

**SOCIAL NETWORKS AND DIFFUSION OF AGRICULTURAL
TECHNOLOGY: THE CASE OF SORGHUM IN METEMA WOREDA,
NORTH GONDAR, ETHIOPIA.**

M.Sc. Thesis

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**SOCIAL NETWORKS AND DIFFUSION OF AGRICULTURAL
TECHNOLOGY: THE CASE OF SORGHUM IN METEMA WOREDA,
NORTH GONDAR, ETHIOPIA.**

**A Thesis Submitted to the Department of Rural Development and Agricultural
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DEDICATION

I dedicate this thesis manuscript in memories of my father Molla Ketema, whom I lost in 1985, my mother Yelfign Deribew and my lovely wife Simegn Addisie (Emush), for nursing me with affection and love and for their dedicated partnership in the success of my life.

STATEMENT OF AUTHOR

First, I declare that this thesis is my bonafide work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements of M. Sc. degree at the Haramaya University and is deposited at the University Library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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BIOGRAPHICAL SKETCH

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LIST OF ABBREVIATIONS

ACSI	Amhara Credit and Saving Institution
ANRS:	Amhara National Regional State
ARARI	Amhara Regional Agricultural Research Institute
BoARD:	Bureau of Agriculture and Rural Development
BoA:	Bureau of Agriculture
CEDEP:	Consultants for Economic Development and Environmental Protection
CSA:	Central Statistical Authority
DAs	Development Agents
FAO	Food and Agriculture Organization of the UN
FHH	Female Headed Household
Ha	Hectare
ILDp	Integrated Livestock Development Programme
IPMS:	Improving Market Productivity and Market Success of Ethiopian Farmers
KM:	Kilometre
M.A.S.L:	Meter above Sea Level
MHH	Male Headed Household
MOA:	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development
NCFs	New Coalition for Food Security
NGOs	Non-Governmental Organizations
PAs:	Peasant Associations
PLWs:	Pilot Learning Woredas
PLS	Pilot Learning Site
PRA	Participatory Rural Appraisal
SPSS:	Statistical Packages for Social Sciences
WoARD	Woreda office of Agriculture and Rural Development

TABLE OF CONTENTS

STATEMENT OF AUTHOR	v
BIOGRAPHICAL SKETCH	vi
ACKNOWLEDGMENTS	vii
LIST OF ABBREVIATIONS	viii
LIST OF TABLES	xii
LIST OF TABLES IN THE APPENDICES	xiv
ABSTRACT	xv
1. INTRODUCTION	1
1.1. Background to the Study	1
1.2. Statement of the Problem	4
1.3. The Research Questions	6
1.4. Objective of the Study	6
1.5. Significance of the Study	7
1.6. Scope and Limitation of the Study	8
1.7. Organization of the thesis	9
2 LITERATURE REVIEW	10
2.1 Concepts and Definitions:	10
2.1.1 Definition of adoption and diffusion of innovation	10
2.1.2 Limitation of the adoption and diffusion tradition	11
2.2 Concept and definition of social capital and social networks	14
2.2.1 Social capital	14
2.2.2 Social networks	16
2.2.2.1 Typology of social networks	17
2.2.2.2 Common networking terminology	18
2.3 Theoretical Background	20
2.3.1 Diffusion networks and diffusion theory	20
2.3.2 Social learning theory	20
2.4 Information Exchange and Interpersonal Networks	23
2.5 Gender and Social Networks	24
2.6 Social Networks and Diffusion of Innovation	26
2.7 Empirical Studies on the Roles of Social Networks in Adoption and Diffusion of Technologies	27
2.8 Conceptual Framework of the Study	29
2.9 Definition of variables and working hypothesis	31

TABLES OF CONTENTS (continued)

3 RESEARCH METHODOLOGY	34
3.1 Description of the Study Area.....	34
3.1.1 Amhara National Regional State (ANRS)	34
3.1.2 Metema Woreda.....	35
3.2 Research Design.....	40
3.2.1 Sampling design and sampling method	40
3.2.2 Data collection method	42
3.2.3 Data collection and data type.....	43
3.2.3 Methods of data analysis.....	45
4 RESULTS AND DISCUSSION	46
4.1 Socio-Economic and Demographic Characteristics of Sample Households	47
4.1.1 Sex of the respondents	47
4.1.2 Family size of the sample households	48
4.1.3 Origin and ethnicity of the respondents	49
4.1.3.1 Origin of the sample households.....	49
4.1.3.2 Ethnicity of the sample households	50
4.1.4 Respondents years of residence in the village	52
4.1.5 Educational level of the sample household heads.....	53
4.2 Types of Formal and Informal Social Networks in the Study Area	55
4.2.1 Formal and informal social Networks.....	55
4.2.1.1 Networks of the respondent beyond the immediate household	55
4.2.1.2 Family member's participation in different social networks	61
4.2.2 Family membership in different groups or associations	62
4.2.2.1 The relative importance of groups and association.....	70
4.2.2.2 Trust based social institutions in the study area.....	71
4.3 Contribution and Importance of Social Networks in the Diffusion of Agricultural ...	75
Technologies	75
4.3.1 Social networks as a source of information, input source and exchange.....	75
4.3.1.1 Relative importance of social networks for information sources	75
4.3.1.2 Roles of social networks in local seed system of the study area	77
4.3.2 Social network actor's influence to adopt a given technology	79
4.3.3 Social networks as channels of technology diffusion.....	81
4.3.4 Roles of social networks in the dissemination of sorghum technology	82
4.3.4.1 Types of sorghum varieties in the production system	82
4.3.4.2 Land holding and area allocated to sorghum production in the 2006/2007....	84
cropping season.....	84
4.3.5 Use of improved sorghum varieties	85
4.3.5.1 Sources of improved sorghum seed	87
4.3.5.2 Types of improved varieties used by the respondents	90
4.3.5.3 Influence of nodes in social networks on the use of improved sorghum varieties	91
4.3.5.4 The status of improved varieties in the study area.....	92

TABLES OF CONTENTS (continued)

4.3.5.5	Problems associated with improved sorghum varieties	93
4.3.6	Analysis of factors influencing the adoption of improved sorghum using logistic regression model	94
4.4	Community level Social Capital in the Study Area	98
4.4.1	Community social networks in the study area	98
4.4.2	Trust and solidarity in the sample PAs	100
4.4.3	The level of trust towards people and institutions	102
5	SUMMARY, CONCLUSION AND RECOMMENDATIONS	104
5.1	Summary	104
5.2	Conclusion and Recommendation	108
6	REFERENCES.....	113
7	APPENDICES.....	121

LIST OF TABLES

Table	Page
1 Population estimate of Amhara region by types of residence.....	34
2: Land use of Metema woreda.....	38
3 Summary of different samples of farmers in the study area	42
4 Relationship between sex of the respondents and use of improved sorghum varieties.....	47
5 Summary of means of family size by settlement category and Sex (N=160).....	48
6 Number of household members and use of improved sorghum varieties.....	49
7: Distribution of sample household heads by origin	50
8: Distribution of sample household heads by ethnicity (N=160).....	51
9: Distribution of sample household heads by years of residence in their village.....	52
10 Years of residence in the village and membership in economically oriented group	52
11: Proportion of sample household heads by highest years of school completed.....	53
12: Number of close friends the respondents have to talk about private matters (N=160)	56
13: People beyond immediate household in case of a long term support (N=160)	58
14 Number of close friends and use of improved sorghum varieties	60
15 Proportions of huseholds' participation in different social networks	61
16 Proportions of Households belonging to groups or associations in the study area.....	63
17 Membership in groups/associations and use of improved sorghum varieties.....	67
18 Relative importance of groups/associations to the respondent's household (N=160).....	70
19: Distribution of social networks as information source (N=160)	75
20: Distribution of social networks as seed source and exchange mechanisms (N=160)	77
21: Distribution of actors that the respondents could be influenced to adopt (N=160).....	80
22 Distribution of nodes in social networks as channels for technology diffusion(N=160)	81
23: Distribution of use of sorghum varieties in the 2007 cropping season.....	83
24: Size of owned land and land allotted for sorghum production in the study sites	84
25: Distribution of respondent who heard about improved sorghum varieties (N=160).....	86
26: Distribution of respondent who used improved sorghum varieties (N=160)	86
27: Distribution of sample respondents' improved sorghum seed sources (n=38).....	87
28 Influence of others in the use of improved sorghum varieties (N=38).....	91
29: Status of using improved <i>striga</i> resistant & early maturing sorghum varieties (N=38).....	92
30 Definition of independent variables for the determinants of improved sorghum adoption... 95	95
31 Logistic regression estimates of factors affecting adoption of improved sorghum varieties. 96	96
32: Respondents perception on the degree of trust and solidarity in the community	100
33: level of trust expressed by respondent's settlement category (N=160).....	102

LIST OF FIGURES AND ILLUSTRATIONS

Figure	Page
1 Conceptual Framework of the study	30
2 Map of the study area (Amhara region and Metema Woreda)	39
3 Sampling Procedure	41
4 Distribution of people/individuals who are consulted in cases of big decision in life	59
5 Types of Improved varieties used by the respondent.....	90
6 Group interview participant in institutional diagramming exercise	99
7 Community Institutions and organizations in the study area.....	99

LIST OF TABLES IN THE APPENDICES

Appendix table	Page
1 Formally released exotic sorghum varieties, their sources and specific characteristics in Ethiopia	111
2 Sorghum Varieties released by Sirinka Agricultural Research Center	112
3 The correlation matrix of independent variables affecting the adoption of improved sorghum varieties.....	112

SOCIAL NETWORKS AND DIFFUSION OF AGRICULTURAL TECHNOLOGY: THE CASE OF SORGHUM IN METEMA WOREDA, NORTH GONDAR, ETHIOPIA.

ABSTRACT

Information on technology adoption and diffusion in a given society is important for focusing future research, extension, government and NGO - led development efforts aiming at benefiting the majority of Ethiopian farmers. The identification of the roles of social networks that influence technology adoption and diffusion is important to identify and design measures to remove or alleviate the constraints affecting diffusion of innovation. This study was undertaken in Metema woreda of North Gondar Zone, Amhara National Regional State and has been designed to throw light on the existing formal and informal social networks among re-settlers. The extent of functional contributions of social networks and their gender implications in the diffusion of sorghum technology, and identification of options for enhancing the role and sustainability of these social networks for promoting agricultural innovation in the woreda was the focus of this study. Multistage sampling procedure was employed to select 2 PAs out of 18 PAs in the woreda and 160 sample households from these 2 PAs. Both qualitative and quantitative data were used to obtain reliable information from primary and secondary sources. Data analysis was done using descriptive statistics, T-test and chi-square test. The this study variations were observed between previous and recent settlers as well as male and female headed households in terms of membership in different economically oriented groups and associations and participation in social networks. The binary logistic regression model out put showed that marital status, family size, number of close friends and membership in cooperatives were found to have positive and significant influence on the adoption of improved sorghum varieties. Likewise, education and years of residence in the village have negative and significant influences on the dependent variable. The study also revealed that, relatives, friends and neighbors were the most important nodes of information source, seed sources and mutual support; and influential networks in the adoption and diffusion process of the study area. To strengthen these influential social networks the organization and empowering of these networks and promoting into community based self help farmers groups with genuine support and supervision from governmental and non-governmental organization is imperative.

1. INTRODUCTION

1.1. Background to the Study

The Ethiopian economy is among the most vulnerable in sub-Saharan Africa (Pankhurst and Gebre, 2002; Devereux *et al.*, 2005). It is heavily dependent on the agricultural sector, which has suffered from recurrent droughts and extreme fluctuations of output. Unprecedented population pressures has contributed to decreasing plot size (average landholdings declined from 0.5 hectares per capita in the 1960s to 0.11 in 1999), making an increasing number of households dependent on inadequately small and unproductive plots, and rendering some traditional farming practices unsustainable (FAO, 2006). The number of food insecure households in Ethiopia has been increasing since the 1960s, as domestic food production has failed to meet the food requirements of the country. As a result, in Ethiopia, food insecurity is seen as the most important feature of development challenges.

In response to the chronic food shortages faced by millions, efforts have been made by the previous and current governments of Ethiopia. Though, it was not successful and criticized by many scholars, the Derg regime embarked on forced inter-regional resettlement and villagization program in the mid-1980s as part of a national program to combat drought, avert famine, and increase agricultural productivity. Resettlement, the regime's long-term solution to the drought problem, involved the permanent relocation of about 1.5 million people from the drought-prone areas of the north to the south and southwest, where population was relatively sparse and so-called virgin, arable land was plentiful.

The current Ethiopian government also launched a large-scale intra-regional resettlement program with the objective of enabling 2.2 million chronically food insecure people attain food security. The government has initiated a pilot resettlement (access to land) program in the past four years. People from the drought-prone areas were mobilized voluntarily to the relatively unpopulated fertile low land areas (NCFS, 2003).

Amhara region is one of the regional governments of Ethiopia, where food security problem has been prevailing for decades. This region is one of the drought prone areas where frequent famine has occurred during the last several years. Among 109 Woredas in Amhara Region, more than 47 Woredas are classified as being food insecure. Since 2003, the recently launched resettlement program has been implemented in the lowlands of Metema, Quara Armachiho and Dangla woredas, with the objective of chronically food insecure people attain food security.

To achieve food security, increasing agricultural production at the household level would be the most important. The marketable surplus is sold to the non-farming and even to the farming communities. Therefore, increasing the production and productivity in a sustainable manner could address the problem of food shortage (MoFED, 2002). Besides, in order to raise the agricultural output and productivity on a sustainable basis in the developing countries, large-scale adoption and diffusion of new technologies is very essential (Ravula *et al.*, 2006).

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”.

Social networks may influence technology adoption and diffusion through their function as a source of informal finance (both credit and insurance), as channels of information and thus vehicles of learning, as a means for resolving externalities and collective action problems, or through enforcement of social norms. Moreover, these functions of social networks may interact with gender to produce different outcomes for decision-makers of different sex. Different members of the same household may also participate in different social networks due to gender or generational differences (Hogset, 2005).

On the other hand, sorghum is closely linked to food and livelihood security of farmers in the semi-arid tropics across Africa and Asia. Because, it exhibits great diversity and can tolerate many environments, including cool or waterlogged areas and its drought-tolerance makes it particularly important in drier areas (Doggett, 1988). In Ethiopia, Sorghum occupies 726,000 to 1,026,000 hectares with annual production of 1 to 1.6 millions of tons and a major staple in the diet, making it the third most important crop (Brhane, 1979; CSA, 1997). It is one of the major traditional food crops in Ethiopia, with multiple uses (Habtu, 1995).

Sorghum is among the most widely cultivated and consumed cereals in Amhara region. According to FAO (2006) report, sorghum constitute second in area coverage next to Teff and following maize in production. In 2005/06 *meher* season, Teff, sorghum and wheat constitute 705,000ha, 483,000ha and 359,000ha of the total cereals in the region.

Most households and investors in the study area cultivate sorghum. It is one of the staple foods of the settlers as well as other seasonal laborers in Metema. As indicated by IPMS (2005) until recently sorghum followed by cotton dominated the cropping pattern of Metema woreda. But now, the pattern has been changing among previous settlers and investors due to pest problem (*striga*) and increased market orientation to cultivate cash crops like sesame and cotton. And for recent settlers, working as hired labor is seen as an alternative livelihood strategy rather than growing their food crops.

In order to support the seed demand of the community and hence to satisfy their food demand by increasing production and productivity, improved *striga* resistant and early maturing varieties of sorghum were introduced and being promoted in the study area. Six different improved sorghum varieties were multiplied by 45 farmers around Kokit peasant association (PA) and were demonstrated.

So, it becomes essential to investigate and design policy and institutional options to encourage the diffusion of innovations, adoption of high yielding varieties and improved management practices as part of strategies used to meet challenges in food security and availability of improved seed in the farming community.

No, attempt has been made so far to study the contribution of social networks in the diffusion of innovation and adoption of agricultural practices specifically sorghum package which is the major food crop in the study area.

1.2. Statement of the Problem

Government of Ethiopia has been implementing a resettlement program, starting from 2003 in different parts of the country by mobilizing people from the drought-prone areas to the relatively unpopulated fertile low land areas. The primary aim of this program was securing land for those who have no land or residing in degraded lands of highland areas, so that they become self sufficient and food secure.

Metema Woreda in Amhara region is one of the host woredas where resettlement program has been taking place. Government organizations, NGOs and other institutions try to achieve the objectives of the programme and make the community (settlers) food secure through different intervention mechanisms such as provision of food ration, utensils, agricultural implements, agricultural technology, health etc on arrival to the site and until they have established livelihoods for survival.

The introduction of agricultural technologies is important to support the country's drive to increase productivity and achieve food self-sufficiency and to fulfill the objective of the resettlement programme. Since sorghum is one of the staple foods of settlers and other communities in Metema Woreda, improved sorghum varieties were introduced and are being promoted by governmental and non-governmental organizations.

The problem is that diffusion of these improved varieties to producers (especially recent settlers) is slow and incomplete. Farm-level technology adoption may be hampered by poorly understood socioeconomic and institutional constraints, some of which may be located in the mechanisms that sustain economically important functions of social networks (Hogset, 2005). People's exposure to a new idea, which takes place within a social network or through the media, will determine the rate at which various people adopt a new behavior and diffuse to the others.

In addition, improved seed access is limited to farmers groups/ communities which have relatively better capital accumulation (especially among previous settlers). It largely depends upon the assets of the settlers: whether or not the settler has the cash (financial capital) or social networks (social capital) to access seed. In case of recent settlers, they left their close friends, families at their origin. As a result, social networks that facilitate seed exchange might have been hampered. And it takes relatively longer time for the new one to be created.

Specially, when communities relocate from their point of origin to resettlement site, they lose their social capital (mutual support, social networks) and this is especially true in case of women. Social integration cannot realistically be expected to be achieved within one or two years after arrival in resettlement site. It usually takes more time for settlers' lives to stabilize. Until this happens, they remain extremely vulnerable to such shocks as seed shortage, crop failure, epidemics, food price fluctuations and critical labor shortage. And they may not have an opportunity to get important support, information for their survival.

Therefore, it is necessity to recognize the settlers' inter-relationships as 'context', and as a context which directly affects their behavior. The types of social context of the settlers include: the settlers' immediate family, those with whom he/she lives and/or works (on a regular, perhaps daily, basis); extended family or kin with whom there is occasional, possibly irregular contact; neighboring farmers, in close proximity, who may or may not be friends; farming colleagues; and farming friends. These comprise the 'settings' within which scenarios of influence in technology adoption and diffusion can occur between individuals (Seabrook and Higgins, 1988).

Moreover, in a given social system, especially in resettlement areas where social capital is disturbed, it is important to identify influential networks and their functional contributions to diffuse innovation: health systems, schools, religious and political groups, social clubs, unions, and informal associations and also identify opinion leaders, peers, and targeted media channels.

No attempt has been made to study and understand the contribution of functional social networks in the diffusion of innovation and adoption of agricultural practices among re-settlers in the study area. This study is expected to contribute to this understanding which will help design appropriate and relevant interventions by the agricultural research, extension and other development process.

1.3. The Research Questions

1. What are the existing formal and informal social networks and their gender implication in the study area?
2. What is the extent of functional contribution made by social networks in the process of sorghum technology diffusion among members of the community and their gender implication?
3. What are the options for strengthening the role of these networks and using them for strengthening the agricultural innovation processes?

1.4 Objective of the Study

The major objectives of the study are, therefore,

- ☞ to identify the various sexdisaggregated formal and informal social networks of old and new re-settler farmers in the study area;
- ☞ to determine the extent of functional contributions of these networks and their gender implication in the diffusion of sorghum technology package among the members of the community; and
- ☞ to identify the options for enhancing the role and sustainability of these social networks for promoting agricultural innovation.

1.5 Significance of the Study

Social networks have important role in accessing and using technology and related information. Social networks play crucial role in facilitating diffusion of technology and related information. The identification of the roles of social networks that influence technology adoption and diffusion is important to identify and design measures to remove or at least alleviate the constraints affecting diffusion of innovation.

In the past, adoption and diffusion research has been conducted with minimal consideration for social capital variables (social network and social interactions). As a result of these and other factors, the degree of adoption of technologies was very low. Identification of factors related to individual farmers' adoption decisions of agricultural technologies and their overall diffusion is particularly useful for the formulation of future research, extension approaches and other development interventions in the study area.

Studying the social networks among re-settlers in relation to technology diffusion of food crops, will have a significant importance in designing appropriate measures and developing capacity to respond to shocks that will happen during the establishment of the resettlement sites.

In short, understanding networks is important, particularly for the development of effective social protection policy. A misunderstanding of the roles of these networks can lead to policy changes that have unintended consequences on the functioning of these networks, with potentially damaging effects on the capacity of the poor to mitigate, and cope with, the effects of shocks. At the same time, a better understanding of such networks can lead to the identification of policies that complement existing networks that already serve the poor well, and to policies that can substitute for networks that simply are not reaching the poor (Haddinott *et al.*, 2005).

In many ways, understanding the diffusion process is the key to understanding how conscious innovative activities conducted by firms and governmental institutions, activities such as

funding research and development, transferring technology, launching new products or creating new processes, produce the improvements in economic and social welfare which is usually the end goal of the government and it will also have policy implications for the introduction of new technologies in poor communities in rural areas of Ethiopia.

1.6 Scope and Limitation of the Study

The study is a micro level study limited to one Woreda in North Gondar zone of Amhara Region. The study was carried out by surveying a sample of 160 randomly selected farm households from two Peasants Associations (PAs), conducting 8 focus group discussions and 2 group interviews in Metema Woreda.

Due to limited time and resources availability, it is not possible to study the entire farming population in the Woreda. It is, therefore, imperative to take representative households for the generation of primary data on different variables.

The study was aimed generally at assessing the roles of social networks in the diffusion of agricultural innovation process in the farming community, and specifically to identify the formal and informal social networks and their gender implications; to determine the extent of functional contributions of these networks in the diffusion of agricultural innovations and; to identify the options for enhancing their role in supporting innovation processes and sustainability.

Ethiopia is a diverse nation in terms of culture, social capital, agro ecology, resource endowment and ethnic groups. Hence, this study cannot be typical or warrant generalizations for the entire country in general, or the region in particular. However, recommendations and policy implications of this study could be used in other locations having comparable or similar context (socio-economic characteristics).

1.7 Organization of the thesis

The thesis was organized in five chapters. Chapter two, deals with review of pertinent literature on diffusion of innovation and roles of social capital. Chapter three provides brief discussion on the study area, research methodology used to under take the study. The fourth chapter presents the results and discussion of the findings subdivided into sub sections. The first section presents the result of socio-economic and demographic characteristics of the sample households; the second section deals with types of formal and informal social networks in the study area; the third section presents the contribution and importance of social networks in the diffusion of agricultural technologies; the last section deals with community level social capital in the study area. Finally, chapter five depicts summary, conclusion and recommendation based on the findings of the study.

2 LITERATURE REVIEW

2.1 Concepts and Definitions:

2.1.1 Definition of adoption and diffusion of innovation

Diffusion of innovations refers to the spread of abstract ideas and concepts, technical information, and actual practices within a social system, where the spread denotes flow or movement from a source to an adopter, typically via communication and influence (Rogers, 1995).

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas (Ray, 2001). An innovation diffuses within a social system through its adoption by individuals and groups. The spread of innovations across social groups over time is referred to as the diffusion of innovations (Stoneman, 2002).

Rogers' definition contains four elements that are present in the diffusion of innovation process. The four main elements are:

Innovation - an idea, practices, or objects that is perceived as new by an individual or other unit of adoption.

Communication channels - the means by which messages get from one individual to another.

Time - the three time factors consists of innovation-decision process, relative time with which an innovation is adopted by an individual or group and innovation's rate of adoption.

Social system - a set of interrelated units that are engaged in joint problem solving to accomplish a common goal.

Rogers differentiates the adoption process from the diffusion process in that the diffusion process occurs within society, as a group process; whereas, the adoption process is pertains to an individual. And he also defines "the adoption process as the mental process through which an individual passes from first hearing about an innovation to final adoption".

