.c/

SN	Commodity	Annual harvest	consumed	sold	Unit price	Total price
	Teff					
	Horse bean					
	Barley					
	Wheat					
	Millet					
	Sorghum					
	Maize					
	Chickpea					
	Onion					
	Tomato					
	Pepper					
	Cabbage					
	Potato					
	Others					
	Total income					

8.2 Income from sale of livestock/1999E.C/

SN	Animal type	Number sold	Unit price	Total sale price
1	Oxen			
2	Cows			
3	Heifers			
4	Bull			
5	Calves			
6	Goats			
7	Sheep			
8	Donkey			
9	Horse			
10	Poultry			
11	Others			
	Total income			

8.3. Income from sale of livestock products/1999E.C/

SN	Product type	Amount collected per year	Consumed	Sold	Unit price	Total revenue
1	Milk					
2	Butter					
3	Egg					
4	Hide					

8.4. Household's participation in off-farm activities and income gained in 1999 E.C

No	Who participate	*Type of activity	Duration(for how long)	Daily earning	Total income
1	Husband				
2	Wife				
3	Elder son				
4	Elder daughter				
5	Others				
	Total HH income				

* Type of activity 1) vegetable trading 2) Cattle trading 3) Grain trading 4) hire of donkey cart 5) Other (specify) -----

8.5 Household's participation in non-farm activities and income gained in 1999 E.C

No	Who participate	*Type of activity	Duration(for how long)	Daily earning	Total income
1	Husband				
2	Wife				
3	Elder son				
4	Elder daughter				
5	Others				
	Total HH income				

* Type of activity 1) daily labour 2) handcraft 3) petty trade 4) remittance 5) Other (specify)

9. Do you have a radio? (Radio ownership) 1= Yes 0= No

10. How frequently do you use the following media materials and methods?

SN	Mass Media	Frequency				
		Never(0)	Rarely(1)	Occasionally(2)	Often(3)	Very often(4)
1	Reading news paper					
2	Listening to radios					
3	Watching television					
4	Listening news- papers from Kebele administrators					

11. How far your residence in km or hours when walking on foot from:

- a. The nearest Wereda town or city? _____
- b. Roads to the nearest market? _____
- c. All Weather Roads? _____
- d. Roads to Extension office? _____

12. How frequently do you visit the nearby town or city? (Cosmopolitaness)

1. Daily (4)
2. Most often (3)
3. Once a week (2)
4. Sometimes (1)
5. Never (0)

13. What is the purpose of the visit?

1. Agricultural related issues like purchase/shopping/marketing (4)
2. To visit friends/relatives (3)
3. To get medical treatment (2)
4. Entertainment (1)
5. Any other purpose (specify) _____

III SITUATIONAL FACTORS

14. Are you involved in any activities of formal and informal institutions/ Organizations in your area? (Social participation) 1= Yes 0= No

SN	Organization/ institution	Frequency of participation			Degree of participation		
		Never (0)	Some Times (1)	Always (2)	No participation (0)	Member only (1)	Leader (2)
	Formal Institutions / Activities						
14.1	Kebele Administration						
	- PA Administration						
	-Village Administration						
	-Courts -Parliament						
14.2	Civic organizations						
	-Farmers' associations						
	- Women's association						
	- Youth club						
	- HIV club						
14.3	Agricultural Related Activities						
	-Farmers' cooperatives/union						
	-Irrigation cooperatives						
	- water use association						
	- Agricultural Development Group						

	Informal institutions / Activities						
14.4	Religious organizations						
	-Mosque						
	- church						
14.5	Informal associations						
	-Idir						
	-Ekub						
	-Mahber						

25. If yes, who arranged it for you? (Use choices in number 23.)
26. Have you ever hosted, extension demonstration, or on farm experiments on your field last year?
1=Yes 0=No
27. If yes, who arranged it for you? (Use choices in number 23.)
28. Have you ever participated in extension exhibition last year? 1=Yes 0=No
29. If yes, who arranged it for you (use choices in No 23)
30. Have you ever faced any constraints on Agricultural production using irrigation? 1= Yes
0= No
31. If yes what are the major constraints?
1. Lack of access to irrigation water.
 2. Lack of marketing.
 3. Lack of transportation facilities.
 4. Lack of supply of chemicals on time.
 5. Lack of supply of appropriate varieties.
 6. Others (specify)