Some other authors tried to show the similarity and difference between adoption and diffusion. Diffusion and Adoption are thus closely interrelated even though they are conceptually distinct. Katungi (2007) indicates that, the unit of analysis in adoption study is an individual decision maker (farmer) or decision-making unit (farm household). Diffusion studies refer to the cumulative adoption path or distribution of adoption (percentage of farmers, percentage of area) over time or space with the community, region, nation or another geographical scale as the unit of analysis.

Diffusion takes time for an innovation to diffuse through out a social system (Dasgupta, 1989). Because, new ideas and ways of doing things do not necessarily take hold all at once, but often spread gradually through social networks. That means from the early adopters of the technology to family, relatives and friends, neighbors and then to villagers as well as other communities.

2.1.2 Limitation of the adoption and diffusion tradition

In intervention practice and theory, ideas regarding innovation have changed considerably in association with the shift from instrumental/persuasive models to interactive models of communicative intervention (Leeuwis, 2002). Over the years the ‘adoption and diffusion of innovations perspective’ has been criticized theoretically and for the intervention practices it has inspired. These highly interconnected shortcomings as summarized by Leeuwis were;

Pro-innovation bias

Studies on adoption and diffusion of innovations tended to start with a predefined innovation, the uptake of which was regarded as desirable for those being researched. Concern in adoption and diffusion research with the rate of adoption and ways to increase this, implies that the innovations studied are considered worthwhile, and that it would make sense for most farmers to adopt them. In practice, however, many innovations are proposed which do not make sense for many farmers.

A linear and ‘top-down’ model of innovation

It was basically assumed that innovation originate from scientists, are transferred by communication workers and other intermediaries, and are applied by agricultural practitioners. This mode of thinking is called ‘the linear model of innovation’. However, when scholars started to analyze in retrospect how successful innovation came about in practice, they soon discovered all sorts of deviations from the linear model.

A uni-linear model of farm development

Both the pro-innovation bias and the terminology used in the adopter category classification (‘early adopters’, ‘late majority’, ‘laggards’, etc.) reflect the idea that there is basically one direction in agricultural development which all farmers who want to continue farming should follow sooner or later. However there are several viable patterns of developing a farm, even under homogeneous conditions. Each pattern of farm development is characterized by different patterns of innovation.

Blindness, biased perceptions of innovativeness and stigmatization

It has been shown that, as an expression of uni-linear ideas on farm development, change agents and/or their organizations preferred and favored particular types and patterns of innovations. This reflects a certain blindness for alternative directions, which is also reflected in adoption indexes. These indexes have been calculated typically on the basis of list of innovations suggested by extension organizations. However, one can expect these lists to have been rather biased in view of the developmental preferences referred to above, leading to misleading perceptions about ‘innovativeness’.

Arbitrary and inadequate categorizations for targeting

The classification into adopter categories has often been used to direct and target communicative intervention activities. However, it is important to realize that –as a result of the way in which people are assigned to different categories –members belonging to the same category may have very little in common apart from the fact that they have adopted a similar

number of innovations out of a selective list. An adopter category may well include people with totally different gender, age, farm size, farming style, land tenure position, ethnicity, pest management problem, etc.

‘Progressive’ farmer bias as a self-reinforcing process

The people regarded as opinion leaders were usually relatively wealthy farmers who had already adopted a relatively large numbers of innovations favored by intervening organizations, and hence were regarded as ‘progressive’ farmers. Leaving aside for a moment whether diffusion actually occurred, communication workers have frequently been criticized for paying most attention to those who needed it least. More precisely, we would argue that communication workers have tended to focus on those farmers and opinion leaders who fitted best with their preferred model of farm development.

The selective and non-automatic nature of diffusion

Communicative intervention has often been biased in terms of the innovations proposed and the opinion leaders selected, it is not surprising that diffusion tended to be selective as well. It has been realized that diffusion is less of an ‘automatic’ process than assumed earlier. In other words, the fact that, people who adopted innovations can be shown to have been influenced by others (e.g. opinion leaders) in retrospect does not mean that ‘opinion leaders’ can be expected to actively support diffusion. In fact, they may well have reasons to shield or selectively withhold information from others, especially in an age of competition and commercialization of knowledge.

Innovation as a collective rather than an individual phenomenon

In adoption and diffusion research, the adoption of innovations has been portrayed as relating to an individual. Although it is recognized to some extent that people are influenced by others in taking innovation decisions, and although some special innovations are described as ‘collective’, there trends to be a greater emphasis on the individual farmer. Conventional adoption and diffusion research, however, does not pay much attention to co-ordination between interdependent actors.

A one-dimensional view of innovations

In adoption and diffusion research, the innovation is often treated as a single entity. However, from a collective point of view, innovations consist of a variety of new and interdependent practices that may be implemented by a variety of people.

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. Putnam (1993), claims 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, he has located trust as an outcome of social capital defined as social networks and associated norms of reciprocity (Putnam, 2000).

Portes (1998), on the other hand, observes, ‘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, as Woolcock (2001) holds, 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 thereof. It also means the voluntary action taken by a group to achieve common interests within this context.

According to Kunitz (2004) and Gibbon & Pokhrel (1999), social capital refers to the bonds (interactions and engagement) between individuals, both in intimate relationships (primary groups) and in voluntary associations (secondary groups) that make it possible for individuals and groups to achieve a variety of goals.

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).

Finally it is understood that social capital 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 capital is a network of people or institutions and organizations that can improve the efficiency of society in general and individual HHs in particular. Therefore, for this study, social capital means the formal and informal networks of people, institutions and organizations that facilitate the exchange of social resources (information, knowledge, inputs etc) in the process of improving the livelihood of HHs and the well-being of the society.

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. Before specific characteristics of social networks can be explored, or their quality investigated, the network type being studied in any given social capital research must be identified (Stone, 2001).

Ye Zingzhong (2002) also described social networks in terms of three connections of blood, geo-space, and profession, in other words kinship, friendship, and fellow villager networks and occupation related networks. Such networks are the fibers of social capital that can bring considerable economic and political advantage or benefit to actors.

According to Agapitova (2005) a social network is broadly defined as an arrangement of differentiated elements (individuals, firms or organizations) linked to each other by multitude of ties of a specified type. According to their content (information, advice, friendship, trust, etc.) and strength (amount of time spent together, emotional intensity, etc.), relationships in the network vary between strong and weak. The strength of a social tie is defined in terms of time and emotions invested in a relationship, as well as reciprocity involved between participating actors. Typical examples of strong ties include friendship and family relations. Weak ties, by contrast, entail more limited investment of time and intimacy, subsuming an array of social acquaintances.

Granovetter (1985) mentioned that weak ties are more important in spreading information because they serve as bridges between otherwise disconnected social groups. Later works by Uzzi (1997) show that strong ties can also provide access to important sources of knowledge. In the case of the strong ties, knowledge transfer is more ‘fine-grained’ and provide a higher

quality information than the one transmitted through the weak ties. He also indicated that trust among the economic actors can be supported by both strong and weak ties. However trust based on the strong tie tends to be exclusively related to this particular tie. On the other hand, trust, based on the weak linkages doesn't have the quality of exchange provided by the strong ties, but is extended to a larger number of actors.

2.2.2.1 Typology of social networks

As distinguished by Woodcock, (2000) three different types of social networks and ties, bonding, bridging and linking social networks.

Bonding social networks

“Bonding” occurs in relatively “alike” groups. It typically arises in connections and ties among families or specific ethnic or kinship-based groups. It might also arise within a particular social group bound together by shared identities, interests and place of residence. Frequently the term bonding social capital is confused with the notion of “strong ties”. In practice, “strong ties” do involve bonding social capital in the sense that they arise from relationship among “alike” members of a network. Bonding social capital complemented by strong ties can provide important emotional, personal and health-related benefits to its members through close support for getting by in life.

Bridging social networks

“Bridging” social capital connects different types of people and groups (e.g. ethnic, social, gender, political or regional) and can be particularly effective for people seeking social and economic gain beyond their immediate society for getting on in life. This type of social capital arises when associations and connections are made across social, geographical or strong ethnic “identity” lines. Weak ties and “structural holes” (Burt, 2000) may facilitate reaching out to new ideas, persons and resources.

Linking social networks

“Linking” social capital connects groups and individuals to others in a different social position (e.g. more powerful or socially advantaged). It includes also relations and interactions between a community and its leaders and extends to wider relationships between the village, the government, and the marketplace.

Many scholars also agreed that these three elements need to be in balance. If bonding is too dominant, for example, it can lead to neighborhoods becoming inward looking and intolerant of outsiders and change. Its residents cannot "get ahead". This can lead to racism and ethnic based social relation.

Robert Putnam (1998 as cited in Stone, 2001) distinguishes between informal and formal networks, or what he terms formality of civic engagement. Informal ties, according to Putnam, include those held between family, kin, friends and neighbors, whereas formal ties include ties to voluntary associations and the like. Among informal networks, distinction is first made between families within and beyond the household, as it is anticipated that family units within one household cooperate and function in different ways to extended networks of kin beyond the household. Informal ‘communities of interest’ beyond family and kin include friendships and other intimate relationships as well as bonds among neighbors. Formal networks of social relations concern those aspects of life most often described as civic (Baum *et al.*, 2000) or institutional. These include associations with formally constituted groups, as well as non-group based activities.

2.2.2.2 Common networking terminology

In addition to defining social networks, some common social networking terms need to be explained in order to understand the social network approach more fully. The following definitions are summarized from Wasserman and Faust (1994).

Actors

These are the nodes in the network. An actor can be an individual, a group, an organization, or even a nation-state.

Ties

These are the links between actors. These ties can be reciprocated, or unreciprocated, and they can be directed (e.g. a person giving another person money) or undirected (e.g. two people working at the same organization).

Relations

A relation is a specific type of tie between actors in a network. There are many different kinds of relations: communication or social interaction, friendship, reciprocity, trust, diplomacy, advice, and so forth

Group

This is a bounded collection of actors on which ties are to be measured. One must be able to argue theoretically, empirically, or conceptually that the actors in this set are tied to one another and are more or less bounded. The actors belong together in a bounded set, one in which the number of actors is finite and the boundaries around this set of actors is clearly defined.

Norms of reciprocity

Reciprocity is the process of exchange within a social relationship whereby 'goods and services' (meaning exchange of any kind) given by one party are repaid to that party by the party who received the original 'goods and services'. Reciprocal relations are governed by norms, such that parties to the exchange understand the social contract they have entered into (Stone, 2001).

2.3 Theoretical Background

2.3.1 Diffusion networks and diffusion theory

The heart of the diffusion process is modeling and imitation by potential adopters of their near friends and groups who have previously adopted a new idea. In deciding whether or not to adopt an innovation, we all depend mainly on the communicated experience of others much like ourselves who have already adopted. These subjective evaluations of innovations mainly flow through interpersonal networks. For this reason, we must understand the nature of networks if we are to comprehend the diffusion of innovations fully (Rogers, 1983).

Theoretical reasoning and direct observation have long suggested that diffusion of innovation doesn't occur in a vacuum and that the kind of social structure in which an actor operates is important in affecting adoption behavior (Rogers and Shoemaker, 1971; Van de Ban, 1960).

2.3.2 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).

Social learning refers to the acquisition of skills, facts, and values which comes about as a result of practice through our contact with other persons. The basic general concept for such contact is interaction (Young, 1956).

According to Kohler et al., (2007) and Hogset (2005), social networks affect the diffusion of innovations through social learning, joint evaluation, social influence, and collective action process. Through social learning, people learn about an innovation's existence and characteristics and take advantage of alters' experiences to lower uncertainties related to adoption.

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 shows that farmers learn how to cultivate a new crop from past choices of others in their social network 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).

Social capital plays an important role in influencing adoption impacts of agricultural technology, because of the ways in which social networks and social relationships facilitate and constrain technology dissemination. As a result of differing social networks and correspondingly different levels of access to information, men and women experience different economic consequences (Ravula *et al.*, 2006).

Moreover, social processes are responsible for development of various kinds of networks that results in different impacts on innovative activities. Social networks might either facilitate or hinder technology adoption and diffusion. They can facilitate technological change by supporting trust, cooperation, circulation and dissemination of new knowledge, process of reciprocal innovation that reduces the distinctions between large and small farms. On the other hand, social networks can hinder innovation by creating barriers to new entrants and thereby limiting opportunities to experiment with new technology. (Agapitova, 2005).

2.4 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).

Information exchange in social networks also provides important economic benefits. For example, dense networks with the dominance of strong ties enable a ‘thick’ information exchange that makes new knowledge quickly available for all actors in the network. On the other hand, loose networks composed by a large number of weak ties give access to a large amount & novelty of information that might, however be less detailed and strategic than provided by the strong ties (Agapitova, 2005).

2.5 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).

Gender is a social construct superimposing cultural significance onto sexual identity. As the main source of economic and social welfare for its members, the family is the first building block in the generation of social capital for the larger society. Many studies now show that social networks, norms and trust that comprise social capital are important determinants of development outcomes. These informal networks and social relationships are particularly important for women. In almost all societies, women are less likely to belong to formal organizations (*ibid.*).

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 (Fafchamps and Quisumbing 2003) and in the division of responsibilities in the household and in the community. 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. Significant heterogeneity among female-headed households has also been highlighted in the literature implying differential provision of resources and their use among rural settings (Peters, 1983).

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 Zwarteveen, 2003). Women have been found to

join groups that mobilize fewer resources than men because they are resource-constrained (Maluccio *et al.*, 2003). Gender norms in the community may also exclude women from social capital-enhancing activities, such as drinking clubs.

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).

Several studies have found that men and women's personal networks differ in composition, although they are similar in size. 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).

Arce and Long (1994) states how farmers' wives also form their own networks: "knowledge is assembled by women farmers through combining informal networks with the membership of a multiplicity of women's organizations set up to represent them ... The knowledge network builds bridges between women's life worlds and cross-cuts official women's organizations "representing" them. These informal ties function as binding elements in the lives of rural women, often more than do formal organizations. However, the experiences that women gain from participating in official organizations feed into their existing interpersonal networks, thus generating a complex and changing category of loyalties, affiliations and perceptions."

2.6 Social Networks and Diffusion of Innovation

Since timing of adoption typically depends on the interaction of social units in a process of communication (Rogers, 1995), a major focus in diffusion research has been on variables that mediate communication processes including both the transmission and absorption of information between members of societal microstructures. Interactions can occur between individuals between individuals and the media, or via business/professional organizations.

According to Feder and Slade (1985), the dynamics of diffusion processes depend mostly on horizontal communication among farmers. Adoption is strongly influenced by members of the same social group. New ideas are more easily adopted when they come from others who are similar in several respects. Outsiders are not entirely trusted, especially in conservative locations. Farmers then monitor and have a perception of other farmers' experiences and performance, and they learn from discussing their own experiences with friends and neighbors.

When adoption is viewed as a social process, it becomes clear that one should expect adoption behavior to be influenced by the personality of the decision maker, their social networks, personal circumstances and family situation. It seems that in the empirical literature every measurable characteristic of farms and farmers has been found to be statistically related to some measure of adoption of some innovation (Rogers, 2003)

Economic research on technology adoption and diffusion of innovation in rural areas has only partially addressed the issue of how interpersonal network exchanges affect adoption. Similar studies on adoption and diffusion build their modeling or empirical estimation on a very likely assumption: that neighboring agricultural households are, *de facto*, members of a social structure who exchange information about improved agricultural practices. Yet much economic and non-economic research suggests that the characteristics of social structures are critical determinants of the way that information is diffused among households (Isahm, 2000).

In many cases, adoption is better accounted for as a network-based decision, where exposure to an innovation through a network of peers has a cumulatively increasing influence on adoption as pressure toward conformity builds and as risks perceived by potential adopters decrease (Valente, 1995).

2.7 Empirical Studies on the Roles of Social Networks in Adoption and Diffusion of Technologies

The literature that exists concerning the influence of social capital on different social, economic and institutional aspects is too diversified to be exhaustively reviewed here. Therefore, only those studies that are directly or indirectly related to the variables of this study were reviewed. Relatively speaking, only few studies have been conducted on the influence of social capital variable on technology adoption and diffusion. This could be attributed to the recentness of the concept which addresses the important role of social capital variables.

Application of the social capital 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.

Bandiera and Rasul (2003) indicate that farmers in Mozambique would be more likely to adopt if other people in their network also adopted. In their research, three quarters of farmers reported being more likely to adopt if a family member adopted. Around half said they would be more likely to adopt if a friend, neighbor, or a friend from their church adopted. The influences of networks does not however pass the boundary of the village-only five percent said they would be more likely to adopt if a friend from another village adopted.

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).

Masuki *et al.*, (2004) highlighted that group networking, number of years spent in formal education, age of head of household and pathways of agricultural information all affect the intensity of adoption positively and significantly. Agbamu (1995) also indicated that, information sources that positively influence the adoption of technologies can include: other farmers; media; meetings and extension officers.

Indeed, studies of innovation adoption and diffusion have long recognized information as a key variable, and its availability is typically found to correlate with adoption (De Harrera and Sain, 1999). Doss and Morris (2001) in his study on adoption of improved maize technology in Ghana basically suggests that gender-linked differences in the adoption of modern maize varieties and chemical fertilizer are not attributable to inherent characteristics of the technologies themselves but instead result from gender-linked differences in access to key inputs.

Swan and Newell (1995) argued that the network of professional organizations was the single most influential variable in determining the adoption of new technology by firms (accounting for 18% of the variance). Similarly, Chaves (1996) indicated that the existence of religious networks almost doubled the probability of adoption of the practice of ordination of women.

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, 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.

It has been found, however, that political participation is related to the degree of involvement one has in the social system. Participation in institutional areas other than the political systems provides one with a network of contacts which mediates between the individual and the political process and functions as a catalyst for political participation (Van and Robert, 1970).

And finally, it is now increasingly recognized that information on agricultural innovations diffuses through social networks rather than being freely available in the village. Social capital plays a crucial mediating role in the process of technology uptake in rural farm communities. The researcher adheres to this view in studying the role that social networks may play in facilitating information exchange in new agricultural technologies among rural households in Metema Woreda. He further differentiates the social networks by gender and settlement pattern in order to gain greater insight into how gender inequalities influence the effectiveness of social networks in facilitating information exchange.

2.8 Conceptual Framework of the Study

The conceptual framework indicates that technological or institutional innovation could stem from various actors at macro or micro level and is channeled into a given social system through formal or informal social networks. Decision making at household or individual level to adopt and diffuse these innovations depends on the preference, trust, solidarity and cooperation of the household or individuals towards the members of the networks. It is hypothesized that, rural individuals or households rely more on informal social networks than formal ones for information and material exchange which is the crucial element of the diffusion process. The bold arrow in the local social system where the study was carried out indicates, households or individuals are more influenced by their informal social networks (Peer pressure) to adopt or diffuse a given innovation.

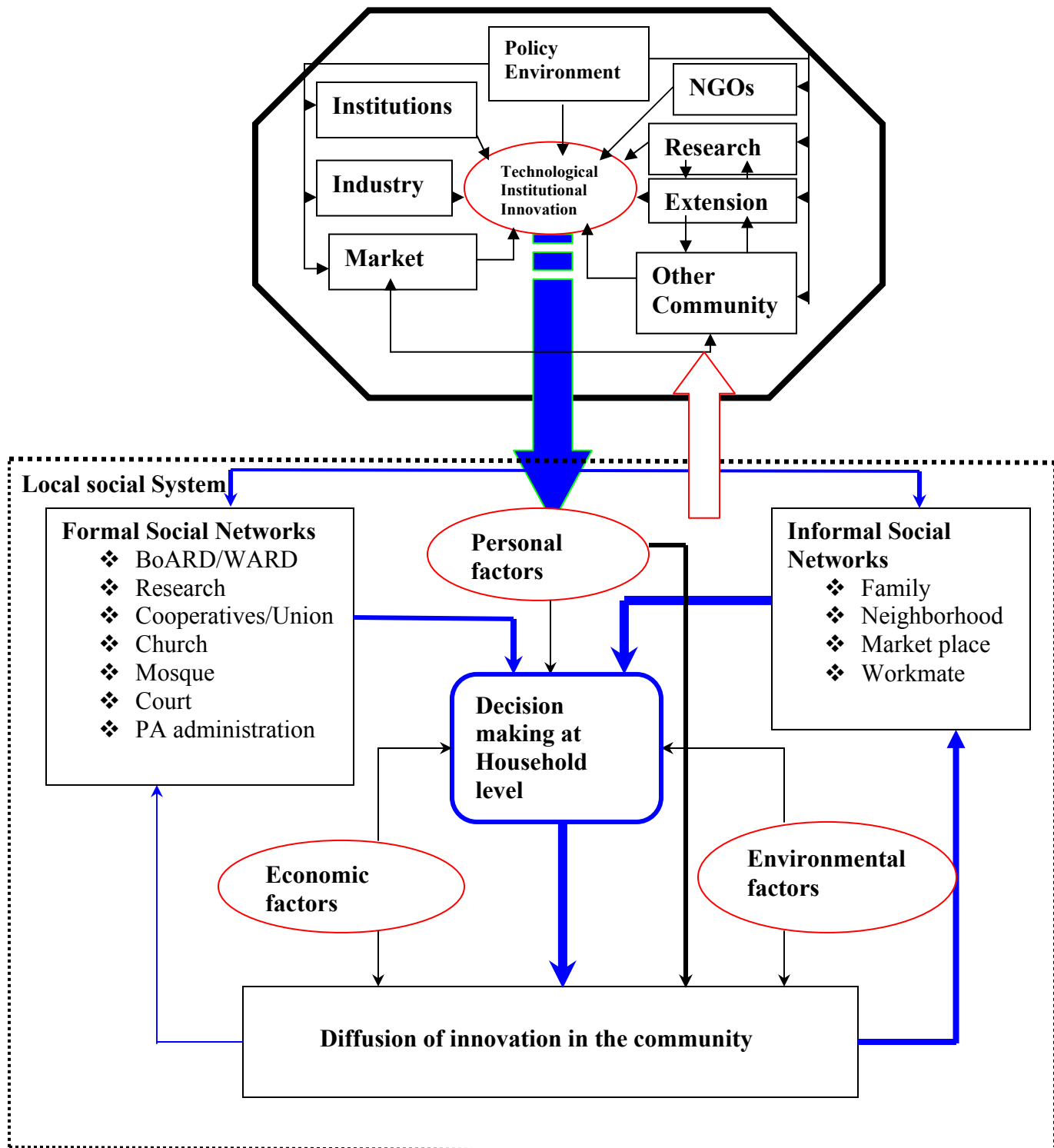


Figure 1 Conceptual Framework of the study

2.9 Definition of variables and working hypothesis

The **dependent variable** of the study to answer the second objective, for the logistic regression analysis has dichotomous nature representing the observed status of the respondents in adoption decision of improved sorghum varieties. In this case, 1 represents adoption of improved sorghum varieties and 0 non-adoptions of these varieties since the introduction.

The **independent variables** of the study, Respondent's decision to use a given improved sorghum varieties is influenced by the demographic personal characteristics and accumulation of social capital of the household, the organizational and institutional support systems based on the various studies already reviewed in the literature review part. The variables hypothesized to affect household propensity to join groups and adopt and diffuse improved varieties were tested whether they were statistically significant or not using t-statistics and chi-square (χ^2) tests. The test was used to test the significance of the mean value of continuous variables of the two groups of previous and recent settlers as well as MHHs and FHHs. Like wise the potential discrete (dummy) variables were tested using chi-square (χ^2) distribution.

The major variables expected to have influence on the decision making to adopt and diffuse agricultural technologies are explained below;

1. **Sex of the Household Head (SEX):** It is a dummy variable that refers to the sex of the head of the household. Gender may create difference in preference and barriers to social capital formation because of differences in roles and constraints. Compared to men, women in rural society tend to have a higher opportunity cost of time, and gender norms in the community sometimes constrain their social interaction. Female Head households may also be unable to participate in organizations that require membership fees or other contributions Male headed households appear to make more friendships in general and maintain more links with individuals in off-farm activities than female headed households. Female household heads may experience more barriers than their male counterparts to acquiring this type of social capital. (Maluccio *et al.*, 2003, Katunggi *et al.*, 2007).

- 2. Marital status (MARITALSTA):** It is a categorical 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 could have a better access to join formal organizations. Hence, they likely to adopt agricultural technologies.
- 3. Education (EDUC):** it is a categorical variable which is linked to information acquisition and trust formation (Alesina and La Ferrara 2002). 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).
- 4. Family size (FMSIZE):** It a continuous variable that refers to the number of family members of a given HH. The family members are important in the formation of social capital through different social networking
- 5. Number of Relatives and Friends (NUMREL):** it is a continuous variable which refers to the number of relatives and close friends the HH members have 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 of whose benefits it is less sure. 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 persuade their relatives to join organizations/social networks of which they are members (Katungi *et al.*, 2007). And it was also hypothesized that households with relatively more number of relatives and friends have access to information, inputs and hence likely to adopt/use improved sorghum varieties.

- 6. Numbers of people beyond the Household in case of long term help (NUMPPWIL):** it is a continuous variable which refers to the number of people beyond the HH who are willing to assist the household members in case of long term help/support. In case of crises like crop failure, death of the breadwinners, households with a more number of people beyond the HH who are willing to assist will have a better access to resources such as credit, labor and seed and hence likely to adopt new technologies.
- 7. Years of residence in the village (YEARRES):** it is a continuous variable measured as the numbers of years the household has lived continuously in the village. The duration of residence in the community indicates the length of time the household has had to make friends. It was hypothesized that previous settlers lived more than six or seven years have a better social capital accumulation and have access to improved sorghum varieties.
- 8. Membership in Cooperatives (MEMBR COP):** it is a dummy variable which refers to the membership of at least one members of the household in economically oriented cooperatives. Membership in cooperatives affects the household's access to information and important inputs in the process of technology adoption and diffusion. Besides previous and recent settlers have no equal opportunities to join these groups.
- 9. Membership in formal credit (MEMBERCRD):** it is a dummy variable which refers to the membership of at least one members of the household in economically oriented credit associations.

3 RESEARCH METHODOLOGY

This chapter consists of description of the study area, research design (sampling design and sampling methods), data collection methods and data types and methods of data analysis.

3.1 Description of the Study Area

3.1.1 Amhara National Regional State (ANRS)

Amhara National Regional State (ANRS) is located in the North-Western part of Ethiopia between latitude 9°-13° 45' N and longitude 36°-40° 30'E, with a total area of 170,152 Km² (which is about 1/6 of the total area of the country (BoA1997)). The region ranges from 600 m above sea level at Metema, North Gondar, to 4520 m.a.s.l. at Ras Dashen, North Gondar, which is also Ethiopia's highest point. The wide range of altitude is a major factor in determining the temperature range of the region. Generally, lowland areas (<1500 m.a.s.l.) experience hot temperatures, while highland areas (>1500 m.a.s.l.) experience relatively cooler temperatures. For example, in the hot to warm sub moist agro-ecological zone, where the altitude ranges from 600 to 1400 m.a.s.l., the mean annual temperature range is 21–27°C while in the cold to very cold moist zone, where the altitude ranges from 2800 to 4200 m.a.s.l., the mean annual temperature varies from 7.5°C to 16°C (CEDEP, 1999).

Table 1 Population estimate of Amhara region by types of residence

No	Residential area	Total population			2005 estimate
		Male	Female	Total	
1	Rural	8,186,295	7,970,585	16,156,880	16,564,096
2	Urban	913,832	1,083,074	1,996,906	2,097,003
	Total	9,100,127	9,053,659	18,153,786	18,661,099

Source: Population team of BoFED, 2004.

According to BoFED population team, Amhara Region has an estimated population of 18,661 millions in 2005. The population growth rate of the Region is 2.9 % per annum with an average population density of 99.80 per km². For administrative purpose, the region is divided into 11 zones (10 rural and 1 urban) and 109 Woredas. Agriculture is the dominant sector in the region and biggest employer of the economically active population. Agriculture in the region is characterized by extremely small holdings, mostly private peasant holdings, dispersion of crop land holdings, traditional farming and low level of literacy among the holders (CSA, 2003). In the Region, agriculture accounts for 63% of the regional GDP, and nearly 90% of the population derives its livelihoods from agriculture and allied activities (BoFED, 2004).

As agricultural production is mainly rain fed, the category and duration of rainfall determine the growing period. The mean annual rainfall varies from 300 mm in the east (Habru and Kobo *weredas* of North Wello) to over 2000 mm in the Awi zone in the west, specifically, the Banja Shikudad, Sekela and Guangua *weredas*. Generally, the western parts of the region are characterized as high rainfall and high agricultural potential areas, with precipitation exceeding 1200 mm annually. Low rainfall and agricultural potential areas are found in the North Wello and Wag Hemra zones. The region experiences unimodal and bimodal rainfall categories, generally, in the west and east, respectively. In the western part of the region, the growing period varies from a little under 120 days in the North Gondar zone to more than 270 days in the Awi zone. On the contrary, the growing period varies from 45 to 90 and from 60 to 210 days in the eastern and south-eastern parts of the region, respectively (BoA, 1997).

3.1.2 Metema Woreda

Metema Woreda is one of the 18 Woredas of North Gondar Administrative zone. It comprises 18 PAs and 2 town associations. The Woreda has an international boundary of more than 60 km between Ethiopia and Sudan. Metema is bordered by Quarra and Alefa Taqusa in the South, Chilga in the East, Tach Arma Choho (Sanja) Woredas in the North and Sudan border in the West.

Population

According to the office of Woreda Agricultural and Rural Development, the population of the Woreda is estimated to be 105,588. According to the Woreda office Plan for 2006, there are 26,847 total households with 78,741 family members. About 25% of the total households are female headed. Out of the total, 7,524 households and 9,062 family members are recent settlers living within the Woreda.

The original residents of the area are Gumuz. Until recently, they practiced slash and burn and hunting wild animals. They produce sorghum as the staple crop which continues to be the major food crop in the area. Since the settlement programmes of the last and current governments, the relative proportion of natives became small in number. They are concentrated in few areas and live close to each other. They are found in only three PAs (*Kumer Aftit, Tumet and Shinfa*). The total number of the indigenous people would be around 500 households. Hence much of the area is occupied settled by newcomers from the highlands (IPMS, 2005).

Topography, soils and climate

The altitude of Metema ranges from as low as 550 to 1608 m.a.s.l while the minimum annual temperature ranges between 22 ° C and 28 ° C. Daily temperature becomes very high during the months of March to May, where it may get to as high as 43 ° C. The mean annual temperature is 31°C. Nearly all of the land in the Woreda is in the lowlands except some mountain tops which fall outside. Metema is one of the Woredas in the country where the climate is harsh and government allows a 30% hardship allowance (ibid).

According to the available data, the mean annual rainfall for the area ranges from about 850 to around 1100 mm. About 90% of the woreda receives mean annual rainfall between 850 and 1000 mm. Metema has a uni-modal rainfall, with the rainy months extending from June until the end of September. However, most of the rainfall is received during the months of July and August (ibid).

The soils in the area are predominantly black and some are soils with vertic properties. Soils in most of the areas are observed to have excessive cracks, as deep as 0.75 m in some places. There are about 9 types of soils in the area where about a quarter of the size of the woreda is Haplic Luvisols and about 22% are Vertisols or soils with vertic properties. On the other hand, Humic Nitosols account for about 6%. Seasonal water logging, especially during the heavy rainfall months, is high (ibid). The erratic rainfall combined with the poor workability of most of the soils, affects farm operations.

Agriculture and land use

Sorghum, Sesame and Cotton cover around 90% of the cultivated area. The area under sorghum is substantial (14,822 ha). The yield of sorghum is between 18 and 20 qt/ha, while that of sesame is between 4 and 6 qt/ha. Seed cotton from the locally grown varieties could yield about 8 qt/ha (ibid).

Livestock production is an integral part of the production system. The cattle population in the Woreda is quite high. Production of cattle (milk, meat), goat (meat) and poultry is a common practice. Cattle are exported to the Sudan while goats are mainly used for the local market. Experts in this Woreda believe that livestock feed is not a limiting resource in the Woreda. However, the farmers in the Woreda do not make hay and dry season feed availability remains a problem. This is especially so because farmers burn grasses for eliminating ticks and to stimulate fresh grass growth during the rainy season (ibid).

Commercial farmers use tractors for ploughing. Oxen are used to plough fields for all crops and to thresh sorghum, while donkeys are used for transporting agricultural produce and water for the smallholder farmers. Despite the large population of livestock, especially cattle and goats, productivity is low as in many other parts of Ethiopia (ibid).

Of the total area of the woreda, only 7.4 % was arable land (cultivable). The majority (71%) of the land was covered by forest and bush land. The other 16.2 %, 4.13 % of the total area was used for farm and pasture land respectively.

Table 2: Land use of Metema woreda

No	Land use type	Area (ha)	%
1	Arable land (cultivable)	32,652	7.4
2	Farm land	71,288	16.2
3	Pasture land	18,200	4.13
4	Forest and bush land	312,300	71.0
5	Occupied by human settlement	3,875	.88
6	Other	1,800	.42
Total area		440,115	100.0

Source: Woreda Agricultural Development and Information Bureau, 2005.

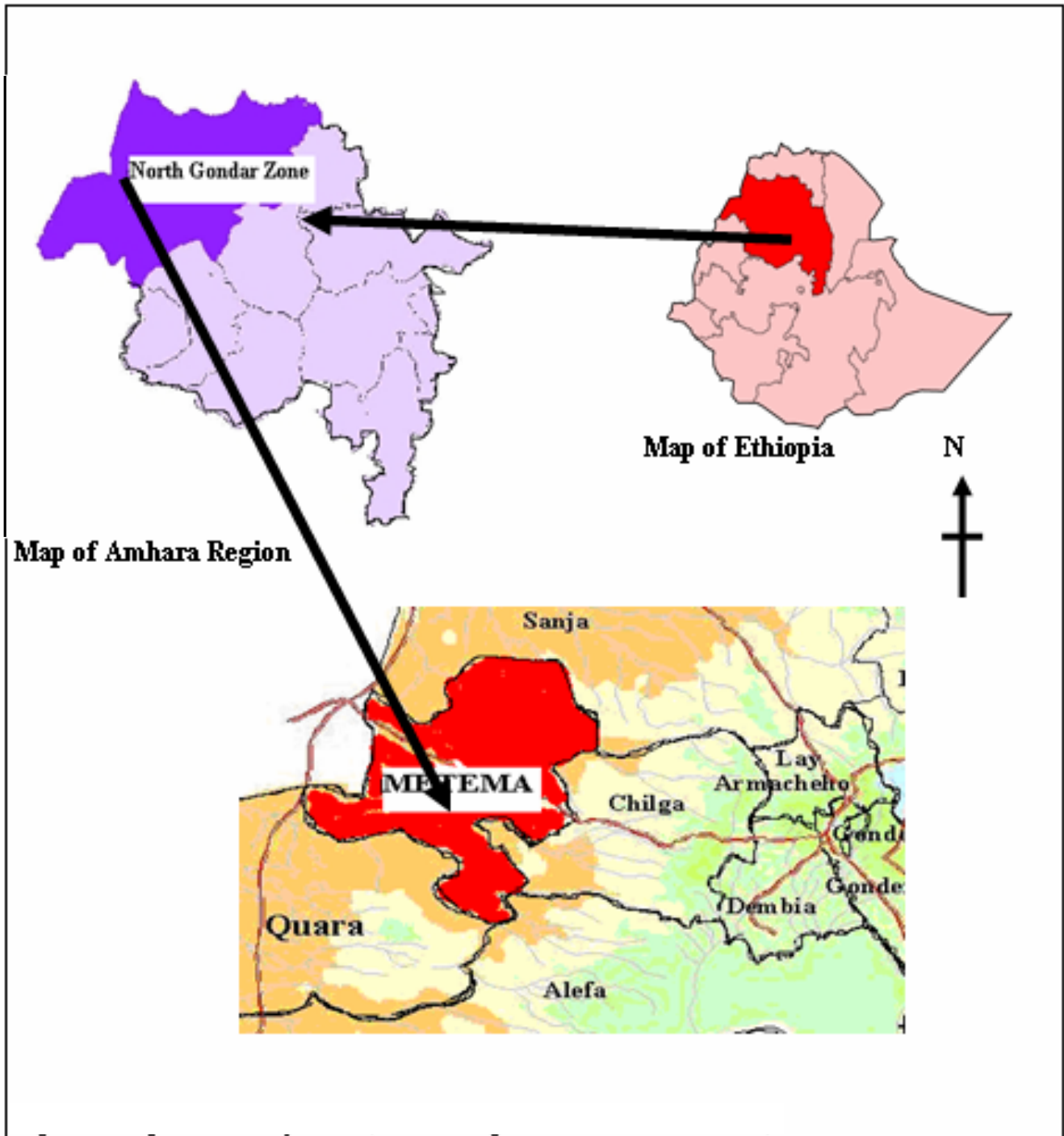


Figure 2 Map of the study area (Amhara region and Metema Woreda)

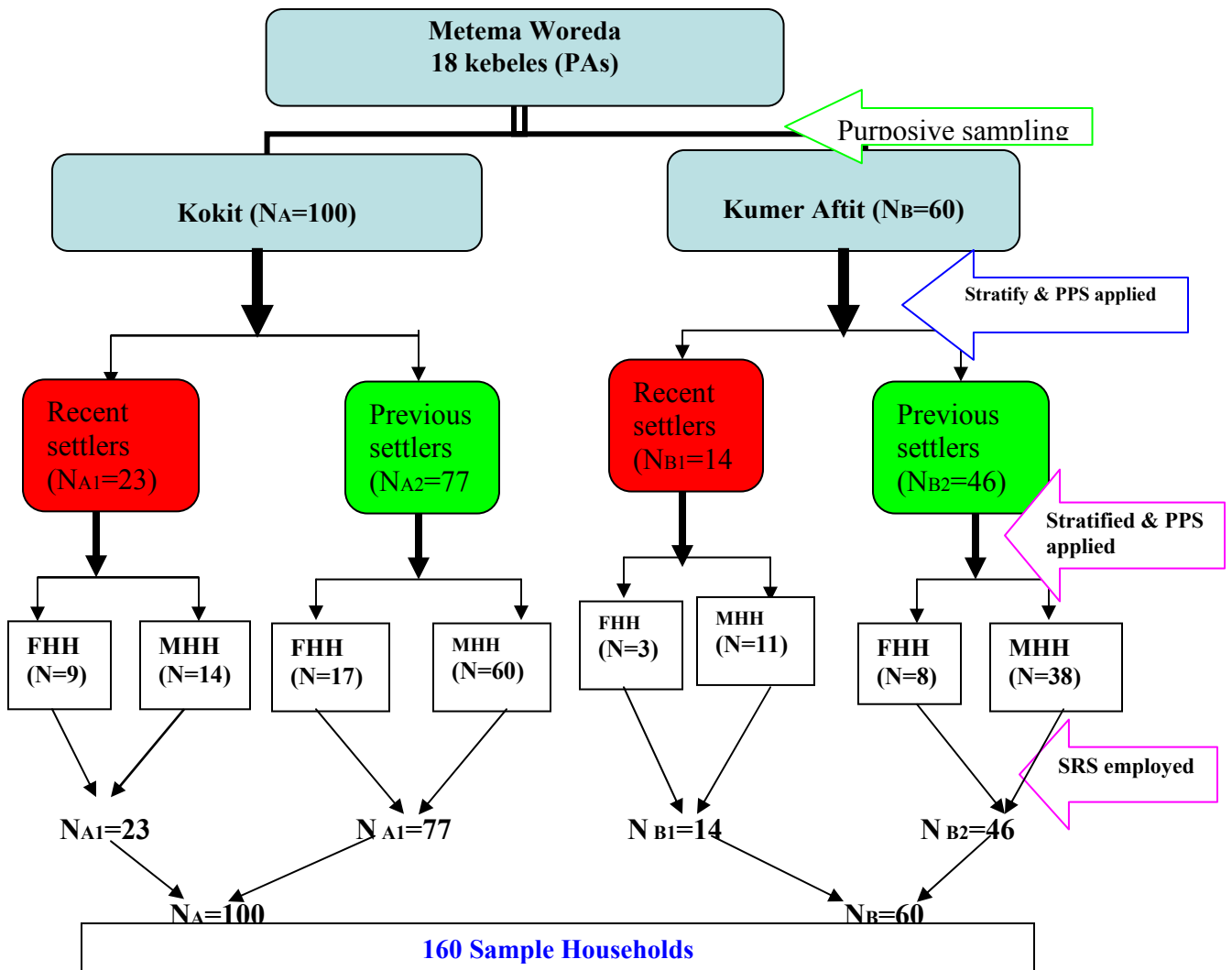
3.2 Research Design

It is becoming increasingly popular that combinations of methods are to be employed in social research. It is usual for researchers to employ mixed method designs to investigate different aspects of the same phenomenon (Crawford and Christensen, 1995 cited in Sarantakos, 1998). In this study both quantitative and qualitative methods were employed. Information was gathered through qualitative methods (semi structured interview with individuals and groups, field observations). Two in-depth interviews were conducted with 8-10 people in each PA, consisting of both previous and recent settlers as well as men and women.

3.2.1 Sampling design and sampling method

The respondents were selected using multi-stage sampling design. Metema Woreda was purposively selected since it is one of the Pilot Learning Woredas (PLWs) of IPMS, a research for development project and the sponsor of this research. High priority is also given by the regional government as it is one of host Woredas for resettlement. The Woreda consists of 18 PAs and 2 town kebeles. Among these 18 PAs, resettlement program has been taken up in six PAs during the past three years. In the first stage, kokit and Kumer aftit PAs out of 6 Peasant Associations (PAs) having higher proportion of area under sorghum were selected purposively. In the second stage, respondents were stratified into recent settlers (resettled since 2003), and previous settlers (resettled before 15 years or more). The previous settlers in this study comprise of indigenous people (Gumuz) and those HHs who have been settled before 2003 either by self initiatives or government sponsored resettlement following the 1984/85 famine in the country. In the third stage, in order to ensure gender disaggregated data, the new and the previous settlers were again stratified into male and female headed households. A total of 160 sample farmers were selected from the new and previous settler categories using probability proportional to size sampling technique. Finally, the sample household respondents were selected randomly from the final categories based on their proportions, ensuring the inclusion of at least 20% Female headed households in the sample. This is due to less number of new female headed households settlers in recent resettlement scheme (Fig 3).

Figure 3 Sampling Procedure



3.2.2 Data collection method

Household survey

A face-to-face interview with structured, pre tested interview schedule was used to collect primary data from the sample respondents. The interview schedule was pre-tested with 15 randomly selected farmers and based on the results of the pre-test necessary modifications were made. Enumerators who are knowledgeable about the area were recruited from the study area and were trained on the objectives, methods of data collection and interviewing techniques.

Group interview

Social capital is relational; it exists between people. Asking a group of people to respond together to certain questions and hypothetical situations may yield information that is more nuanced than data derived from surveys. As a result, groups which comprised elders, religious leaders and knowledgeable people in the village were purposively selected in each PA.

Focus group discussion

Focus Group discussions were conducted in 2 PAs. Separate (stratified by their settlement category and gender) group discussions were organized and held in each selected PA. Each group comprised of 7 to 10 participants. The participants were selected randomly from the study area.

Table 3 Summary of different samples of farmers in the study area

No	Method	N Sampled		Sample location	Sampling criteria
		Kokit	Kumer Aftit		
1	Semi-structured group interview	10	8	In sample PAs	Purposively selected by their settlement category and sex
2	Focus group discussions	6-8	5-7	In sample PAs	Chosen based on their settlement category and sex
3	Household survey	100	60	In sample PAs	Random, stratified by settlement category and sex

3.2.3 Data collection and data type

Both primary and secondary data were collected in this study. The primary data were collected from 160 sample respondents through interview schedule, group interview including Participatory Rural Appraisal and focus group discussion. For the household survey and Group interview at community level, Instruments of the Social Capital Assessment Tool (Grootaert *et al.*, 2003) adapted to local context were used.

These were used to elicit the views and understandings of households as well as the community about the existing formal and informal social networks and their gender implications, extent of functional contribution made by social networks in the process of agricultural technology diffusion among members of the networks and community and the constraints that impede the sustainability of these networks and its coping strategies.

Group interview to understand the community social networks

The community social networks profile was defined through a series of group interviews conducted in the community during the initial days of field work. This allowed the researcher to become familiar with community characteristics and issues relating to social capital for reference in later phases of the data collection, especially the household survey.

Participatory Rural Appraisal (PRA) techniques such as an institutional diagramming exercise & priority ranking were used. This generated diagrams (web) of institutional network relationships which is the basis of the social networks. This technique was employed during group interview.

Household survey through interview schedule

For the household survey, the necessary information from sample households were collected on the household demographics, socio economic conditions, level of education; types, organizational density, diversity, characteristics of groups, organizations in which a household is a member; data on network and mutual support organizations, which contribute to the

information exchange, resource pooling, seed exchange in agricultural technology diffusion process. The respondents were asked whether they planted improved sorghum varieties since last cropping season and their sources of seed; data on the constraints of social networks which may affect the sustainability of these institutions in the process of technology diffusion in the community such as exclusion from group, conflict resolution (problem handling mechanisms), trust and cooperation among members.

Focus group discussion

Focused group discussion, the interviewer guides a conversation among a small group of six to eight members of the community. These are semi- structured; the interviewer's (facilitator's) skills are used to introduce a list of topics, to encourage wider discussion and opinions of community members. The group discusses and develops the topic with some direction from a facilitator. The role of the facilitator is in the background, ensuring that the group boundaries are kept to and to ensure that the group stays on track.

After the completion of the household survey, focus group discussions were held in 2 PAs to enrich and triangulate the data collected through interview. Eight (four from each PA as stratified by their settlement category and gender) group discussions were organized in the 2 PAs. Secondary data were obtained from various sources such as reports of MOA at different levels, IPMS, NGOs, CSA, Woreda Administrative office, previous research findings, Internet and other published and unpublished materials, which were found to be relevant to the study.

3.2.3 Methods of data analysis

Following the completion of the data collection, the data was coded and entered in to Statistical Package for Social Science (SPSS version 12) computer program for analysis. Primary data collected from individual and group respondents, through the interview schedule were analyzed using descriptive statistics such as simple measures of central tendency, mean, standard deviation, frequency, percentages and cross tabulation through the use of statistical package for social science (SPSS version 12) and Diagrams were used for community social institutions and organizations. Ranking was used to find out the importance of groups and associations to their household, importance of social networks in information exchange, seed source and exchange, as a influences of nodes in social networks to adopt a given technology and as a channel of innovation. Mean comparison methods (independent sample t-test, chi-square test) and binary logistic regression model were used to test the potential power of selected continuous and discrete variables that may affect the use of improved sorghum varieties in the study area. These tests were also used to compare and test the level of trust among different people and institutions and age and family size among previous and recent settlers, and male and female headed households.

Descriptive tools were supplemented by qualitative analytical methods (mainly for those data acquired through the participatory/ qualitative methods) like interpretation and explanation of various opinions, views and concepts; and summarizing, categorizing, and presentation of these in convenient forms. Data from the qualitative survey were analyzed at field after looking to the category matching using the essential method tables, figures, photography and their interpretation and description were also used.

Secondary information collected from BoARD of the Woreda, IPMS and other relevant governmental and Non Governmental organizations (NGOs) in the resettlement program were analyzed using descriptive statistics.

4 RESULTS AND DISCUSSION

In this chapter, the results of the study are presented and discussed in detail to address the three objectives of the research. The results are based on household survey of 160 sample households, 8 focus group discussions with previous and recent settlers with different gender composition (men and women separately), 2 group interviews in sample PAs.

The chapter is divided into four sections, namely; socio economic and demographic characteristics of sample HHs; types of formal and informal social networks in the study area; contribution and importance of social networks in the diffusion of agricultural innovation and; community level social capital in the study area.