VI Input / Technology Source and its Use Pattern:

32. (Indicate how frequently you use the following sources to get agricultural technology / input, for irrigated agriculture

SN	Actors	Frequency of use		
		Always (2)	Some times (1)	Never (0)
1	WOoARD Office			
2	NGOs existing in the area			
3	Alamata Research Center			
4	Farmers' cooperatives			
5	Agricultural Development Agents			
6	Neighbors/Friends			
7	Other farmers			
8	Input supplier organizations			
9	Others (specify)			

33. Have you ever faced constraints in using any package inputs for irrigation use? 1= Yes 0= No

34. If yes, what is / are the main constraint(s)?

1. Poor quality of seed
2. Unavailable on time
- 3 Source from far distance
4. Less Extension support
5. If other specify _____

V Credit / Finance Source and its Use Pattern

35. Did you receive credit last year? 1= Yes 0= No

36. If yes indicate the source, frequency of use of the actors and the purpose of taking the credit.

SN	Credit source	Frequency of use			Purpose of taking the credit
		When ever needed (2)	Some times (1)	Never (0)	
1	Service cooperatives				
2	Dedebit Saving and Credit Institution				
3	Local money lender				
4	others (specify)				

NB. Purpose of taking the credit

- | | |
|---------------------------------------|-----------------------|
| 1. Purchase of industrial by- product | 5.To settle Debts |
| 2. Construction of house | 6. For growing crops. |
| 3. Purchase of livestock | 7. purchase of inputs |
| 4. To fill up family requirement | 8. others _____ |

37. Have you ever faced any constraints on getting access for credit? 1= Yes 0= No

38. If yes, what is/are the main constraint(s)?

1. Unavailable on time
2. Unable to pay down payment
3. Lack of credit
4. Lack of collateral

5. High interest rate
 6. Other (specify) _____

VI information Source and its Use Pattern

43. Indicate the frequency of use of the actor as a source of information and their means of communication they use in agricultural production using irrigation:

SN	Actors / sources	Frequency of use			Means of communication
		Always (2)	Some times (1)	Never (0)	
1	WOoARD Office				
2	NGOs existing in the area				
3	Farmers' cooperatives				
4	Farmers development groups				
5	Agricultural Development Agents				
6	Neighbors/Friends				
7	Religious institutions				
8	Input supplier organizations				
10	Others (specify)				

*Means of communication: 1) Demonstration 2) Field day/visit 3) Training 4) Written materials (leaflets, manuals, and so on) 5) Others (Specify) -----

VII Market / Market Linkage

39. Where and for whom do you sell your vegetable products?

S N	Where do you sell your products	For whom do you sell your products								
		Farmers (consumer)	Retailer (urban)	Retailer (rural)	Wholesalers (urban)	Wholesalers (regional)	Consumer (urban)	Service cooperatives	Government Organization	others
1	Village/ PA market									
2	Alamata									
3	Mekelle									
4	Region three									
5	Others(specify)									

40. Where and for whom do you sell your cereal products?

SN	Where do you sell your products	For whom do you sell your products								
		Farmers (consumer)	Retailer (urban)	Retailer (rural)	Wholesalers (urban)	Wholesalers (regional)	Consumer (urban)	Service cooperatives	Government Organization	others
1	Village market									
2	Alamata									
3	Mekelle									
4	Region three									
5	Others(specify)									

41. Have you ever faced with constraints on access of market? 1= Yes 0= No

42. If yes, what is/are the main constraint(s)?

- 1. Unable to get market information
- 2. Far distant of market place
- 3. Unable to get alternative market specify_____
- 4. Lack of transportation
- 5. Market Fluctuation
- 6. If others,

44. Which source or actors are the most important for you to be market oriented and influence your choice of crops towards vegetable crops?(rank them)

SN	Actors / sources										
		1	2	3	4	5	6	7	8	9	10
1	WooARD Office										
2	Alamata Research Center										
3	NGOs existing in the area										
4	Farmers' cooperatives										
5	Farmers development groups										
6	Agricultural Development Agents										
7	Neighbors/Friends										
8	Religious institutions										
9	Input supplier organizations										
10	Others (specify)										