The results are presented using descriptive statistical tools such as mean, percentage, and cross tabulation. Independent T- test and chi-square test were employed to see the relationship between selected variables. Qualitative data analysis methods such as ranking, interpretation and diagramming were also used.

4.1 Socio-Economic and Demographic Characteristics of Sample Households

In this section, different household characteristics that influence participation in different social networks, groups and associations and that could have potential impact on the use of improved sorghum varieties are discussed.

4.1.1 Sex of the respondents

The sample was composed of 76.9 % (n=123) male headed households and 23.1% (n=37) female headed households. The chi-square value of (8.94) indicates that there is a relationship between the sex of the household heads and use of improved varieties. The value of phi and Cramer's V also showed that a positive, strong and significance relationship between sex of the household heads and use of improved sorghum varieties (Table 4). The male headed households are more likely to use improved varieties of sorghum in the study area. Among the users of those varieties 94.7 % were male headed households. This might be because male headed households have a better social networking to secure and/or get improved seeds and information about the varieties.

Table 4 Relationship between sex of the respondents and use of improved sorghum varieties

No	Variable	df	(Values and significance 2-tailed and			
			χ^2 -test		Symmetric measures	
			Pearson's χ^2	phi	Cramer's V	Gamma
	Sex of the respondent	1	(8.94)***	(0.236)***	(0.236)***	(0.757)***

Source: computed from own survey, 2007

df: degree of freedom

*** Represent Significant at 1% probability level.

4.1.2 Family size of the sample households

As shown in table 5, the family size of the total sample respondent's ranges from 1 to 13 with a mean of 4.44 persons and a standard deviation of 2.30 and coefficient of variation 51.7%. For the previous settlers, family size ranges from 1 to 13 and the average family size was 4.69 with a standard deviation of 2.42 and coefficient of variation 51.5%. However, in the case of recent settlers the family size ranges from 1 to 8 with a mean of 3.57 persons, a standard deviation of 1.54 and coefficient of variation 43.1%.

Table 5 Summary of means of family size by settlement category and Sex (N=160)

No	By Settlement category	Mean	Std. Deviation	Mean difference	t- Value Sig. (2-tailed)
1	Previous settlers(n=123)	4.69	2.422		
2	Recent settlers (n=37)	3.56	1.537	1.13	2.681 (0.008)***
	Total	4.44	2.30		
By Sex					
1	Male Headed (n=123)	4.74	2.324	1.34	3.216 (0.002)***
2	Female Headed (n=37)	3.40	1.877		
	Total	4.44	2.30		

Source: computed from own survey, 2007

*** Represent Significant at 1% probability level.

The family size of previous settlers was significantly larger and more variable than that of the recent settlers. The significant difference observed among the previous and recent settlers is because; most recent settlers come to the resettlement sites with out their families. Because, Men were encouraged to move first to the resettlement sites and families were left behind. The purpose seems to minimize risk, for new sites would have health problems, which could be unbearable for children and women. Men were advised to bring their families after making things ready. These are; harvesting food crops construction of houses for their families who will come later on.

The number household members increase the probability of the household to make contact with different social networks and hence better access to inputs (labor, seed and information). The t-test in Table 6 confirmed that, a strong and positive relationship between the number of family living in the household and the use of improved sorghum varieties in the study area.

Table 6 Number of household members and use of improved sorghum varieties

No	Variable	Use of improved varieties (N=160)	Mean	Std. Deviation	t-Value	Sig. (2-tailed)
	Number of Household members	Yes	38	7.9474	1.50580	11.685 .000***
		No	122	4.2951	2.15395	

Source: computed from own survey, 2007

*** Represent Significant at 1% probability level.

Moreover, since labor is the single most important and expensive input in the lowlands of Amhara region in general and the study area in particular, larger families with their greater supply of labor are expected to adopt a technology than the smaller family size. Improved sorghum varieties require higher labor for bird protection, harvesting and thrashing as compared to the local varieties. In this regard, previous settlers, with larger family size were likely to use the improved sorghum varieties than the recent settlers who have lower family size and left behind their families in their origin.

4.1.3 Origin and ethnicity of the respondents

4.1.3.1 Origin of the sample households

In Amhara region, intra-regional settlement program of the government mainly focuses on the most food insecure woredas of the region, typically, North and south Gondar, North and south Wollo and North shoa Zones. However, previous resettlement program included other regions as well.

Table 7: Distribution of sample household heads by origin

No	Respondent's Origin	Respondents settlement category				Total	
		Previous settlers (n=123)		Recent settlers (n=37)			
		f	%	f	%	f	%
1	Gondar	75	46.9	4	2.5	79	49.4
2	Wollo	33	20.6	22	13.8	55	34.4
3	Shewa	0	0.0	11	6.9	11	6.9
4	Gojam	7	4.4	0	0.0	7	4.4
5	Tigray	4	2.5	0	0.0	4	2.5
6	Born in the village	3	1.9	0	0.0	3	1.9
7	Other regions	1	0.6	0	0.0	1	0.6

Source: computed from own survey, 2007

Table 7 reveals that, the majority of the respondents (49.4%) are originally from North and South Gondar zones followed by North and South wollo(34.4%,including Oromiya Zone) North shoa (6.9%), Gojam(4.4%), Tigray (2.5%), born in the village (1.9%) and from other places (0.6%). This shows that, more than 80% of the re-settlers were from Gondar and Wollo areas where most of the food insecure Woredas are found and recurrent drought has been occurred.

4.1.3.2 Ethnicity of the sample households

Since most of the people in the study area, were settlers at different points in time and from different parts of the country, their ethnic composition differs as well. This sub section indicates the ethnic composition of the sample household heads

Table 8: Distribution of sample household heads by ethnicity (N=160)

No	Respondent's Ethnicity	Respondents settlement category				Total	
		Previous settlers(n=123)		Recent settlers (n=37)		f	%
		f	%	f	%		
1	Amhara	111	69.4	29	18.1	140	87.5
2	Gumuz	4	2.5	0	0.0	4	2.5
3	Oromo	0	0.0	2	1.3	2	1.3
4	Agew	4	2.5	6	3.8	10	6.3
5	Tigraian	4	2.5	0	0.0	4	2.5

Source: computed from own survey, 2007

The majority of the sample households (87.5%) belong to the Amhara ethnic group followed by Agew (6.3%), Gumuz and Tigraian (2.5%) and Oromo ethnic groups (1.3%). Even though some reports indicated as if they were the natives to the area, gumuz ethnic groups were the pioneer to settle in the area (Table 8). However, they are found in only three PAs (Kumer Aftit, Tumet and Shinfa). The total Gumuz households would be around 500. The Tigrain ethnic groups are found only among the previous settlers which settled during the previous settlement programs (During the Derg regime) from Gode (Somali) and Sudan. As some key informants pointed out, effort was made to resettle people from same area with kin relationship in the same locality. This was to maintain social fabric created at place of origin such as cultural and social integration.

Godquin and Agnes (2005) also reported that origin heterogeneity and ethnic heterogeneity increase the number of persons who can help in case of economic loss and from whom one can obtain price information, respectively. Origin heterogeneity also positively influences the participation in burial groups; villages with higher origin heterogeneity are villages with more migrants from outside who may have smaller family networks within the village. If family networks are an important source of support (both financial and labor) when a death occurs, origin heterogeneity will increase the number of households interested in taking part in burial groups. However, Isham (2000) found evidence that the ethnic homogeneity of social networks in rural Tanzania significantly increased information diffusion and the adoption of fertilizers.

4.1.4 Respondents years of residence in the village

Duration of residence in the community affects respondent's membership in some groups and associations. Since most of the respondents are settlers at different points in time, years of residence in their respective localities vary as well.

Table 9: Distribution of sample household heads by years of residence in their village

No	Years category	settlement category				Total	
		Previous settlers (N=123)		Recent settlers (N=37)		f	%
		f	%	f	%		
1	≤ 3 years	0	0.0	17	45.9	17	10.6
2	4 to 6 years	2	1.6	20	54.1	22	13.8
3	7 to 15 years	54	43.9	0	0.0	54	33.8
4	≥ 16 years	67	54.5	0	0.0	67	41.9

Source: computed from own survey, 2007

The study shows that, the majority (75.7%) of the sample household heads lived more than 7 years in the village. whereas, the remaining 24.3% of the sample lived 3 to 6 years in the study area (Table 9). The recent resettlement program was launched in 2003; as a result at the time of the survey, the recent settlers lived only 3 to 5 years in the study area.

Table 10 Years of residence in the village and membership in economically oriented group

No	Variable	df	Values and significance (2-tailed)			
			χ^2 -test		Symmetric measures	
			Pearson's χ^2	Phi	Cramer's V	Gamma
1	Cooperatives	1	(34.57)***	(0.465)***	(0.465)***	(0.865)***
2	Credit/finance	1	(14.31)***	(0.299)***	(0.299)***	(0.898)***

Source: computed from own survey, 2007

*** Correlation is significant at 1% level

As can be seen in Table 10, there is a significant difference among re-settlers in years of residence in the respective localities. Hence, it showed a significant difference between recent and previous settlers in joining economically oriented organizations (Formal social networks). Recent settlers being relocated from their origin and unable to fulfill the preconditions set by these organizations, were not eligible to join these groups or associations. The formal credit association (ACSI), for example, could accept the potential credit users if they at least lived 5 years in the village.

4.1.5 Educational level of the sample household heads

Level of education positively affects opportunities for improving the livelihood of a given household. The presence of literate people in the household means better access to information and resources, and better social networking.

Table 11: Proportion of sample household heads by highest years of school completed

No	Education level	settlement category and sex					
		Previous settler(n=123)		New settler (n=37)		Total	
		Male	Female	Male	Female	Male	Female
		%	%	%	%	%	%
1	Illiterate	36.7	88.0	52.0	75.0	39.84	83.8
2	Read and write	24.5	4.0	4.0	0.0	20.33	2.7
3	Grade1-4	17.3	4.0	20.0	8.3	17.88	5.4
4	Grade5-8	16.3	0.0	12.0	8.3	15.45	2.7
5	Grade 9-10	1.0	4.0	8.0	8.3	2.44	5.4
6	Preparatory (11-12)	1.0	0.0	0.0	0.0	0.81	0.0
7	Others (Religious)	3.1	0.0	4.0	0.0	3.25	0.0

Source: computed from own survey, 2007

Table 11 reveals that, 39.84% of male and 83.8% of female HH heads was illiterate. And 20.33% of males and 2.7% of females were able to read and write. On the bases of their settlement category, 36.7% and 88.0% of male and female previous settlers respectively, were illiterate. Likewise, 52.0% and 75.0% of male and female recent settlers respectively were illiterate. It was also found that, 17.3% and 16.3% of male previous settlers attended Grade 1

to 4 and grade 5 to 8 respectively. Likewise, 20.0% and 12.0% of male recent settlers attended Grade 1 to 4 and grade 5 to 8 respectively

Education is the most significant correlate of social capital, particularly with regard to social trust and institutional trust. Numerous studies indicate that there is a strong positive relationship between levels of education and levels or stocks of social capital at individual and community levels (Putnam 1995; Knack and Keefer 1997; Onyx and Bullen 2000; Hughes *et al.*, 2000)

Godquin and Agnes (2005) also reported that asset rich and better educated households are more likely to participate in groups and associations to have larger social and economic assistance networks. That may reflect higher returns to social capital for the wealthy or greater barriers to participation for the poor.

Besides, better educated household heads have relatively more social capital accumulation, because education encourages the formation of horizontal social networks through participation in formal organizations and off-farm employment.

4.2 Types of Formal and Informal Social Networks in the Study Area

Social networks are more of the property of groups and communities than individuals. In a given society, social capital can exist only if individuals came together, create and maintain relationships. Proponents of social capitalists' approaches maintain that tight communal groups, relationships of kinships, friendship and ethnicity can form dense networks of solidarity, cooperation and communal sanctions that reduce the transaction costs of economic activities

4.2.1 Formal and informal social Networks

Understanding the groups and networks that enable people to access resources (such as seed and labor), 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 (Dudwick, *et al.*, 2006).

4.2.1.1 Networks of the respondent beyond the immediate household

As discussed in the literature review, the number of close friends, relatives beyond the immediate household would be positively associated with the household propensity to accumulate organizational or group based social capital.

Table 12: Number of close friends the respondents have to talk about private matters (N=160)

Settlement category	Sex	Percentage	Number of close friends			
			Only one	2-3 people	4-5 people	More than 5 people
Previous settlers (n=123)	Male	%	18.4	48.0	14.3	19.4
	Female	%	32.0	52.0	16.0	0.0
	Total	%	21.1	48.8	14.6	15.4
Recent settlers (n=37)	Male	%	20.0	60.0	8.0	12.0
	Female	%	41.7	50.0	8.3	0.0
	Total	%	27.0	56.8	8.1	8.1
Total		%	22.0	50.0	13.8	14.2

Source: computed from own survey, 2007

The survey result shows that (Table 13) 50.0% and 22.0% of the total sample households had 2 to 3 people and only 1 close friend, respectively that they can talk to about private matters or call on for help. Moreover, 14.2% of the respondents had more than 5 people in their proximity. About 30% of previous settlers had more than 4 close friends. On the other hand, about 16.2 % of the recent settlers had more than 4 close friends.

However, the number of people beyond immediate household who are willing to assist the respondents in case of a long term support/help (for example: in case of the death of breadwinners or heads of the households) varies among sample households. As shown in Table 14, the majority of previous settlers (43.9%) reported, they had one or two people beyond immediate household, who are willing to assist them. However, the majority of recent settlers (48.6%) reported they have no social networks to call on for help with money, food or labor and no one was willing to assist them in case of a long term support/help.

Both previous and new female headed households reported the same. The majority of sample female headed households (52.0% of previous and 66.7% of recent settlers), had no one beyond immediate household who were willing and able to assist in case of a long term support/help (Table14). This may imply that, as compared to female headed households, male headed households had a better social network beyond the immediate household. This in line with the findings of Katungi *et al.*, (2006) where male-headed households build and maintain bigger social networks with relatives and friends in close proximity than female-headed households in Uganda.

In focused group discussion with women (previous and recent settlers separately), it has also been confirmed that, women have less number of close friends. They are usually confined to their home and therefore do not participate in most social gatherings, meetings and in different committees. Due to these and other socioeconomic barriers (access to resource such as credit and time constraints), they had limited opportunities to build trust and solidarity with their colleagues.

One of the participants, from the previous settlers group named W/ro Zewdie said,

“Oh! We know very well only our husband and children. Apart from these, probably we may know our neighbors of the same sex, who are always with us in fetching water, market and milling places. But if you ask me about my husband, he is a cabinet member, committee of the “Gode mahber”, and he was also committee member of Kokit multipurpose cooperatives. So, probably he may have more than 10 close friends, can you imagine the difference?”

Table 13: People beyond immediate household in case of a long term support (N=160)

Settlement category	Sex	Percentage	Number of people beyond immediate household			
			None	2-3 people	4-5 people	More than 5 people
Previous settlers (n=123)	Male	%	27.6	45.9	17.3	9.2
	Female	%	52.0	36.0	12.0	0.0
	Total	%	32.5	43.9	16.3	7.3
Recent settlers (n=37)	Male	%	40.0	40.0	16.0	4.0
	Female	%	66.7	16.7	16.7	0.0
	Total	%	48.6	32.4	16.2	2.7
Total		%	36.3	41.3	16.3	6.1

Source: computed from own survey, 2007

Decision making is an integral part of every one's life. Decision can be made alone, with a group, or as an organization. It has become clear that agricultural decisions are not made solely by the individual "head of the household," but extends to other household and/or community members and is also influenced by other actors in, or even out side, the agricultural chain (Maarse *et al.*, 1998. cited in Leevwis, 2004).

The settlers being studied are not isolated actors operating in a neutral social context. Rather, they have direct and indirect relationships with other people, institutions, who have certain explicit or implicit ideas about what they would like HHs to do in a specific context (For instance to buy or sell properties like ox, to use some pesticide on their farm). Such actors can include, husband or wife, children, relatives, religious leaders, Kebele administrators, government or NGO agencies.

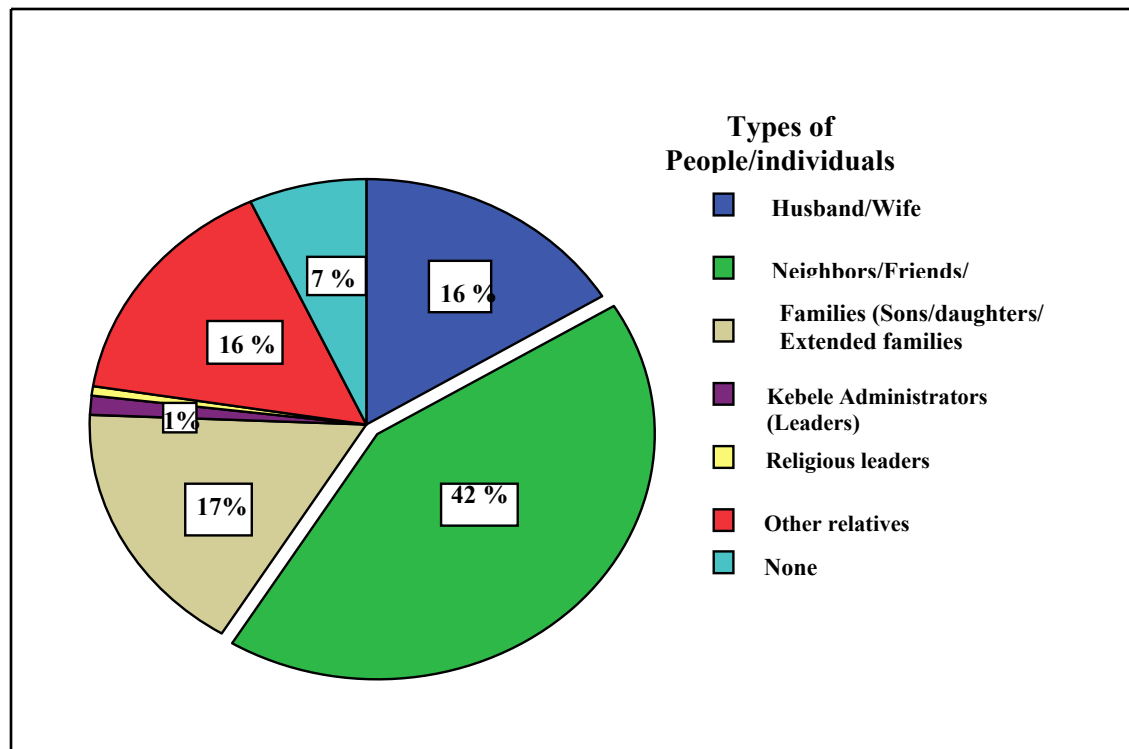


Figure 4 Distribution of people/individuals who are consulted in cases of big decision in life

Figure 4 presents the types of people or individuals who are consulted by the respondents in cases where a major decision has to be made or need advice about a problem. The majority of the respondents (42%) reported that neighbors, friends were consulted in such cases. However, previously settled female headed households (44.0%) reported, families including sons, daughters, and extended families were consulted. This may imply, as reported in this study, females were mostly depend on families who were in nearby villages or neighbors.

In the group discussion with (previous and new male headed households separately) settlers, it was also agreed that neighbors, friends and acquaintances were important networks on which every household depends for decision making. They also added the Amharic proverb “*Keruk Zemed Yekirb Gorebet Yishalal*” to mean, “A neighbor is better than far away families or kin”. This has its own implication in technology adoption decisions of the household. As indicated in Table 29, 52.6% and 26.3 % of the respondents who used the improved sorghum varieties have been influenced by friends/ relatives and neighbors through advice and discussion.

The t-test result in Table 15 showed that, the number of relatives and close friends interacting with the household has a positive and significant association with use of improved sorghum varieties. The number of relatives may reduce the aversion to risk and hence increase the household's willingness to try and use new technologies. That is households that interact closely with more friends and relatives are also likely to be better informed about the benefits and characteristics of the improved sorghum varieties. Besides, being better informed, households are likely to persuade and influence their relatives, friends and neighboring farmers.

Table 14 Number of close friends and use of improved sorghum varieties

No	Variables that can affect use of varieties	Use of improved varieties	(N=160)	Mean	Std. Deviation	t-Value	Sig. (2-tailed)
	Number of close friends the respondent has	Yes	38	5.5000	1.05907	17.363	0.000***
		No	122	2.2377	.99630		

Source: computed from own survey, 2007

*** Correlation is significant at 1% level

As reported by Ye Jingzhong (2002) in rural china, a social network has the self-multiplication similar to that of natural biological multiplication. When two actors come together, there is the possibility that the nodes in other actor's social network will connect with the nodes in the other actor's networks, thus broadening the networks of both. Information and other inputs, which is then filtered and accessed through previous experience and existing knowledge will then flow and be disseminated through such bridging points. And he further concludes that, the larger the bridgehead the better the flow and accumulation of information through interactions at the interface between different actors' life worlds and the various nodes in the network, which in the mean time get transformed into social capital.

4.2.1.2 Family member's participation in different social networks

Social networks are made up of more complex inter-relationships in which households are linked to other agents such as individuals, organization or groups through bilateral relationship. As indicated in Table 16, most of the previous settlers' families participate at least in 5 social networks. However, families of recent settlers were participated in few social networks in the community. It was also hypothesized that HHs with a higher participation in social networks have better access to information and are likely to use improved sorghum varieties.

Table 15 Proportions of households' participation in different social networks

No	Social networks	Of households					
		Previous settlers (n=123)			Recent settlers (n=37)		
		MHH	FHH	Total	MHH	FHH	Total
		(n=98)	(n=25)		(n=25)	(n=12)	
	%	%	%	%	%	%	
1	Kebele social Court	5.1	0.0	4.1	4.0	0.0	4.0
2	Parliament (regional)	4.1	4.0	4.1	0.0	0.0	0.0
3	Local Cabinet member	25.5	4.0	21.1	28.0	8.3	21.6
4	Education/family-teacher	9.2	8.0	8.9	0.0	0.0	0.0
5	Church/Mosque	15.3	0.0	12.2	0.0	8.3	2.7
6	Market place	52.0	44.0	50.4	40.0	58.3	45.9
7	Unions/cooperatives	77.6	40.0	69.9	12.0	16.7	13.5
8	Networks of Neighbors, friend	81.6	76.0	80.5	76.0	83.3	78.4
9	Mutual support	41.8	16.0	36.6	20.0	41.7	27.0
10	Development group	4.1	4.0	4.1	4.0	8.3	5.4
11	Committee member of groups	6.1	0.0	4.9	0.0	0.0	0.0

Source: computed from own survey, 2007

Among the previous settlers, 80.5%, 69.9%, 50.4% and 36.6% of family members participated in networks of neighbors and friends, unions or cooperatives, market place and mutual support respectively. Male headed households mostly participate in networks of neighbors and friends (81.6%), unions or cooperatives (77.6%). While, female headed household mostly participate in networks of neighbors and friends (76.0%), market place (44.0%) and unions or cooperatives (40.0%).

It is also shown that, relatively male headed households were participating in formal social networks of Kebele social court (5.1%), Parliament (regional) (4.1%) and local cabinet member (25.5%). This implies that MHH have relatively linking social capital than FHHs.

Like wise, 78.4%, 45 %, 27 % and 21.6 % of families of recent settlers also participated in networks of neighbors and friends, market place, mutual support and local cabinet member respectively (Table 16)

In the group discussion held with women, it was also revealed that, marital status could have influence on women's participation in different social networks. Married women are likely to be active in collective decision-making meetings because they are better trusted and respected. They are also able 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.

According to some key informants, most of the re-settlers came to the area and registered as single. However, after sometime, they marry. Even some male recent settlers have wife and children at their origin.

4.2.2 Family membership in different groups or associations

In this study, household's membership in different groups or association was studied. Group membership is found to be varying among settlers (previous and recent settlers) as well as between female and male headed households.

Table 16 Proportions of Households belonging to groups or associations in the study area

No	Groups or associations	Family Membership					
		Previous settlers (N=123)			Recent settlers (N=37)		
		MHH (n=98)	FHH (n=25)	Total	MHH (n=25)	FHH (n=12)	Total
		%	%	%	%	%	%
1	Cooperatives	78.6	28.0	68.3	12.0	16.7	13.5
2	Credit/finance group	38.8	16.0	34.1	4.0	0.0	2.7
3	Farmers group	8.2	0.0	6.5	4.0	0.0	2.7
4	Religious group	63.3	40.0	58.5	40.0	41.7	40.5
5	Mutual support association	30.6	16.0	27.6	28.0	25.0	27.0
6	Political group	22.4	8.0	19.5	32.0	16.7	27.0
7	Women's group	0.0	4.0	4.00	0.0	0.0	0.0
8	Labor Exchange group	42.9	12.0	36.6	60.0	41.7	54.1
9	Ethnic-based group	0.0	0.0	0.0	0.0	8.3	2.7

Source: computed from own survey, 2007

Economically oriented organizations such as cooperatives (68.3%), credit and finance group (34.1%) and labor exchange groups (36.6%) and social organizations like religious or spiritual groups (58.5%) were the most popular among the previous settlers. However, in the case of recent settlers, social organization such as religious or spiritual groups (40.5%), mutual support associations (27.0%), economically oriented organizations such as labor exchange groups (54.1%) and politically oriented group (27.0%) were the most popular groups or associations (Table 17).

The result of the study reveals that membership in formal organizations (networks) were mostly dominated by previous settlers. However, in case of recent settlers, they are mostly involved in informal trust based exchanges groups and identified as the main sources of labor and other economic benefits. Due to the inability to fulfill the preconditions set by the formal organizations, most of the recent settlers and female headed HHs could not be a member of these groups.

The varying composition of men and female headed networks was clearly seen in this study. On one hand, the male headed HHs networks tended to be more formal usually comprised of fellow farmers who are members of these economically oriented organizations/associations. On the other hand female headed household's networks tended to be informal and included more in religious groups and mutual support associations in contrast to MHH's networks.

As reported by IPMS (2005), in order to get credit, 5-7 people should form a group and elect a chair person. The chair person controls the group and monitors his fellow group members for any possible misuse of money. Farmers who would like to take credit for the first time will submit request through the PA. The PA committee composed of (chairman, vice chair, DA, representative from youth, representative from elders, etc) will screen farmers by taking certain parameters given by Amhara Credit and Saving Institution (ACSI). These are: farmers who are believed to be hard working, economically active (18-60 years of age), socially acceptable, motivated, resided at least for 5 years in the PA, ownership of one or no oxen, no outstanding debt etc.

The government's resettlement document says, "re-settlers would be eligible to make use of existing physical and social infrastructure that is already in place in the receiving areas" However, as they do not meet most of these criteria, except few recent settlers (13.5% in cooperatives and 2.7% in credit and finance), most of them in the sample PAs, were not able to join cooperatives and credit and finance groups.

In the group discussion held with recent settlers, it was pointed out that, recent settlers had no guarantee to stay in the area and had no fixed assets to be used as collateral and to fulfill the above mentioned criteria set by ACSI. They might leave at any time they feel uncomfortable because the process of resettlement program involves the temporary separation of families and they would retain their land use rights and other immovable property in the original home villages for up to three years after being relocated. So they can return to their original home villages for good whenever they change their mind.

Therefore, other previous settlers do not want to allow them to be a member of their group. Because, they do not want to take the risk of repayment problems that could happen in their group. One of the group participants from the recent settlers, who live in village 2 of *Kokit* PA, confirmed that;

“We want to join groups like cooperatives and ACSI “kuteba” but we were not given opportunities so far. I hope this may changed after some time. Especially, previous settlers are not willing to form a group with us. When we arrived here, the government gave us cotton seed on credit through the cooperative, but because of crop failure, we couldn’t harvest in that cropping season and we couldn’t repay the credit till now .When we express interest to join the group, they always point out that, we did not repay the old loans and are still in debt”.

Among the recent settlers, those who became member of cooperative (12.0% male and 16.7% female headed households) were spouses of previous settlers who could fulfill the preconditions for membership.

Recent settlers depend primarily on labor exchange group (54.1%) and their religious or spiritual groups (40.5%) followed by mutual support associations (27.0%) and political group (27.0%) (Table17). Some key informants also pointed out that, local government officials insist that settlers be member of political group (cabinet or Kebele militia) during the initial process of the program and their arrival to their destination. The probable reason may have the objective of persuading their family members, colleagues who left in their origin to follow their footsteps and to establish their own administrative at their destination. This shows that, the recent settlers have relatively linking social capital than bridging social capital.

Even though, it was not popular, previous and recent settlers were members of farmers group (6.5% and 2.7%) respectively. These groups were organized by, different Governmental and Non-governmental organizations. Though not strong, Farmers Research Groups (FRGs) were recently established by Gondar Agricultural Research Center with the aim of participatory technology generation and dissemination. Farmers group for rice production and other commodities (sorghum and livestock) were found at *Kumer aftit* and *Kokit* kebeles. Groups

organized by ILDP were also found in these Kebeles with the purpose of animal feed production and marketing. Groups organized by IPMS project were fattening groups. All the groups were established on voluntary bases and all are at infant stages. Besides, except in Gumuz ethnic group at Kumer aftit PA, in all studied villages, there were no popular ethnic based groups.

As indicated in Table 17, sampled male and female headed households had different membership in different groups or associations. In the previous settler's category, most of male headed households were members of cooperatives/cooperative union (78.6%), religious or spiritual groups (63.3%), labor exchange group (42.9%), credit and finance group (38.8%) and mutual support associations (30.6%). However, the female headed households were members of religious or spiritual group (40.0%), cooperatives (28.0%), mutual support associations (16.0%) and credit and finance group (16.0%). This shows that, female headed households were participating primarily in religious or spiritual groups such as "*Senbetie*" and "*Mahber*" followed by cooperatives and mutual support associations.

On the other hand, most male headed household from the new settler's category, were members of labor exchange group (60.0%), religious or spiritual group (40.0%), political group (32.0%), and mutual support associations (28.0%). Like wise, recent settlers of female headed were members of religious or spiritual group (41.7%), labor exchange groups (41.7%), mutual support associations (25.0%) and political group (16.7%).

Table 17 also shows that, among recent settlers, male headed households were heavily depending on their labor exchange groups, religious or spiritual group and political groups based on number of households participating in each group. However, Female headed HHs depends on their religious or spiritual group, labor exchange group, mutual support associations and political groups. This is in line with the study conducted by Deribe (2007) in Dale woreda, where the majority of the female respondents frequently involved in informal local institutions such as *ekub*, *edir* or *mahber* next to religious organizations and thirdly they frequently involve in women's associations.

IPMS (2005) report the presence of Women's affairs offices at the regional, zonal, woreda and PA level. Vice chair of the PA follows women affairs issues. It was also reported that, 697 rural women have organized themselves in association and have birr 2,871 capital in the study area. Parents committees have been established at all schools and oversee girl students' issues. And it was also pointed out that, women who organized themselves will be given priority to get credit from ACSI to run small business.

However, this study shows that women's groups were not popular among re-settlers. This implies that rural women were not well organized in groups or association. In fact those groups which are claimed to be organized by women's affairs were concentrating in urban and pre-urban areas like Shehedi and Metema Yohanes. However, unlike other villages included in the study, in "Gode" village of Kokit PA, there were women's "edir" and men's "edir" separately. In other villages, both men and women had the same "edir" but with different roles and responsibilities. In this case, women's "edir" has its own chairwomen, secretary and rules and regulations. It is managed and operated by women only.

Table 17 Membership in groups/associations and use of improved sorghum varieties

No	Variables	df	(Values and significance 2-tailed and			
			χ^2 -test		Symmetric measures	
			Pearson's χ^2	phi	Cramer's V	Gamma
1	cooperatives	1	(4.805)**	(0.173)**	(0.173)**	(0.407)**
2	Religious group	1	(3.177)*	(0.141)*	(0.141)*	(0.354)NS

Source: computed from own survey, 2007

** and * Correlation is significant at 5 % and 10 % level

NS: Not significant

Membership in any group can produce social externalities such as information sharing, copying or insurance, and exchange of inputs like seed, labor among the group members. As indicated in Table 18 memberships in cooperatives showed a positive and significant relationship (χ^2 -value of 0.028) with the use of improved sorghum varieties. Among the respondents who used sorghum varieties, 71.1 % of were members of cooperatives. The reason might be generally, inputs such as improved seeds, fertilizers and pesticides are distributed to the clients through cooperatives. As a result, members of cooperatives would have first hand information, and access to get and use these technologies.

Though, most of religious based groups were primarily organized to satisfy spiritual or religious rituals and thereby strengthening Christianity, they could facilitate resource exchange (seed and information) and put forth peer influences on decision making. The Pearson's chi-square test of this analysis shows significant (χ^2 -value of 0.075) relationship between participation in religious based groups like ("*Senbete*", and "*Mahiber*") and use of improved sorghum varieties. That is, most of the households (68.4%) who use the technology, in the two sample groups are participating in those religious based groups (Table 18).

Box 1: The “Gode” Returnee Members Association

In the study of group and associations in the study area, “Gode” Returnee Members association was found to be unique and strong in trust and solidarity among members. The case study done in Kokit Peasant association, Metema woreda was confirming the result of the study.

In 1978, the Derg officials moved married and unmarried men from South Wollo (Were illu and its surroundings) to state farms in Ogaden (Somali Region) as farm workers. After two years, their wives were moved to the area. In Gode, they used to live a communal life in the camp. They worked for the state farm and the government paid their salary.

Following the downfall of Derg, they moved and resettled to Metema woreda in 1994. Task force was established to assist and take care of the Gode returnee. They do have their own association in which only people who came from Gode are a member. The association does have its own milling service and warehouses to provide services primarily to its members.

As compared to other villages in the study area, the Gode community does have a strong social capital accumulation which was built for the last 30 years. Many of the members of Gode mahber are more successful and characterized by better social capital, taking on leadership positions, with involvement in informal community institutions such as funeral associations and churches, and good relations with the administration, local people and investors.

Even recently, to protect their properties primarily livestock from theft problem prevailing in the woreda, they established a sort of rotating keeping system of livestock. For a group of 7 to 10 households there is one permanent livestock keeper hired by the group and one household member from the owners which can be substituted by other household in the next day.

4.2.2.1 The relative importance of groups and association

This sub section indicates how sample household heads perceived the importance of the groups and associations of which they are a member. Distribution of groups and associations in terms of importance to the household is presented in Table 19 for previous and recent settlers as well as male and female headed households..

Table 18 Relative importance of groups/associations to the respondent's household (N=160)

No	Groups or associations	Relative importance							
		Previous settlers (n=123)				Recent settlers (n=37)			
		MHH		FHH		MHH		FHH	
		Total Score*	Rank	Total Score	Rank	Total Score	Rank	Total Score	Rank
1	Cooperative	195	1 st	19	2 nd	2	5 th	6	3 rd
2	Credit/finance group	84	2 nd	9	3 rd	1	6 th	1	5 th
3	Religious group	79	3 rd	22	1 st	23	2 nd	14	1 st
4	Labor exchange group	66	4 th	5	4 th	37	1 st	13	2 nd
5	Mutual support	42	5 th	5	4 th	17	3 rd	6	3 rd
6	Political group	11	6 th	0	-	11	4 th	0	-
7	Farmers group	9	7 th	0	-	0	-	0	-
8	Women's group	0	-	1	-	0	-	0	-
9	Ethnic based group	0	-	0	-	0	-	2	4 th

Source: computed from own survey, 2007

* The total weight score in this study is the rank order frequencies multiplied respectively by 3 for first importance, 2 for second importance 1 for third importance

The response analysis of Table 19 indicates that cooperatives, credit and finance group religious or spiritual groups, and labor exchange groups were the most important group or associations for previous settlers in general and male headed household. The other probable reason might be that household heads among previous settlers being better educated individuals are more likely to join economically oriented organizations. Sample households in previous settlers category also felt that mutual support associations, neighboring or village associations and political groups were important groups for their household (Table 19).

The response analysis (Table 19) for recent settlers indicates that labor exchange groups, religious or spiritual group, mutual support associations and political groups were the most important group or associations for recent settlers. Labor is very expensive in the study area, this may require that the recent settlers rely on labor exchange groups. This could be due to the fact that recent settlers had no access to formal organization (cooperatives and credit and finance groups) which require membership fees and collateral that could not be fulfilled by recent settlers.

Membership in cooperatives and credit group were mainly dominated by male headed households from the previous settler's category. Female headed households were primarily participating in religious or spiritual groups.

4.2.2.2 Trust based social institutions in the study area

Religious based institutions

Focused group and key informants discussion revealed that, in the study area there are a variety of social institutions that are diverse in purpose, composition of members, membership size, and importance in communities. The institutions that are present are (*mahber* and *senbete*) which are religious institutions that have as their main function creating and strengthening ties between Christians). *Zeka* is also found in Muslim communities. These institutions have no explicit economic or insurance purpose.

In the case of the *senbete*, members rotate in bringing food and drinks to be consumed by the priests after Holy mass each week around the church, and *mehaber* members seek to honor the saints by gathering at a member's house on a saint's day every month, with the (rotating) host providing food for the guests. In case of *senbete* both husbands and wives are responsible and participate equally. However, in case of *mahber*, men and women may have different memberships in the name of different saints. Usually, men belong to St. Michel (on 12th), St. Gabriel (on 19th) and St. George (on 23rd) *mahiber*. Like wise, women belong to St. Mary (on 21st) and *Kidane Mihiret* (on 16th) *mahiber* (the dates are in Ethiopian calendar). On the other

hand, *Zeka* is also a religious based practice among the Muslims. In this case, any one who wants to have *zeka* can prepare food and drinks and donate especially to the poor and destitute. Usually, *zeka* is prepared during good harvest to praise Allah.

However, female headed households and some of the recent settlers are looked down upon by the community members and are excluded from many social activities and community based associations. Much of their isolation arises from their inability to meet the criteria for equal participation in social events. They cannot become members of certain religious associations (*mahbers, senbetes*) because they are unable to contribute towards feasts and religious ceremonies.

Mutual insurance and financial institutions

Iddir/kire, the most prominent social institutions in most urban and highland areas of Ethiopia, is not very strong in the study area. In this regard, *Gode* village of *Kokit* PA is exceptional where the formal type of *iddir* exists and which has as its main function the provision of financial and in-kind support for a household in which a family member or a key animal such as an ox dies or has to be slaughtered. The assistance usually takes the form of coverage of funeral costs in the case of a household member. In the case of livestock, the *iddir/kire* members buy the meat of the slaughtered ox from the household. The reason for this peculiarity in *Gode* village might be their strong social capital accumulation in the past 30 years.

Traditional rotating savings and credit association such as *equb* are not practiced in the study area. In the group discussion, some participants mentioned that,

“Ten years ago we had these rotational saving’s groups called equb, to raise sufficient amount of money for purchasing equipments, ox or to cover unexpected crises. But now, there are formal institutions like ACSI and cooperatives which provide these services. However, these formal organizations are not open to all potential users of credit, because of their strict preconditions. Besides, individuals cannot be trusted as before”.

The replacing of traditional rotating savings arrangements with formal organization may be advantageous to the well-off and better organized individuals in the study area. However, those who have no access to formal organizations (like ACSI) will lose their traditional resource pooling systems. Especially, for recent settlers would be very difficult to take advantage of formal organizations which place a number of preconditions that cannot be fulfilled by this group.

Community based labor exchange mechanisms

Like other places of rural Ethiopia, labor exchange arrangements were prominent in the study area. Labor exchange groups are very crucial components in agricultural production system where labor is expensive. Labor shortage, during peak season of the year is a prevalent phenomenon in the study area. Commercial crop production in the area and other adjacent woredas has been contributing to the labor scarcity and high cost of labor in the study area (Personal observation).

To mitigate these problems, farmers use different labor exchange arrangements in their localities particularly for peak seasons like weeding, harvesting and threshing. Some of the well-known labor arrangements were discussed during group interviews sessions held in each PA. These were;

“Wobera/Debo/Jiggie”: Among settlers there are traditions of mutual exchange of labor called “Wobera” some also call it as “Debo” or “Jiggie”. “wobera” takes the form of large groups, where neighbors, friends and relatives of the host contribute their labor to help the household in times of critical farm operations to finish quickly. In turn, the household (or member of the household) will reciprocate for those who contributed their labor, when required. In this case, the host farmer, who called for the “wobera”, has to provide some food and “Tella” (local beer).

“Womiya/Wonfel/Debayat”: Some settlers who came from *Wollo* and *North shoa* use the name “*Wonfel* or *Debayat*” interchangeably. The other group from South and North Gondar use the term “*Womiya*”. In this case, it is a one-to-one exchange of labor. An individual may ask another individual to help him with a given task and he in turn will return the farmer. Unlike, *Wobera/Debo*, there is no need to prepare food and drink.

“Limena” (literally meaning begging): This type of labor sharing is also practiced among re-settlers. This is mainly arranged for disabled, retired people who have no support to manage their farms. Sometimes it is also arranged for female headed households. As for participation in reciprocal labor exchanges, these groups of people are unable to provide meals and labor. However, this type of assistance to these groups has been declining from time to time. This is because sharecropping and hiring of lands to other farmers was taken as an alternative solution to address labor shortage.

The majority of sample respondents used labor exchange practices for harvesting, threshing and weeding respectively. However, both previous and recent settlers gave priority for harvesting and threshing farm operations. The most important reasons forwarded by the respondents, were that harvesting threshing are the most sensitive farm operations, which needs care and attention. Because, it may be devastated by unexpected rain, rodents and other natural and man made hazards like fire.

Group discussions revealed that, agreed on, most informal social networks in the community are continuously being shaped and reshaped. They could be established at times when they are needed and disbanded after meeting their objectives. On the dynamics and changing element of social networks, they felt that the mechanisms that sustain the different nodes (actors) in a social network are norms, commitment and a relationship of trust among members of the networks.

4.3 Contribution and Importance of Social Networks in the Diffusion of Agricultural Technologies

4.3.1 Social networks as a source of information, input source and exchange

Social networks can be used to mobilize a range of specific resources including credit, cheap labor, information, seed exchange further enhancing the competitiveness of communal networks (Granovetter, 1995).

4.3.1.1 Relative importance of social networks for information sources

There are many sources of information about what the government is doing (such as agricultural extension, workfare, family planning, etc.) in any society. Formal organizations and media, informal social networks are almost invariably the most trusted of sources. 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 as sources of information in terms of access and value of information.

Table 19: Distribution of social networks as information source (N=160)

No	Sources	Relative importance							
		Previous settlers (n=123)				Recent settlers (n=37)			
		MHH		FHH		MHH		FHH	
		Total Score*	Rank	Total Score	Rank	Total Score	Rank	Total Score	Rank
1	Relatives, friends and neighbors	180	1 st	57	1 st	50	1 st	25	1 st
2	An agent of the government	160	2 nd	19	2 nd	31	2 nd	11	2 nd
3	Radio	98	3 rd	16	3 rd	15	4 th	7	5 th
4	Political leaders	64	4 th	4	7 th	18	3 rd	1	7 th
5	Local Market	30	5 th	14	4 th	11	5 th	10	3 rd
6	Spiritual Places	21	6 th	6	6 th	9	6 th	4	6 th
7	Community leaders	13	7 th	7	5 th	6	7 th	8	4 th
8	Public meetings	7	8 th	4	7 th	0	-	0	-

Source: computed from own survey, 2007

As indicated in Table 20 relatives, friends and neighbors; an agent of the government (Like DAs), Radio and political leaders were the most important sources for previous settlers respectively. For recent settlers, it was reported that relatives, friends and neighbors and an agent of the government (Like DAs), were important sources. The reason might be because, relatives, friends and neighbors as well as an agent of the government (DAs) were the frequently used sources and that could be trusted, reliable, and accessed with minimum transaction costs. This result is in line with the study by Dereje (2006) in Akaki area where, neighbors and fellow farmers rank first as information sources of the farmers.

Moreover, in the group discussion, it was pointed out that the local market is not only the physical materials for exchanging and transacting commodities, but also importantly, it is the place where information concentrates and flow into the community. Many settlers obtain the information that serves as the basis for decision-making from local markets.

Information plays a key role in the adoption of agricultural technologies. Information about a technology can come from own experience and/ or external sources. Information from external sources comes from formal institutions such as BoARD, NGOs, and the mass media or through informal mechanisms such as farmer's organizations or networks of friends, relatives and acquaintances.

As indicated by Rogers (1962), adoption and diffusion process comprises hearing about an innovation to final adoption of the technologies. The study also revealed that, there was significant, positive and strong relationship between information about the improved sorghum varieties and its uses or adoption. Out of the 102 (63.8%) of respondents who heard about the improved sorghum varieties from different sources, 38 (37.3%) were used the improved sorghum varieties.

4.3.1.2 Roles of social networks in local seed system of the study area

Community seed systems are a relevant level of analysis considering that most seed sourcing and exchange takes place between community members. Understanding farmer's seed systems is necessary to understand the adoption and diffusion of agricultural technologies in the study area. Farmer to farmer seed exchange mechanisms are mostly based on traditional social networks and family relations and can be very effective in the diffusion of technology in the social system.

Table 20: Distribution of social networks as seed source and exchange mechanisms (N=160)

No	Sources	Relative importance							
		Previous settlers (n=123)				Recent settlers (n=37)			
		MHH		FHH		MHH		FHH	
		Total Score*	Rank	Total Score	Rank	Total Score	Rank	Total Score	Rank
1	Own seed selected from previous harvest	183	1 st	32	2 nd	53	1 st	20	2 nd
2	Relatives, friends and neighbors	173	2 nd	39	1 st	47	2 nd	23	1 st
3	Local Market	102	3 rd	30	3 rd	24	3 rd	20	2 nd
4	Cooperatives	54	4 th	2	5 th	7	5 th	0	-
5	Bureau of ARD	33	5 th	8	4 th	14	4 th	5	3 rd
6	Research centers	6	6 th	1	6 th	0	-	0	-
7	Investors	11	7 th	1	6 th	1	6 th	3	4 th
8	Farmers from Sudan	1	8 th	1	6 th	0	-	0	-

Source: computed from own survey, 2007

The results of this study also shows that (Table 21), most previous settlers in the study area rank own seed selected from previous harvest, seeds from relatives, friends and neighbors, seeds from local market and cooperatives, as the most important sources of seed. The reasons for their ranking were quality, adaptability, trust and reciprocity and easy and simple terms of exchange.

However, for the recent settlers, relatives, friends and neighbors; own seed selected from previous harvest, local market and BoARD were the most important sources of seed exchange mechanisms. The most plausible reason for this being to acquire the initial seed to cultivate, recent settlers were dependent on others (previous settlers and/or BoARD) for the harvest on arrival to the site. As a result, unlike the previous settlers, new comers mostly secure seed from external sources such as BoARD and Local market. However, the previous settlers try to retain seeds from their domestic production even when most of the harvest fails due to drought, or erratic rainfall distribution.

Studies shows that, most farmers rank seed from other sources second in preference to their own seed in terms of quality, access, adapted materials and convenience. For the majority of farmers throughout Eastern Africa, their own seed is the most important source in most seasons. In Hararghe highlands of Eastern Ethiopia, the majority of bean farmers obtained seed from their own stock in 1996, 58% for white pea beans (a commercial crop) and 54% for colored varieties (Mekbib and David, 1999).

In the group discussion with male headed HHs of previous settlers, it was mentioned that, in case of sorghum, farmers easily obtain seed for varieties such as “Zole”, “Wodiakir”, and other improved varieties (including “Gambella 1107”, an early maturing and *striga* resistant varieties) from relatives, friends and neighbors, family members usually in exchange for same quantity of grain or seed after harvest, exchange for other crops (Sorghum-with-Teff), at a reasonable price and occasionally as a gift. However, some participants felt that the traditional seed exchange mechanisms were changing and, it was gradually becoming, business oriented. According to them, “*If you have money, every thing is with you. Otherwise you can not acquire what you want*”.

However, in case of commercial crops such as cotton and sesame; farmers could not easily access seed from networks of friends, relatives and neighbors. This is because of the price of those seeds was high, and is not easily accessible. Mostly, these seeds are provided by cooperatives, investors, traders and rarely by BoARD.

Social networks, be they formal or informal, were crucial components of the seed system in the study area. The level of social capital the household has may strongly affect access to new varieties, seed exchange, information, or other resources in the community. As compared to recent settlers, previous settlers have relatively better social capital accumulation. As a result, they have a better access to new varieties, seed exchange and information.

In situations of disaster such as flooding, crop failure, the community could have different sources of seed security mechanisms. Market, organizations and well-off farmers are the most important seed sources in situations of disaster. Respondents of both PAs, rank market as the first most important sources of seed. Because, the woreda is endowed with a good market opportunities to acquire seeds through traders form other places. Well-off farmers in the community who produce surplus can be important sources of seed as well. Most of the time, however, organizations like BoARD and research centers, could be the sources of seed through seed aid, field trials and demonstrations.

4.3.2 Social network actor's influence to adopt a given technology

Social networks are source of help in times of crisis, information exchange and provide security for the household. Interpersonal networks are the most important sources of information and influence. Members of a group or a network may exert powerful influence on individuals in the process of adoption and diffusion of agricultural technologies. This sub section indicates how sample households perceived the importance of nodes in social networks as influencing adoption of technologies.

As indicated in Table 22, for previous and recent settlers, experts or development agents, neighbors, relatives/ friends and family members were the most important nodes in social networks that influenced adoption of a new technology. Most respondents were not confident enough to try the technology first.

Table 21: Distribution of actors that the respondents could be influenced to adopt (N=160)

No	Actors	Relative importance							
		Previous settlers (n=123)				Recent settlers (n=37)			
		MHH		FHH		MHH		FHH	
		Total Score*	Rank	Total Score	Rank	Total Score	Rank	Total Score	Rank
1	Experts/ DAs	189	1 st	28	1 st	43	1 st	24	1 st
2	Relatives and friends	162	2 nd	25	3 rd	39	3 rd	22	2 nd
3	Neighbors	146	3 rd	26	2 nd	40	2 nd	19	3 rd
4	Family Members	31	4 th	15	4 th	7	4 th	3	4 th
5	Members of Religious groups	7	5 th	2	5 th	4	5 th	0	
6	Respondent would like to test by themselves	2	6 th	0	-	1	6 th	0	-

Source: computed from own survey, 2007

The research result shows that, respondents would be more likely to adopt a new technology if experts (DAs) told them to do so and at the same time if neighbors, relatives and friends and family members in their network also adopt the technology.

In fact, informants and focus group participants felt that, experts or DAs were very important only in the early stage of technology introduction and giving technical back up. However, the crucial networks to influence adoption and diffusion of technologies are neighbors, relatives and friends as, most people trust their social networks than outsiders (they consider DAs or experts as outsiders) who share the same goals and operate the same context. Box 2 reveals that even though the initial introduction of “*Abshir*” sorghum variety was made by experts of BoARD, the diffusion of the variety was facilitated by friends, neighbors and relatives’ of social networks in the village. This is in line with the findings of Bandiera and Rasul (2003) in Mozambique where farmers were more likely to adopt if other people in their network also adopted.

4.3.3 Social networks as channels of technology diffusion

Agricultural technology can be diffused in a given community through different social networks. Both formal and informal social networks could be used as channels of technology diffusion. This sub-section indicates how sample households perceived the importance of social networks as channels of technology diffusion in the social system.

Table 22 Distribution of nodes in social networks as channels for technology diffusion(N=160)

No	Channels of innovations	Relative importance							
		Previous settlers (n=123)				Recent settlers (n=37)			
		MHH		FHH		MHH		FHH	
		Total Score	Rank	Total Score	Rank	Total Score	Rank	Total Score	Rank
1	BoARD	159	1 st	32	1 st	39	1 st	20	1 st
2	Cooperatives	154	2 nd	19	2 nd	24	3 rd	5	4 th
3	Neighbors	83	3 rd	18	3 rd	30	2 nd	15	2 nd
4	Market and Exchange	38	4 th	11	4 th	21	4 th	11	3 rd
5	Relatives and friends	37	5 th	11	4 th	12	5 th	2	6 th
6	Local Groups	21	6 th	10	5 th	7	6 th	3	5 th
7	Investors	16	7 th	3	7 th	3	7 th	0	-
8	Family Members	8		4	6 th	0	-	2	6 th
9	Research centers	3		0	-	0	-	0	-
10	Religious groups	2	8 th	0	-	1	8 th	5	4 th

Source: computed from own survey, 2007

This study indicates that, Bureau of Agriculture and Rural Development (BoARD), cooperatives, neighbors, market and exchange, relatives & friends, local groups, investors, family members, religious groups, research centers through demonstration and field visit were important formal and informal nodes in social networks through which technical and institutional innovation could be channeled to the social system in the study area. However, the relative importance and effectiveness of these channels were perceived differently by previous and recent settlers.

Table 23 reveals that, BoARD, Cooperatives, neighbors and market and exchange were the most important channels for technology diffusion as perceived by previous settlers. Relatives and friends, local groups (“*Debayit*”, “*Wobera*”, “*Womiya*”), religious groups and investors were also important groups. Local groups such as *Debayat* and *Wobera*, may create opportunities to see agricultural innovations in their neighbor and friend’s farms during exchange of labor.

In the case of recent settlers, it was observed that BoARD, neighbors, market and exchange and Cooperatives were the most important channels for technology diffusion. BoARD is considered the most important channel as recent settlers depend on the office heavily for input provision (seed, fertilizer, oxen)

This indicates that all actors in the process of technology diffusion have their own contribution at different points in the continuum. The formal organizations such as BoARD, Cooperatives and research played a significant role at the initial stage of introduction and demonstration of technologies. Moreover, they could be the sources of information, inputs (seed and fertilizer) and technical backup. On the other hand, the less formalized and informal social networks took the line’s share, in the diffusion of technologies in the community (See Box 2).

4.3.4 Roles of social networks in the dissemination of sorghum technology

4.3.4.1 Types of sorghum varieties in the production system

Sorghum is produced for various purposes in the study area. The grain is used mainly for making “*injera*”, bread and “*Tella*” (local bear), secondly it is also used for porridge, “*kollo*” (roasted grain), and “*Nifro*” boiled grains. The stalk is used for animal feed and house construction. Though it is not popular, stalk is used for fuel and fencing.

The study shows that, there are at least three known “local” and about six improved *striga* resistant and early maturing varieties being cultivated. However, the extent of cultivation of improved varieties is low. Among the improved exotic sorghum varieties released in Ethiopia (see Appendix Table 1); six *Striga* resistant and early maturing varieties were introduced in 2003 to alleviate *striga* problem and crop failures due to erratic rainfall prevalent in the area. The improved *striga* resistant varieties (*Gobiye*, *Abshir* and *Birhan*) and early maturing (*Teshale*, *Meko* and *Yeju*) varieties were demonstrated on 45 farmer’s fields in Kokit PA.

Table 23: Distribution of use of sorghum varieties in the 2007 cropping season

Varieties		Use of Sorghum Varieties					
		Kokit PA (N=100)			Kumer Aftit PA (N=60)		
		Previous settlers (n=77)	Recent settlers (n=23)	Total	Previous settlers (n=46)	Recent settlers (n=14)	Total
No		%	%	%	%	%	%
		1	“Zole” (Red)	81.8	91.3	84.0	95.7
2	“Wodiakir”(White)	71.4	69.6	71.0	67.4	42.9	61.7
3	“Wodie Arba”	10.4	30.4	15.0	4.3	21.4	8.3
4	“Debir”	0.0	0.0	0.0	4.3	0.0	3.3
5	“Titron”	1.3	0.0	1.0	4.3	0.0	3.3
6	“Feterita”	0.0	0.0	0.0	2.2	0.0	1.7
7	Improved Varieties	14.3	4.3	12.0	10.9	7.1	10.0

Source: computed from own survey, 2007

However, the majorities (84.0% and 71.0%) of respondents in Kokit PA use “Zole” (red sorghum) and “Wodie Akir” (white sorghum) respectively (Table 24). 95.0% and 61.7% of the respondents in *Kumer aftit* PA were also using these varieties respectively. Only 12.0% of respondents in *kokit* PA and 10.0% of respondents in *Kumer Aftit* PA were using the improved sorghum varieties. “Wodie Arba” variety which could mature within 40 days is used by 15.0% of *kokit* respondents and 8.3 % of *kumer Aftit*. Other varieties such as “Debir”, “Titron” and “Feterita” were used to be cultivated by very few farmers. It can be concluded that they are almost out of production.

This could imply that, the newly introduced sorghum varieties were not used by the majority of the households in the study area. The probable reason may be their susceptibility to bird attack. Some key informants indicated that, unlike the other places, the majority of farmers did not protect their sorghum fields by keeping watch the whole day in their farms. As a result, they preferred to plant local varieties (like *Zole*) which are less susceptible to bird attack.

4.3.4.2 Land holding and area allocated to sorghum production in the 2006/2007 cropping season

Sorghum is the principal food crop for previous and recent settlers in the study area. Respondents in the study area had an average land holding of 1.6 hectare which was higher than the national average holding size per household and holder 1.25 and 1.21 ha respectively (CSA, 2007) and the regional average holding size of 1.04 ha per household.

Table 24: Size of owned land and land allotted for sorghum production in the study sites

No	Land Holding Size (ha)	Land allocated to sorghum (ha)	Frequency	Percent
Previous settlers (n=123)				
1	0.0	0.00	23	18.7
2	1.0	0.25 to 0.5	25	20.3
3	2.0	0.75 to 1	60	48.8
4	3.0	1 to 1.5	8	6.5
5	4.0	1.75 to 2	4	3.3
6	>5.0	>2	3	2.4
	Mean land holding	1.6260		
	Std. Deviation	1.11		
Recent settlers (n=37)				
1	0.0	0.0	4	10.8
2	1.0	0.75 to 1	9	24.3
3	2.0	1 to 1.5	24	64.9
	Mean land holding	1.5405		
	Std. Deviation	0.69		
		t-value (0.564)NS		

Source: computed from own survey, 2007

NS: Not significant

Even though, the mean difference (0.0854) and t-value (0.564) shows no significant difference among the settlers group, it seems recent settlers had relatively larger crop land allotted to sorghum. This could imply that, recent settlers primarily focused on food crop cultivation with their primary objective being food security. However, the previous settlers were geared to commercialization of other cash crops such as sesame and cotton. As a result, they allocate more land for these crops.

As could be seen in Table 25, as the size of owned land increased, the area allocated for sorghum production increased showing the importance of sorghum in rural HHs food security in the study area.

However, the group and key informants discussion indicated that, for previous settlers, land is not a problem in Metema woreda. Previously settled and the indigenous farmers may have up to 5 ha, and many farmers cultivate more than this. Some farmers have even reported that they have up to 25 ha. For the newly settled farmers however 1 ha of land is given at arrival and another 1 ha will be given in the second year. But no one wants to disclose the exact area of land he/she cultivates.

4.3.5 Use of improved sorghum varieties

As indicated in Table 26, Out of the 160 sample respondents, 102(63.8%) households heard about the improved *striga* resistant and early maturing sorghum varieties, at different points in time (since its introduction in 2003 up to the time of the survey). Out of these, respondents who have heard, 83 (51.9%) were from the previous settlers category. While the remaining 19(12%) were recent settlers. In relation to their respective PAs, 53 (68.8%) and 10(43.5%) were, previous and recent settlers in kokit PA respectively where the first introduction cum demonstration of these sorghum varieties took place. Like wise, 30(65.2%) of the previous settlers and 9(64.3%) of recent settlers respectively were from *kumer aftit* PA.

Table 25: Distribution of respondent who heard about improved sorghum varieties (N=160)

No	PA	Response	Settlement Category				Total	
			Previous settlers (n=123)		Recent settlers (n=37)		f	%
			f	%	f	%		
1	<i>Kokit</i>	Yes	53	68.8	10	43.5	63	63.0
		No	24	31.2	13	56.5	37	37.0
		Total	77	100.0	23	100.0	100	100.0
2	<i>Kumer Aftit</i>	Yes	30	65.2	9	64.3	39	65.0
		No	16	34.8	5	35.7	21	35.0
		Total	46	100.0	14	100.0	100	100.0

Source: computed from own survey, 2007

However, as shown in Table 27, the adoption of these varieties was not to the extent expected by BoARD and research centers. From the total respondents (respondents who heard about the varieties, 102 (63.8%)), only 38 (24%) of the respondents have used the varieties since their introduction in 2003. Out of these, 24 (63%) of the users were from Kokit PA. These imply that the improved sorghum varieties were not well diffused in the nearby PA (Kumer Aftit).

Table 26: Distribution of respondent who used improved sorghum varieties (N=160)

No	PA	Response	Settlement Category				Total	
			Previous settlers (n=123)		Recent settlers (n=37)		f	%
			f	%	f	%		
1	<i>Kokit</i>	Yes	21	27.3	3	13.0	24	24.0
		No	56	72.7	20	87.0	76	76.0
		Total	77	100.0	23	100.0	100	100.0
2	<i>Kumer Aftit</i>	Yes	9	19.6	5	35.7	14	23.3
		No	37	80.4	9	64.3	46	76.7
		Total	46	100.0	14	100.0	100	100.0

Source: computed from own survey, 2007

Out of 160 sample respondents, the majority 122 (76%) were not using the improved sorghum varieties. Rather, they use “Zole” (Red sorghum) and “Wodie Akir” (White sorghum) varieties. The important reasons forwarded for non use or non adoption of these varieties is: despite their preferable quality of *striga* resistance and earliness, color, straw and market value, these varieties were highly susceptible to bird attack. Unless and otherwise they plant in adjacent plots to minimize risk and share the damage, they would have nothing to harvest at the end of the cropping season. The other reason as reported in group discussion was limited seed availability.

4.3.5.1 Sources of improved sorghum seed

Formal and informal organizations could be the sources of improved varieties for the farming community. However, access to these improved varieties depends on the capital (financial and social) the HHs or individuals have. It largely depends upon the assets of the settlers: whether or not the settler has the cash (financial capital) or social networks (social capital) to access seed. This sub-section indicates how sample households accessed improved varieties of sorghum and the modes of exchange of the varieties.

Table 27: Distribution of sample respondents’ improved sorghum seed sources (n=38)

No	Improved seed source	Settlement Category				Total	
		Previous settlers (n=30)		Recent settlers (n=8)		f	%
		f	%	f	%		
1	saved from previous harvest	14	36.8	2	5.3	16	42.1
2	From neighbors exchange for the same quantity of grain after harvest	12	31.6	1	2.6	13	34.2
3	From farmers who are using the varieties through exchange of other crop	19	50.0	2	5.3	21	55.3
4	From friends/relatives in the same village as a gift	5	13.2	1	2.6	6	15.8
5	From friends/relatives outside the village as a gift	4	10.8	0	0.0	4	10.5
6	From BoARD	15	39.5	8	21.1	23	60.5

Source: computed from own survey, 2007

Note: Respondents may have 3 or more sources in different cropping seasons

In the study area, friends and relatives within or outside the community are important sources of seed, particularly for small amounts of new varieties. As indicated in Table 28, out of 38 respondents who used the improved varieties of sorghum, the majority (50.0%) of previous settlers obtained the seed from farmers who are using the varieties through exchange (in cash or in kind).

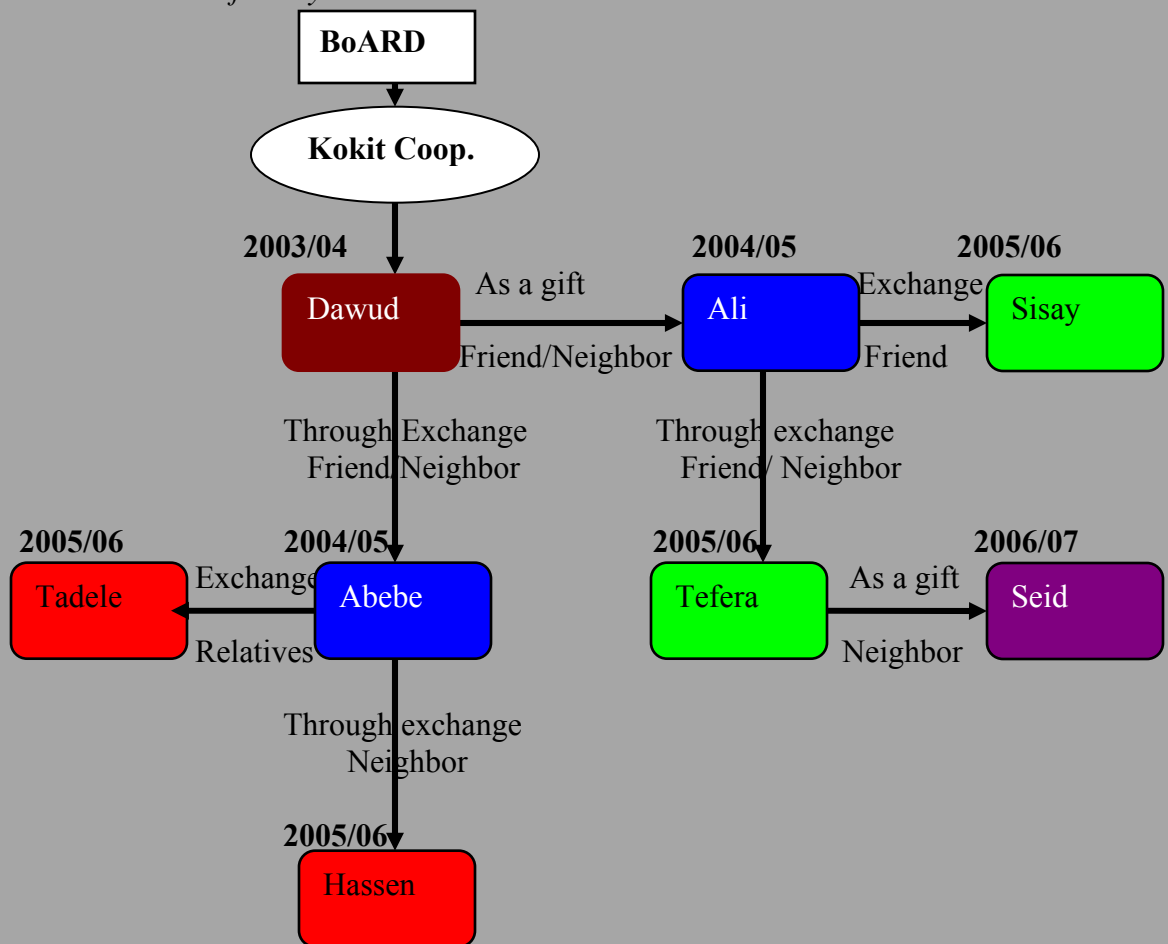
The other 39.5%, 36.8% and 31.6% of these category used office of Agriculture, saved from previous harvest and from neighbors exchange for the same quantity of seed or grain after harvest respectively, as a source of improved sorghum seed in the last five years. The recent settlers solely depended on BoARD as a source of improved sorghum seed since their arrival to the settlement area.

This could imply that, most of previous settlers use their neighbor's friends and relatives as sources of improved seed. However, recent settlers solely depend on BoARD as a source of improved varieties. Because, they left their close friends, families at their origin as a result, social networks that facilitate seed exchange collapsed. And it takes relatively longer time for the new one to be created.

Bridging social networks (which are not well functioning among recent settlers) are very important in resource (information, seed, and labor) exchange mechanisms than bonding and linking networks. The weak ties of bridging social networks are more important in spreading information between otherwise disconnected social groups such as previous and recent settlers in this study. However, strong ties of bonding social networks can provide access to important sources of knowledge.

Box 2: Diffusion of “Abshir” Variety through social networks in Gode village

In 2003/04 six improved sorghum varieties were introduced for Kokit PA by BoARD through Kokit multipurpose Cooperative. As illustrated bellow the sorghum variety (“Abshir”) has been spread over the village through social networks (farmer to farmer seed dissemination). Ato Dawud was one of the 45 farmers who host the demonstration of these varieties. After harvest (in 2004/05), he provided the seed to his friends/neighbors (namely Ali and Abebe) as a gift and exchange for the same grain after harvest respectively. In the 2004/05 cropping season both Ali and Abebe planted this variety and harvested a good yield. Ato Ali also provided the seed for his two friends/neighbors as he promised to them during field visit. On the other hand, Abebe has provided the seed to his relative and neighbor. In 2005/06 cropping season relatively many farmers were tried the varieties; however, due to bird attack the yield expected was not satisfactory.



4.3.5.2 Types of improved varieties used by the respondents

Apart from the local varieties (“Zole” and “Wodie Akir”) used intensively, some farmers also use improved *striga* resistant and early maturing sorghum varieties. As shown in figure 5, the majority (61.5%) of the respondents who used those varieties did not know the names of the varieties they used. However, they gave their own name in their locality. Some farmers around Kokit PA, called the varieties; “Ye Aba Worku Mashilla” by the name of expert who first introduced the varieties to the area. Some called; “Yesehari Mashilla” to mean that came for recent settlers. While 5.1%, 10.3%, 12.8%, 2.6% 2.6% and 5.1% of the respondents used “Gobiye”, “Yeju”, “Abshir”, “Birhan” “Meko” and Gambella 07” varieties respectively.

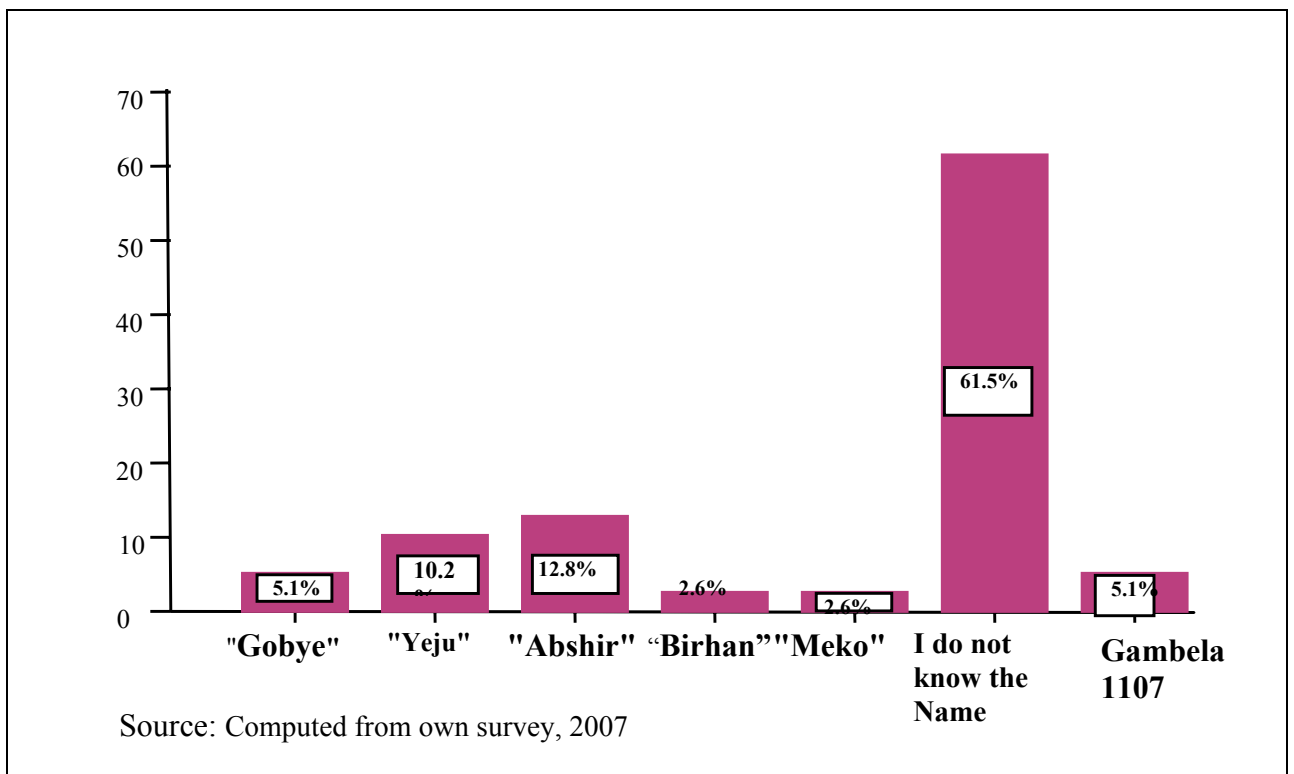


Figure 5 Types of Improved varieties used by the respondent

4.3.5.3 Influence of nodes in social networks on the use of improved sorghum varieties

Besides informational effects, social networks could exert some social pressure on their member. Networks with some members who have adopted the new technology not only provide accurate information to their members but also persuade them to adopt. The mode of influence for different social networks could be advise, discussion, field visit, encouragement and negotiation.

Table 28 Influence of others in the use of improved sorghum varieties (N=38)

No	Who has influenced	Mode of influence	Frequency		Rank
			f	%	
1	Friends, relatives	Advising, Discussions	20	52.6	1 st
2	Neighboring farmers	Field visit, discussion	10	26.3	2 nd
3	Experts (DAs)	Encouraging, Advising	5	13.1	3 rd
4	Family Members	Discussions, negotiation	2	5.0	4 th
5	Kebele leaders	Encouraging, Advising	1	3.0	5 th

Source: Computed from own survey, 2007

As indicated in Table 29, 20 (52.6%) of the respondents who used the improved sorghum varieties, have been influenced by friends, and relatives through advise and discussion. Where as 10(26.3%), 5 (13.1%), 2 (5%) and 1 (3%) of the users were influenced by neighboring farmers, experts (DAs), family members and Kebele leaders respectively. These imply that technology adoption among the farming community is based on the relations that exist in the society. Most of respondents were depending on their informal social networks of friends, relatives, neighboring farmers as well as family members.

4.3.5.4 The status of improved varieties in the study area

Majority (91.7%, 78.6%) of the respondents who used the improved varieties in kokit and Kumer Aftit PAs respectively stopped using those varieties and went back to local ones such as “Zole” and “Wodie Akir” varieties. Whereas, only 2 (8.3%) and 3(21.4%) of respondents from Kokit and kumer Aftit PAs respectively, were using those varieties only or using both local and improved varieties together or interchangeably (Table 30). This finding contradicts the findings of IPMS (2005) which reported that the varieties were used as a major source of planting material and an estimated 200 hectare of land is covered within and outside the PA, where they were initially multiplied.

Table 29: Status of using improved *striga* resistant & early maturing sorghum varieties (N=38)

No	PA	Responses on use of improved varieties	Settlement Category				Total	
			Previous settlers		Recent settlers		f	%
			f	%	f	%		
1	Kokit (N=24)	I am using those varieties only	1	4.8	0	0.0	1	4.2
		I completely stopped using those varieties and went back to use local ones	19	90.5	3	100.0	22	91.7
		I am using both local and improved ones	1	4.8	0	0.0	1	4.2
2	Kumer Aftit (N=14)	I am using those varieties only	0	0.0	1	20.0	1	7.1
		I completely stopped using those varieties and went back to use local ones	7	77.8	4	80.0	11	78.6
		I am using both local and improved ones	2	22.2	0	0.0	2	14.3

Source: computed from own survey, 2007

4.3.5.5 Problems associated with improved sorghum varieties

The major problems associated with the improved *striga* resistant and early maturing sorghum varieties were identified during group discussions held in kokit PA, with both previous MHH and FHH settlers. The varieties were introduced to, at least for five years and they have better insights on the characteristics of these varieties than recent settlers, who came to the area around 2003. The participants identified and ranked three major problems of those varieties.

1. **Bird attack:** - Both male and female group participant rank bird attack as the most important problem of these varieties. The early maturing varieties have attractive color and sweet in taste. As a result, the varieties were susceptible to bird attack. These varieties reach maturity level before all other crops reach pod stage.
2. **Seed non-availability:** - was identified and ranked as the 2nd most important problem. Even though it is attacked by birds, some farmers would like to plant in their farmstead. However, seed is not available at the right time for planting.
3. **Striga infestation:** - Even though they are called Striga resistance varieties, some times infestation has been observed. As a result, some farmers did not use the varieties.

4.3.6 Analysis of factors influencing the adoption of improved sorghum using logistic regression model

In the Logistic regression model, the farmer who used any improved sorghum variety since their introduction in the study area is considered to be “an adopter”. In a discrete adoption, a farm household has either adopted improved sorghum varieties or has not adopted them. Dependent variable is either adopter or non-adopter. 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 logistic regression model was employed in this study to estimate the effects of the hypothesized independent variables on the adoption of improved sorghum varieties.

The dependent variable was used a dichotomous variable with an expected value of one indicting adoption of improved sorghum varieties at different point in time and zero otherwise. Nine independent variables were included in the model. These variables were selected on the bases of theoretical explanation and the results of various empirical studies. Moreover, they were selected by testing significant differences of the mean using t-test and χ^2 and testing the existence of multicollinearity using bivariate correlation. Before using logistic regression model for hypothesized variables, it is necessary to test the problem of multicollinearity or association among the potential independent variables. Bivariate correlation analysis was used to see the degree of multicollinearity among nine independent variables.

With multivariate analyses, the existence of a high pair-wise correlation (in excess of 0.8) among independent variables indicates a serious degree of multicollinearity (Gujarati, 2003). By multicollinearity, it means that it may not be possible to tell the difference of one independent variable free from the influence of other independent variables with which it is correlated. Hoshmand (1999) indicated that a high degree of correlation exists between two independent variables when a bivariate correlation is equal to 0.70. Based on the correlation coefficient results (Apendex Table 3), the variables have no problem of multicollinearity. Below, the definition of variables and units of measurement that were used in the logistic regression model are presented.

Table 30 Definition of independent variables for assessing the determinants of improved sorghum adoption

No	Independent variable	Expected	Variable Description
1	Sex	+	Sex of the respondent, measured as a binary variable, 1 if the respondent is male 0 other wise
2	Marital status	+	A categorical, 1 if respondent is married, 2 divorced, 3 widowed, 4 never married
3	Education level	+	categorical, 1 if the respondent is illiterate, 2 read and write, 3 grade 1-4, 4 grade 5-8, 5 grade 9-10...
4	Family size	+	Number of people living in the household, measured in number.
5	Number of close friends	+	A continuous variable, measured in number.
6	Number of people beyond the HH in case of long term help	+	A continuous variable, measured in number.
7	Years of residence in the village	+	A continuous variable, measured in number of years the HH head lived in the village
8	Membership in cooperative	+	Membership of family members in cooperatives, measured as a binary variable, 1 if the family members are members 0 other wise
9	Membership in credit group	+	Membership of family members in credit group, measured as a binary variable, 1 if the family members are members 0 other wise

The maximum likelihood method of estimation was used to elicit the parameter estimates of the binomial logistic regression model and statistically significant variables were identified in order to measure their relative importance of farmers' improved sorghum varieties adoption decision. The result of logistic regression is presented below.

Table 31 Logistic regression estimates of factors affecting adoption of improved sorghum varieties.

	Coefficient	Odds ratio	Wald statistics	Significance level
Constant	-29.661	.000	9.779	.002
Sex of the respondent	3.201	24.558	2.022	.155
Marital status	2.832	16.977	5.568	.018
Education level	-.487	.615	3.979	.046
Family size	1.743	5.716	12.657	.000
Number of close friends	2.525	12.491	9.673	.002
Number of people beyond the HH in case of long term help	.069	1.072	.025	.874
Years of residence in the village	-2.199	.111	6.587	.010
Membership in cooperative	11.494	98.138	4.984	.026
Membership in credit group	-1.039	.354	1.313	.252
χ^2	141.17			
-2 Log likelihood	34.241			
Correct prediction of all samples (%)	95.0			
Correct prediction of adopters (%)	89.5			
Correct prediction of non-adopters (%)	96.7			

Source: Model output

Among nine independent variables used in the model, six variables were found statistically significant. This implies that they do have a significant effect on the adoption of improved sorghum varieties. These variables include: Marital status, education level, family size, number of close friends, years of residence in the village and membership in cooperatives. The result of this study also indicates that there is no significant difference between the sex of the respondent, number of people beyond the household in case of long term help and membership in credit group of adopters and non-adopters of improved sorghum varieties.

Marital status of the respondents was found to influence the adoption decision of settlers positively and significantly ($p < 0.05$). Married respondents have relatively more social networks and better access to improved seed than divorced and widowed. As a result, those respondents with married household heads are likely to adopt new technologies as compared to those with divorced and widowed household heads.

Education level found to have negative and significant influence on the adoption of improved sorghum varieties. Households who have a better education are assumed to be geared to cash crop orientation where food crop production is a second priority. The result of this study shows that farmers who have better education do not adopt improved sorghum varieties. The majority (>60%) of the users were either illiterate or only who could read and write.

The number of people living in the household is also another factor which has a positive and significant influence on the extent of adoption of the settlers. It was hypothesized that those respondents who have more number of family to adopt improved sorghum varieties. This is possibly because they have better social networking than those who have less number of family members. The number household members increase the probability of the household to make contact with different social networks and hence better access to inputs (labor, seed and information). Moreover, labor is scarce in the study area. Hence, households with a large family member would like to adopt more technologies than households with few members.

Number of close friends that the households can talk to about private matters or call on for help in a long term emergency have found to be positively and significantly ($p < 0.01$) affecting the adoption of improved sorghum varieties. It was hypothesized that households who have more number of close friends and more number of people beyond immediate household in case of long term support are more likely to adopt agricultural technologies. The probable reasons may be better access to inputs and information; avoiding risk and uncertainties to adopt or not to adopt a given technology.

Number of years the household lived in the village found to have negative and significant ($p < 0.05$) influence on the adoption improved sorghum varieties. Households lived more than fifteen years in the study area were relatively food secured and geared to commercial crop production than the recent settlers who are solely depend on food crop production. As result, households who lived more than fifteen years were less likely to adopt improved sorghum varieties.

Family membership in cooperative or cooperative unions also found to be positively and significantly ($p < 0.05$) influencing the adoption of sorghum varieties. It was hypothesized that household with at least one member of the family participate in cooperative group would likely to adopt improved sorghum varieties. The reason might be, most of agricultural inputs (credit, improved seed) were distributed through cooperatives. As a result, members will have first hand information and easily access to these resources than non-members.

4.4 Community level Social Capital in the Study Area

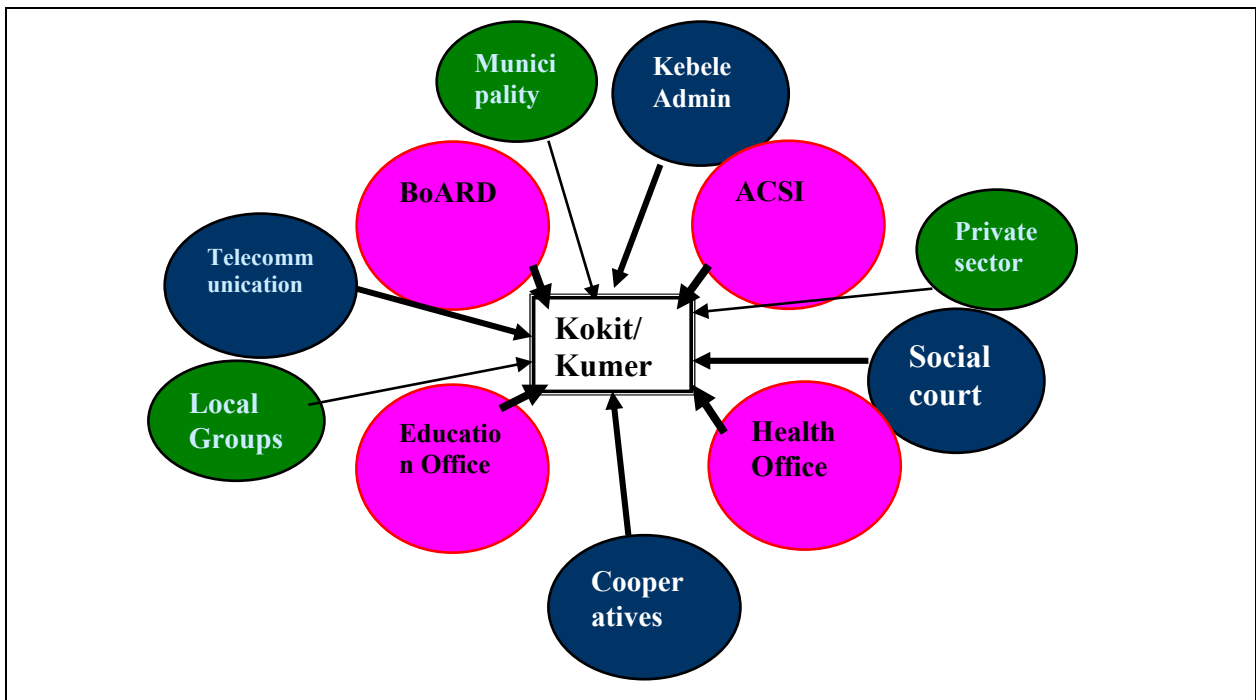
4.4.1 Community social networks in the study area

Though rural communities are sometimes remote or in poor areas, they are socially well articulated with the outside. This external articulation is as important to the operation of a community as its internal organization. A community's interactions with outside can be represented by its network of institutional connections (Ye Jingzhong, 2002).

The result of this study showed that (Fig 6 and 7), the community had organizational networks through which external contact and interactions could be made. The participants of the group interview tried to define their importance by using different sized circles and different lines indicating social distance as well as explained the relationships. The central rectangle represents the community and the length of the line indicates the importance of the connection. The shorter and bold the line the closer/more important the connection, and vice versa. BoARD, Education Bureau, ACSI and Health office were said to be the closest to the community and facilitated interactions with outside. Secondly, they put Kebele administration, social court, cooperatives and telecommunication as the next closest institutions with a medium sized circle. The justification was, these institutions have a limited role that can be played in the locality and they couldn't transcend outside the PAs. Thirdly, municipalities, private sectors (clinics), and local groups (*edir, senbete, mahiber*) took the smallest circle and relatively the farthest distance for the community. However, these institutions are very close and important at individual levels.



Figure 6 Group interview participant in institutional diagramming exercise
 Source: Photo by the Researcher



Source: Result of group interview and institutional diagramming

Figure 7 Community Institutions and organizations in the study area

4.4.2 Trust and solidarity in the sample PAs

Trust is an abstract concept that is difficult to measure in the context of a household survey; it may mean different things to different people (Grootaert, 2003). This dimension of social capital refers to the extent to which respondents feel they can rely on relatives, neighbors, colleagues, acquaintances, key service providers, and even strangers either to assist them or (at least) do them harm. Adequately defining “trust” in a given social context is a prerequisite for understanding the complexities of human relationships (Dudwick *et al*, 2006).

So, trust in this study can be defined as the extent to which respondents feel they can rely on the character or behavior of, allow having or using resources, have faith and confidence on family members, friends, and relatives government agencies and local groups, in exchanges of goods and services in their localities.

Table 32: Respondents perception on the degree of trust and solidarity in the community

PA	Settlement category	Frequency	Degree of trust		Total
			Most people can not be trusted	Most people can be trusted	
<i>Kokit</i> (n=100)	Previous settlers	f	49	28	77
		%	63.6	36.4	100.0
	Recent settlers	f	17	6	23
		%	73.9	26.1	100.0
	Total	f	66	34	123
		%	66.0	34.0	100
<i>Kumer</i> (n=60)	Previous settlers	f	36	10	46
		%	78.3	21.7	100.0
	Recent settlers	f	8	6	14
		%	57.1	42.9	100.0
	Total	f	44	16	37
		%	73.3	26.7	100.0
Total	f	110	50	160	
	%	68.7	31.3	100.0	

Source: computed from own survey, 2007

The result of the study shows (Table 32) that, the majority of the respondents (66.0 % of *Kokit* and 73.3% of *Kumer Aftit* PAs) reported that, most people in the village or neighborhood cannot be trusted. The reasons were population pressure, criminals, alcohol addiction and theft problems. This is also confirmed, in the group discussion held with previous settlers. It was mentioned that, with the newly launched resettlement program and illegal cattle and other commodity marketing with Sudan, plenty of sex workers, illegal traders, alcohol and drinking houses (locally called *Tella Bet* or *Mesheta Bet*) and theft came to existence. As a result, the community suffered a lot within these 3 years. Before five years or so, there was trust among community members. Trust could be distributed primarily within the extended families or clans and then to relatives, friends and secondly it goes to specific network and localities of the community such as members of a group, cooperatives. But now, they couldn't even trust their sons aged above 15 years, extended families and other relatives as well.

One of the participants, Abebe Abera of *Kokit* PA, well articulated these ideas as follows:

“Until now, we did not bother about our property. We used to leave our harvest in the field for three to four days, even weeks; we used to leave our cattle in the forest without any guard. No one touched others property. But now, we are in trouble, we can't sleep the whole night, to take care of our property.”

Even previous and recent settlers have blamed each other especially in the cases of theft problems in the community. The previous settlers said:

“Recent settlers do not have enough assets such as oxen, donkeys, goat and sheep. They also failed to harvest a good yield in the last 2 years because of excess rainfall in the area. As a result, they likely to steal and misbehave in the community”

On the other hand recent settlers said;

“We don't know the area as well as the previous settlers; they know each and every exit in the woreda and the way to Sudan. They also know more illegal cattle traders than us. So, how can we be blamed for theft?”

4.4.3 The level of trust towards people and institutions

In social capital theories, it is understood that the dynamics of individual and social lives are mediated through trust, a central factor in building cohesive and integrated communities, the ‘glue’ that holds society together. Its presence is seen to have a positive impact on the ways individuals act towards each other and its absence, evident in the breakdown of social and institutional relationships. This sub section indicates the sample household’s level of trust on people and formal and informal institutions in their locality.

Table 33: level of trust expressed by respondent’s settlement category (N=160)

No	People or institutions trusted	Mean Index of trust (1-5)		Mean difference	t-values (2 sided)
		Previous settlers (n=123)	Recent settlers (n=37)		
1	People from their ethnic group	3.040	1.891	1.487	5.361(0.000)***
2	People from other ethnic group	2.406	1.378	1.028	7.256(0.000)***
3	People from religion	3.089	2.973	0.116	0.537(0.572)
4	Shop keepers/traders	2.691	1.567	1.123	7.898(0.000)***
5	Close friends and relatives	4.374	4.216	0.157	1.013(0.361)
6	Neighboring farmers	3.951	3.135	0.816	4.726(0.000)***
7	Families	4.861	4.864	-0.003	-0.041(0.967)
8	Police/militia	2.617	1.810	0.807	4.809(0.000)***
9	Teachers	3.642	2.054	1.588	9.157(0.000)***
10	Development agents(DAs)	3.748	2.184	1.558	8.139(0.000)***
11	Strangers	2.284	1.027	1.257	12.333(0.000)***
12	Group members	3.455	1.783	1.671	10.604(0.000)***

Source: Computed from Own survey, 2007

Note: *** significant at 1% level

Table 33 present comparisons of the mean indices of trust in people in general and in various institutions between previous and recent settlers using two sample t-tests. Accordingly, declaration statement of trust on different people and institutions was constructed and presented to respondents.

The possible responses were provided on a *five-point continuum-scale* basis as to a very small extent, to a small extent, neither small nor great extent, to a great extent and to a very great extent. Responses to each question were coded, using numbers as 1= to a very small extent, 2= to a small extent, 3= neither small nor great extent, 4= to a great extent and 5= to a very great extent. Responses of each category were then summed up and the mean of the response was used as an index of trust.

The t- values in the last column in Table 33 show that previous settlers were significantly more trustful of every people and institutions than recent settlers. However, there was no significant difference among settlers regarding trust in people from their religion, close friends and relatives; and families. As recent settlers are taken away from their native places, they tend to solely depend on families, close friends and members of religion, who came and live together. However, the previous settlers do have relatively a better social life based on trust acquired through time (since their arrival).

Most people, however, do not seem to trust people from other ethnic groups, shopkeepers or traders, police or militias and strangers. However, they do trust family members and close friends and relatives to a very great extent.

This could imply that, in the new settler's community where, social capital is low and, little trust exists among individuals in the social networks, the rate of diffusion of agricultural innovations will be low.

In the focus group discussions, it was also revealed that, the most valued characteristics among network members (be it formal or informal) were trustworthiness, reciprocity, cooperation and community respect. More importantly, trust is the glue to bind all these characteristics and the network members together. It was also suggested that, sustaining the existence of these networks becomes a necessary foundation for economic development in general, technology dissemination and innovation diffusion in particular.

5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Ethiopia is endowed with natural resources and diversity. However, despite the huge potential of human, natural and social capital, it is characterized by chronic food insecurity and vulnerability to drought and famine for the last four/five decades. Recurrent drought, population pressure, land and soil degradation and other socio-economic factors were mentioned as the most important reasons for food insecurity in the country. The different regimes of Ethiopian governments launched different resettlement programs to mitigate the food insecurity in Ethiopia.

Even though, it was not successful and criticized by many scholars, the Derg regime embarked on forced inter-regional resettlement and villagization program in the mid-1980s as part of a national program to combat drought, avert famine, and increase agricultural productivity.

The intra-regional voluntary resettlements in potential areas where population is low and land is available are also launched by the current Ethiopian government. Learning from the past mistakes, this program has been implemented in different regions in Ethiopia, since 2003. The study was conducted in Metema woreda of North Gondar Zone of Amhara region. Metema woreda is one of the areas where the resettlement program has been launched. In this study, previous settlers includes indigenous (Gumuz) people, those people who were settled in the 1980s following the 1984/85 famine in the country, people who were moved from Somali region (*Gode*) and refugees in Sudan. On the other hand, recent settlers are those households who settled during the recent resettlement program in the study area.

The objectives of the study were, identifying the formal and informal social networks among settlers, their contribution to the diffusion of sorghum technologies in the study area its gender implication and identifying the options for enhancing the role and sustainability of these social networks for promoting agricultural innovation.

Multistage sampling procedure was employed to constitute the study sample at individual level. Both qualitative and quantitative methods were employed to generate relevant data. A total of 160 households were interviewed using structured interview schedule. Personal observation, focus group discussions and key informant and group interviews were done.

Different analytical techniques were applied to analyze the available information. Descriptive statistical tools such as mean, percentage, cross tabulation and ranking were used to assess the types of formal and informal social networks in the study area and respondent's membership in these networks. Percentage and ranking also used to assess the relative importance of groups and associations to the household, to assess the relative importance of social networks as a source of information, seed and exchange mechanisms, influences of social networks to adopt a given technology and channels of innovation in the social system. T –test, chi-square test and binary logistic regression were used to determine the influences of independent variables on the adoption of improved sorghum varieties.

The descriptive analysis result showed that the average age, family size, crop land allotted to sorghum production were found to be 40.27% years, 4.43 persons, and 1.46 hectare respectively. In terms of family size there was a significant mean difference at less than 1 % probability level between previous and recent settlers (t-value 2.681) and also male and female headed households.

It was also observed that, the majority of previous settlers (43.9%) had one or two people beyond immediate household, who are willing to assist them. However, for the majority of recent settlers (48.6%) no one was willing to assist them in case of long term support/help.

According to the descriptive analysis, some variations were observed between previous and recent settlers as well as male and female headed household in terms membership in different groups and associations. Economically oriented organizations such as cooperatives, credit and finance group and labor exchange groups and social organizations like religious or spiritual groups were the most popular among the previous settlers. However, in the case of recent

settlers, social organization such as religious or spiritual groups, mutual support associations, economically oriented organizations such as exchange groups and politically oriented group were the most popular groups or associations. Due to inability to fulfill the membership criteria, recent settlers were not able to join economic based formal organizations like cooperatives and credit groups.

It has been noted in the earlier sections of this thesis that, the rank order frequency of relative importance of nodes of social networks as sources of information indicated that relatives, friends and neighbors; an agents of the government (like DAs), radio and political leaders were the most important sources of information for the settlers. This study also showed that, own seed selected form previous harvest; relatives, friends and neighbors, local market, and cooperatives were the most important seed source and exchange mechanisms for the previous settlers. For the recent settlers, relatives, friends and neighbors; own seed selected from previous harvest, local market and BoARD was most important of seed source and exchange mechanisms respectively.

Experts or development agents, neighbors, relatives/friends and family members were the most important social networks that respondents could be influenced by to adopt a given technology. The result of group discussion also confirmed this result in such a way that, these social networks are crucial in the adoption process in the community. Experts were very important in the first phase of technology introduction and demonstration; however, social networks such as neighbors, relatives/friends and family members were influential in whole process of adoption and diffusion of technologies in the community.

The study showed the majority of respondents use local varieties of sorghum instead of improved varieties. In the group discussion it was mentioned that, the problems associated with improved varieties were bird attack, seed shortage and *striga* infestations.

The binary logistic regression model output showed that marital status, family size, number of close friends and membership in cooperatives were found to have positive and significant influence on the adoption of improved sorghum varieties. Likewise, education and years of residence in the village have negative and significant influences on the dependent variable.

The sustainability of social networks to facilitating the technology dissemination also depends on the trust and solidarity build in the community. This study reveals that, the majority of the respondents reported that most people in the village or neighborhood cannot be trusted. Population pressure, criminal, alcohol abuse and theft problems were the most important causes of distrust in the community. In the group discussion it was also mentioned that with newly launched resettlement program and border marketing with Sudan, plenty of sex workers, illegal cattle traders, drinking houses (locally called “*Tella Bet*” or “*Mesheta Bet*”) and theft were came to existence. As a result, the existing informal social networks were diminishing and some of the traditional mutual insurance arrangements were vanished. The mean index of trust in people in general and in various institutions between previous and recent settlers; using two sample t-test also showed that, as compared to recent settlers, previous settlers were significantly more trusting on every people and institutions in the their respective locality. However, for trust in people from their religion, close friends and relatives, and families, no significant difference observed among settlers.

In general the study revealed that, social networks whether developed through formal organizations, friendship, neighborhoods, work groups or informal interactions, are a critical component of social capital through which social resources embedded in networks may provide various benefits, such as information, influence and input exchanged to the community.

5.2 Conclusion and Recommendation

This study has identified the formal and informal social networks and their gender implication and their contribution in agricultural innovation diffusion in the study area.

The study revealed that economically oriented social groups or associations such as cooperatives and credit and finance groups were mostly serving the previous settlers and male headed households which are relatively the well-off groups in the study area, whereas, the recent settlers and female headed households are not served or involved in these groups. These social groups or associations are crucial components in the process of agricultural development in general and food security in particular. Therefore, efforts should be made to involve recent settlers and female headed households, who are the most vulnerable groups to be food insecure through purposeful intervention mechanisms.

The findings of this study confirmed that, due to their strict rules and regulations, formal credit and saving groups or institutions such as ACSI were unable to serve the recent settlers. Most of the recent settlers could not fulfill the preconditions and parameters set by the institutions. Besides, for recent settlers, their traditional resource pooling systems would have collapsed as they relocated from their origin. There fore, village saving and loans associations should be organized for the recent settlers if food self sufficiency among re-settlers in general and recent settlers in particular is to be achieved. Cooperative promotion office has to encourage, follow up and facilitate the organization of these associations and provide the necessary support to promote these associations in to formal organizations. In addition, NGOs could also take the initiative to provide a revolving fund that could be managed by the members with a close supervision of these organizations and BoARD.

It was also indicated that women's groups are not popular in the study area. The existing formal groups or associations are mostly in favor of men. Therefore, efforts should be made to establish strong women's groups and strengthening the existing informal groups in to self-help groups (SHGs) with purposive planning of projects/programmes that will empower and benefit women and their groups. Women's affair at the regional and woreda level has to lead this initiative with a close and collaborative support of NGOs, BoARD. Organizing women could be done by women's affair. Non-Governmental Organizations have rich experience and capacity to empower women through their programmes. So, planning and implementing projects/ programmes shall be the responsibility of NGOs working in the study area.

The study also showed that relatives, friends and neighbors were the most important nodes of information and seed sources; influential networks in the adoption and diffusion process of the study area. Hence, organizing and empowering these networks in to community based Farmers Research and Extension Groups (FREGs) and strengthening the existing FREGs will have a great importance in the process of technology generation, adoption and diffusion process. Therefore, efforts should be made to organize new groups at village, PA and Woreda levels and strengthening the existing groups through different capacity building strategies. Besides, in order to strengthen the bridging and linking social capital of these groups, the village level groups should have representatives at PA and woreda level groups. So that, information flows, experience sharing from the formal organizations to the groups as well as the informal social networks will be easy and effective. Research, BoARD and NGOs have to work together to achieve this objective. Research and BoARD have to lead the initiative jointly, because they do have the capacity to implement such participatory approaches, which are proven else where in the country. On the other hand, NGOs could support financially, technically through their capacity building programmes.

The study reveals the importance of trust to the sustainability of important social networks in the community and its close association with the functioning of social networks. Moreover, the sustainability of social networks that could facilitate the achievement of food security in general and technology dissemination in particular depends on the trust and solidarity built in the community. However, due to criminal, alcohol abuse and theft problems prevailing in the study area, there is a declining trend of trust and solidarity in the community. As a result, some of the important traditional mutual supporting systems as well as sense of cooperation in the study area has been diminishing. Therefore, efforts should be made by the concerned bodies such as police, kebele administrations and community leader to devise controlling mechanisms to minimize the causes of distrust in the community. Community based policing, creating awareness among community members, community training and taking measures on the sources of distrust could have a great role in building trust among community members.

Finally, it is suggested that further research into the role of social networks and gendered power relations in resource mobilization and market transactions in the community may be examined and explored in greater detail by establishing the village network architecture to include marginalized groups (Recent settlers and female headed households) specifically.

Appendix table 1 Formally released exotic sorghum varieties, their sources and specific characteristics in Ethiopia

No	Variety Name	Original Name	Years of release/registration	Source	Specific character
1	Dinkmash 86	ICSV 1	1986	ICRISAT	Early
2	Seredo	Seredo	1986	ICRISAT	
3	IS9323	IS9323	1986	ICRISAT	
4	IS9302	IS9302	1986	ICRISAT	Adapted to mid altitude areas
5	Kobomash 76	NES-830x705	1976	ICRISAT	
6	76T1#19	76T1#19	1976	ICRISAT	
7	76T1#23	76T1#23	1976	ICRISAT	Early
8	76T4#416	76T4#416	1976	ICRISAT	
9	Melkamash 79	Diallel Pop 7-682	1979	ICRISAT	
10	76T1#14	76T1#14	1979	ICRISAT	
11	Meko	M36121	2000	ICRISAT	Good food making quality
12	Gubiye	P9401	2000	Purdue University	<i>Striga</i> resistant
13	Abshir	P9403	2000	Purdue University	<i>Striga</i> resistant
14	Birhan	PSL5061	2002	Purdue University	<i>Striga</i> resistant
15	Teshale	3443-2-OP	2002	ICRISAT	
16	Yeju	ICSV 111Inc	2002	ICRISAT	
17	Hormat	ICSV 1112BF	2005	ICRISAT	<i>Striga</i> resistant
18	Red Swazi	Red Swazi	2007	ICRISAT	Early, malt sorghum variety

Source: Adapted from Adugna (2007)

Appendix table 2 Sorghum Varieties released by Sirinka Agricultural Research Center (SARC)

No	Accession Name/Pedigree	Breeder's Name	Years of Release	Yield (Q ha ⁻¹)		Days maturity	Adaptation		Merit
				Research Field	Farmer's field		Altitude (masl)	Rainfall (mm)	
1	M36121	Meko 1	1997	30-50	-	120	<1850	600-900	Yield
2	ICSV 111Inc	Yejuo	2002	50.9	20-60	108	<1850	600-900	Yield and earliness
3	3443-2-OP	Teshale	2002	55.5	20-66	123	<1850	600-900	Yield and earliness
4	90MW 5353	Abuare *	2003	38.2	-	120	<1850	600-900	Yield and earliness
5	KEY # 8566	Birhan	2002	41.8	10-14	101	<1850	600-900	<i>Striga</i> resistance
6	P-9401	Gobiye	1999	40	-	103	<1850	600-900	<i>Striga</i> resistance
7	P-9403	Abshir	1999	30	-	101	<1850	600-900	<i>Striga</i> resistance
8	ICSV 1112BF	Hormat*	2005	23.3	16-22	121	1450-1850	660-1025	<i>Striga</i> resistance

Source: Sirinka Agricultural Research Center (SARC)

NB: * These varieties were not introduced in the study area (Metema woreda)

Appendix table 3 The correlation matrix of independent variables affecting the adoption of improved sorghum varieties

No	Independent Variable	1	2	3	4	5	6	7	8	9	
1	Sex of the respondent	-.331	1								
2	Marital status	-.164	-.365	1							
3	Education level	-.052	.214	-.266	1						
4	Family size	-.074	-.388	.654	-.350	1					
5	Number of close friends	-.205	-.125	.595	-.301	.534	1				
6	Number of people beyond the HH in case of long term help	-.250	.007	.112	-.081	-.096	.064	1			
7	Years of residence in the village	-.249	.245	-.456	.122	-.585	-.537	.020	1		
8	Membership in cooperative	-.533	.222	-.435	.278	-.510	-.475	.059	.390	1	
9	Membership in credit group	-.196	-.155	.108	-.116	.126	.108	.088	.017	-.154	1

Source: SPSS 12.0 Out put

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7 APPENDICES

Interview schedule used for data collection (For Household survey)

Instruction: Introduce yourself before starting the interview. Inform the respondent politely to whom you are working for and explain the purpose of the interview. Fill the responses in the space provided or circle alternative responses in the space provided or circle alternative response (s) where appropriate.

Serial No of the interview schedule _____

1. General Information

1.1. Peasant Association:

Kokit Kumer Aftit

1.2. Village Name _____

1.3. How many years did you live in this village? _____ (since _____)

1.4 Respondent's name _____ Sex _____

Religion _____ Household head Yes No

1.5 Origin of the respondent

Place Ethnicity

1.6 Respondents Category and years of settlement:

Previous settler _____ E.C New settler _____ E.C

1.7 Date of interview _____

1.8 Name of enumerator _____ Signature _____

2. Household Characteristics

2.1 Household members

No	2.1.1 List names of all individuals in household <i>(List household head first, use first names only)</i> Name	2.1.2 what is “_____” relationship to household head? <i>(Use code box)</i> Code	2.1.3 Sex <i>Male--- 1 Female--2</i>	2.1.4 How old is “_____” years	2.1.5 what is “_____” ‘s marital status? Married.....1 Common-low...2 Divorced.....3 Widow(er).....4 Never married....5	2.1.6 Complete education level? <i>(Use code box)</i>	2.1.7 How long have you lived in this community? ?	Remark
01								
02								
03								
04								
05								
06								
07								
08								
09								

Code box for Question 2.1.2

Head.....01	Uncle/Aunt08
Wife/husband.....02	Cousin09
Son/daughter.....03	Grand Parent.....10
Father/mother.....04	Children from another family.....11
Sister/brother.....05	Other non-Relative.....12
Stepson/stepdaughter.....06	Other relative.....13
Stepfather/stepmother.....07	Renter14

Code box for Question 2.1.6

Illiterate, no schooling.....1
Adult Education.....2
Grade 1-43
Grade 5-8.....4
Grade 9-10.....5
Preparatory (11 &12)....6
Other(Religion).....7

2.2 [If you are a household head] What is your social role other than a household head in the community?

1. Priest/ sheka/traditional healer
2. Kebele Cabinee”, Administrator, militia, “
3. Committee member of _____
4. Others (specify) _____

2.3 What advantages do you get from this social role?

2. SOCIAL CAPITAL

Now I would like to ask you some questions about how you feel about this village/neighborhood, and how you take part in the community activities.

3.A Household membership in different groups and associations

3A.1 Are you or is someone in your household a member of any groups, organizations or associations? [Probe: Who in the household belongs to which Group? Are there any other groups or informal associations that you or someone in your household belongs to? *[If the household is not a member in any group, go to section 3B.]*

3A.2 Do you consider yourself/household member to be active in the group, such as by attending meetings or volunteering your time in other ways, or are you relatively inactive? Are you/household member a leader in the group?

Household Member <i>(use roster code)</i>	Name of Organization/ association	Type of Organization <i>(use codes below)</i>	Degree of participation <i>(Use code below)</i>
		<i>Type of Organization</i>	<i>Degrees of participation</i>
		Farmers group.....1	Leader.....01
		Cooperative/cooperative Union.....2	Very active.....02
		Credit/finance group(Eg. Equb.....3	Somewhat active...03
		Religious group or spiritual group (e.g. church, mosque, temple, informal.....4	Not active.....04
		Mutual support association (Edir).....5	Only member.....05
		Political group(Cabinee/ Mlitia)6	
		Labor exchange group(Debo, Wonfel)....7	
		Women’s group(womens Edir).....8	
		Ethnic-based community group.....9	
		Others10	

3A.3 which of these groups/associations in which you are a member is the most important to your household? (List up to three by name and in order of importance.)

Group 1: _____ []

Group 2: _____ []

Group 3: _____ []

3A.4 Do men and women have equal propensity to participate in groups/associations?

1. Yes 2. No

3A.5 If No, what are the reasons or constraints?

3B. Social Networks

3B.1 About how many close friends do you have these days? These are people you feel at ease with, can talk to about private matters, or call on for help.

3B.2 If you suddenly had to go away for a day or two, could you count on your neighbors to take care of your children?

- A. Definitely
- B. Probably
- C. Probably not
- D. Definitely not

3B.3 If you suddenly faced a long-term support/help such as the death of a breadwinner or how many people beyond your immediate household could you turn to who would be willing to assist you?

- A. No one
- B. One or two people
- C. Three or four people
- D. Five or more people

3B.4 Who do you talk to, here in the village " _____ "[Here the enumerator should site the village name] when you have a big decision to make in your life, or when you need advice about a problem, exchange of resources, seek information? can you name three people

<u>Name</u>	<u>Thier relationship with the household</u>
1. _____	_____
2. _____	_____
3. _____	_____

3B.5 Did you/your family members participate in the following social networks?

	<u>Yes 1</u>	<u>No 2</u>
1. Kebele social Courts	[]	[]
2. Parliament	[]	[]
3. Local Cabine member	[]	[]
4. Education (Family-Teacher commettee)	[]	[]
5. Church/Mosque (As a priest, sheka)	[]	[]
6. Market place (who frequently go to market)	[]	[]
7. Unions (cooperatives)	[]	[]
8. Clubs & societies	[]	[]
9. Networks of neighbors, friends & acquaintances	[]	[]
10. Families	[]	[]

3B.6 Do these social networks have trans-generational continuity (like from father to son) within the community?

1. Yes 2. No

3B.7 If No, what are the reasons? -----

Gender and social networks

3B.8 Do men and women involved in the same/ different social networks?

- A. The same
- B. Different
- C. It depends on the occasions and purpose of the networks

3B.9 if different, what are the reasons?

- A. Social barriers
- B. socio-economic problems(such as lack of resource, time)
- C. others(specify)_____

 3B.10 who belongs to formal organizations/networks?

- By Gender A. Men
- B. Women
- By Age A. Young men
- B. Young women
- C. elders (men)
- D. elders (women)

3B.11 If men/women, reasons?

3B.12 If elders (men/women), reasons?

4. Trusts and Solidarity

In every community, some people get along with others and trust each other, while other people do not. Now, I would like to talk to you about trust and solidarity in your community.

4.1 Generally speaking, would you say that most people can be trusted, or that you can't be too careful in your dealings with other people?

- 1 Most people can be trusted
- 2 Most people can not be trusted

3.3 In general, do you agree or disagree with the following statements?

	1. strongly Agree 2. somewhat Agree 3. Neither agree nor disagree 4. somewhat Disagree 5. strongly Disagree
4.2 A. Most people who live in this village/neighborhood can be trusted.	
4.2 B. Most people in this village/neighborhood are willing to help if you need it.	
4.2 C. In this village/neighborhood, people generally do not trust each other in matters of lending and borrowing money.	

4.3 Now I want to ask you how much you trust different types of people. On a scale of 1 to 5, where 1 means a very small extent and 5 means a very great extent, how much do you trust the people in that category?

	1. To a very small extent (1) 2. To a small extent (2) 3. Neither small nor great extent(3) 4. To a great extent (4) 5. To a very great extent (5)
4.3A. People from your ethnic or linguistic group/race/caste/tribe	
4.3B. People from other ethnic or linguistic groups/race/caste/tribe	
4.3C. People from your religion	
4.3D. Shopkeepers	
4.3E. Close friends and relatives	
4.3F. Neighboring farmers	
4.3G. Families	
4.3H. Police	
4.3I. Teachers	
4.3J. Development agents(DAs)	
4.3K. Strangers	
4.3L Group members	

4.4 Do you think that over the last five years, the level of trust in this village/neighborhood has gotten better, worse, or stayed about the same?

- 1. Gotten better
 - 2. Gotten worse
 - 3. Stayed about the same
-

4.5 How well do people in your village/neighborhood help each other out these days? Use a five point scale, where 1 means always helping and 5 means never helping.

- 1. Always helping
 - 2. Helping most of the time
 - 3. Helping sometimes
 - 4. Rarely helping
 - 5. Never helping
-

5. Information and Communication

5.1 What are the three most important (in order of importance) sources of information about what the government is doing (such as agricultural extension, workfare, family planning, etc.)?

- 1. Relatives, friends and neighbors
- 2. Spiritual places (like Church, mosque)
- 3. Local market
- 4. Radio
- 5. Television
- 6. Political leaders
- 7. Community leaders
- 8. An agent of the government (Like DAs)
- 9. NGOs
- 10. Others (specify)

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5.2 What are the three most important (in order of importance) sources of seed exchange mechanisms (such as improved seed of sorghum, sesame etc)?

- 1. Relatives, friends and neighbors
- 2. own seed selected from previous harvest
- 3. Local market
- 4. cooperatives
- 5. Bureau of Agriculture and Rural development(BoARD)
- 6. Research centers
- 7. Investors

--	--	--

5.3 What is/are the reasons for these (selected above) sources being the best source of seed exchange?

- 1. terms of exchange is favorable/flexible/simple
- 2. variety choice is adapted, appropriate and wide
- 3. reciprocity and trust: we know them and they are related to us
- 4. Easily accessible

5.4 In general, compared to five years ago, has access to information improved, deteriorated, or stayed about the same?

- 1. Improved
- 2. Deteriorated
- 3. Stayed about the same

--

6. Labor exchange and Mutual social support

6.1 Did you use labor exchange (like “Wonfel”, “debo” and “wobera”)

- 1. Yes
- 2. No

6.2 If yes, for which farm operation?

- 1. Ploughing
 - 2. Planting
 - 3. Weeding
 - 4. Harvesting
 - 5. Threshing
 - 6. other (specify)
-

Do you/your family participate in the following mutual social support systems and social networks?

	Yes	No
A. <i>Edir</i>		
B. <i>Equb</i>		
C. <i>Meredaja mahiber</i>		
D. <i>Senbete</i>		
E. <i>Others</i>		

7. Use of sorghum technology Package and seed exchange mechanisms

7.1 What is the total area of your land under sorghum production for this (1999/2000 E.C) cropping season? -----

7.2 What are the varieties (*both improved and local*) you used for this cropping season and used to in the past?

For this cropping season

1. _____
2. _____
3. _____

before this cropping season

1. _____
2. _____
3. _____

7.3 Have you heard about improved *striga* resistant & early maturing sorghum varieties?
[Here enumerators should remind about 45 farmers demonstration of kokit kebele]

1=Yes 2=No

Yes

No

7.4 If yes, when did you first hear about the varieties? Since-----

7.5 Have you ever used improved *striga* resistant & early maturing sorghum varieties?

1=Yes 2=No

Yes

No

7.6 If yes, which variety did you use?

Gobiye		Abshir	
Yeju		Birhan	
Teshale/		Meko	
Gambella 1107			

7.7 If yes, since when -----

7.8 Land allocated for *striga* resistant & early maturing varieties in last seasons (1998/99E.C)

Year	Total Land holding (in timad)	Total land under sorghum (in timad)	Total area for improved Variety(in timad)

7.9 What is the status of those varieties?

1. I am using those varieties only.
2. I am using those varieties together with other modern sorghum varieties.
3. I completely ceased using those varieties and goes back to use those local varieties.
4. I discontinue using those varieties and now I am using other modern varieties.
5. I am using both local and modern sorghum varieties other than those varieties.
6. I am using those local and modern varieties together with those varieties.

- Why for? _____

7.10 If the answer for question No 7.5 is No, why? -----

7.11 If yes, where did you get seeds of these sorghum varieties?

- Self saved from previous harvest.....
- From a family member exchange for the same quantity of grain after harvest....
- From neighbor exchange for the same quantity of grain after harvest.....
- From Farmers who are using the varieties, through exchange-----
- From a friend/relative in the same village as a gift.....
- From a friend/relative in the outside this village as a gift.....
- From local market/shopkeeper/traders.....
- From cooperative/cooperative union.....
- From BoARD office.....
- From Research centers (Gondar: Adet: Sirinka)-----
- From other source (specify).....

7.12 Did you use the variety last year? 1=Yes 2=No

7.13 If no, why?

- | | | |
|------------------------------|------------------------------------|---------------------|
| 1= Seed not available | 4= Never heard of improved variety | |
| 2= Too expensive | 5= Bird attack | |
| 3= Not convinced of benefits | 6= We don't have land | 7= others (specify) |

7.14 Does the new variety require more labor? Yes/no

7.15 Is improved seed available on time? 1=Yes 2=No

7.16 If no, what are the reasons?

- 1=Unavailability 2=far distance 3= others (specify)

7.17 Can you purchase the quantity you need every year? 1=Yes 2=No

7.18 If no, why? 1= Not available 3= Cash shortage 5=Not available on time

- 2= Too expensive 4= I am not sure of benefit 6=Not better than local
7=Others (Specify) _____

7.19 In situations of disaster or shocks, where do you get support for seed in the community?

- | | |
|---------------------------------|--------------------------|
| 1. well off farmers | 5. Friends and relatives |
| 2. other communities | 6. cooperatives |
| 3. The market | 7. others (specify)_____ |
| 4. Organizations (GOs and NGOs) | |

8. Influences of Social networks on the diffusion of Agricultural innovation

8.1 When you want to adopt or use any agricultural innovation that is new to the community (like improved seed, pesticide) who is/are primarily to follow?

8.2 If the answer for Question No 7.5 is yes, who influences you to use or adopt the technology?

- Friends, relatives through Advising and discussion
- Neighbors Farmers through Field visit and discussion.....
- Experts through Advising and encouraging.....
- Family Members through negotiation and discussion.....
- Kebele leaders through Advising and encouraging.....
- Religious leaders through Advising.....

8.3 Who or what had taught you to use modern varieties of sorghum?

8.4 If you want to use a given innovation that comes recently in your locality, what is/are your preconditions?

- 1. If one of my family member use the technology
- 2. If members of my religious group use the technology
- 3. If one or more of my relatives, friends and acquaintances use the technology
- 4. If my neighbors uses the technology
- 5. If experts/development agents told me to do so
- 6. Others(specify)_____

8.5 Through which channels technological or institutional innovations channeled to the community or social system? list 3 important channels

- | | |
|---------------|-----------------|
| <u>Formal</u> | <u>informal</u> |
| 1. _____ | 1. _____ |
| 2. _____ | 2. _____ |
| 3. _____ | 3. _____ |

8.6 Among these social networks, which are crucial for the diffusions of technology within and outside the community?

- 1. _____
- 2. _____
- 3. _____

Thank you!