Universität für Bodenkultur Wien
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Assessing the role of social learning, institutions and social capital for soil conservation in Northern Ethiopia

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Doctoral Thesis

Vienna, September 2012, Centre for Development Research

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Declaration

I declare that the dissertation is an original work and no material in this thesis has previously been submitted at this or any other university.

Dedication

To my parents: Eyerusi Ayenew and Dessie Belay

Acknowledgements

First and foremost, I thank and praise God for giving me the strength and confidence to complete this study.

I wholeheartedly thank my supervisors, Professor Uwe Schubert, Dr. Maria Wurzinger and Dr. Michael Hauser, for their guidance and support during my doctoral study and for transforming me into an independent researcher.

I appreciate the support of farmers, experts, researchers, and local administrators who participated in interviews, group discussions and questionnaire surveys. I am equally grateful for the following offices for their support: Bureau of Finance and Economic Development, North Gondar Zone Sustainable Natural Resource Management Office, German Agency for Technical Cooperation Amhara Regional Office, and Sustainable Water Harvesting and Institutional Strengthening Amhara office.

I also thank the Austrian Development Cooperation and the OeAD GmbH for the financial assistance.

Thanks to CDR staff and research fellows for your support. Thank you Florian Peloschek, Verena Pflug, Fabian Wenger, Lemelem Behailu, Sara Ogalleh, Lorenz Probst, Anna Lisa, and Rebekka Kölbl for your continuous support throughout my stay at CDR.

I am also grateful for the moral support of some of my best friends and colleagues: Dr. Lalisa Duguma, Amlaku Asres, Dr. Mastewal Degefa, Dr. Zerfu Hailu , Dr.Belayneh Ayele, Dr. Zewdu Wuletaw, Dr. Abraham, Abebe Wondmeneh, Kume, Bafena, Ashe, Achamyeleh Kassa, Semahegne Wold Gebrial, Mesfin Gebre Medhin, Ayana Zewdie, Fekadu Chekol, Tadelech, Alemayehu, Belayneh Adugna, Sahle, Teshome Mulu, Kassahun, Belayneh, Alene, Seid, and Workineh.

I sincerely appreciate my wife, Birtukan Mekonnen, and my three kids, Bereket, Mahider and Beniam, for their love and encouragement throughout my stay in Austria and Ethiopia.

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Abbreviations

ADLI	Agriculture Development Led Industrialization
ADPFSO	Amhara Disaster Prevention and Food Security Office
BOFED	Bureau of Finance and Economic Development
CSAE	Central Statistics Authority of Ethiopia
EFSDPO	Federal Food Security and Disaster Prevention Office
FAO	Food and Agricultural Organization
FC	Farmers conference
FDRE	Federal Democratic Republic of Ethiopia
FFDs	Farmers' field days
GD	Group discussions
GDP	Gross Domestic Product
GIZ	German Agency for Technical Cooperation
GTP	Growth and Transformation Plan
GZADO	Gondar Zuria Agricultural Development Office
INF	Informal learning approaches
KfW	German Development Bank
LSC	Social Cohesion
LST	Trust between famers, experts and public administrators, and social cohesion LSC
MOA	Ministry of Agriculture
MOARD	Ministry of Agriculture and Rural Development
MOFED	Ministry of Finance and Economic Development
MOU	Memorandum of Understanding

SUNRPA	Sustainable Utilization of Natural Resources Project of Amhara
SUNRPO	Sustainable Utilization of Natural Resources Project of Amhara Office
WFP	World Food Program

Summary

Soil conservation innovations have not been widely adopted in Ethiopia even in areas where land degradation is a serious problem. Literature shows that the quest for sustainable soil conservation measures requires the understanding of knowledge co-production of farmers, experts, and scientists. This type of knowledge production is possible through social learning and to analyze social learning the theory of communicative action is a key element. In order to govern the actors' interaction during learning and in the adoption of soil conservation innovations, actors have to agree on institutions (rules of the game). Concepts such as the Agricultural Innovation System (AIS) are used to analyze the interaction of the various actors with their institutions.

While communicative theories and AIS highlight the importance of interaction and communication for innovations, they do not explain how the process of social learning can be institutionalized in order to sustain and govern it. Thus, concepts related to institutions help to better understand the role they play in governing the interaction of actors. In addition, in recent research, social capital is getting emphasis on the assumption that communities are more often efficient than state institutions and organizations in managing natural resources. Yet, the role of social learning, social capital and institutions in soil conservation studies are seldom-voiced components and the main objective of this thesis is to explore the role of these components in the adoption of soil conservation innovations.

Employing a case study approach, data were collected from July to December 2010 and from July to December 2011 from Amba Zuria watershed in Northern Ethiopia. Semi-structured interviews, group discussions, questionnaire surveys, and workshops were the main data collection methods. The transcripts of the interviews, group discussions and workshops were analyzed using a qualitative data analysis software ATLAS.ti. For the questionnaire survey, a social capital measurement framework known as Integrated Questionnaire for the Measurement of Social Capital (SC-IQ) was used to design the queries. The data from surveys was analyzed using a probit model.

The findings show that social learning encourages adoption of soil conservation measures. It creates opportunity for broader understanding on soil conservation and for the emergence of trust and mutual understanding among the actors. It also plays a role for the application of indigenous and scientific knowledge and the creation of social capital. The study shows differences in social capital between adopter and non-adopter farmers. Social capital elements such as trust and cooperation were higher among adopter farmers may be due to their involvement in social learning platforms. Moreover, the social capital between experts, farmers and local administrators was higher in Amba Zuria where social learning was intensified. This indicates that exposure to social learning could be one potential reason to adopt soil conservation innovations. The findings also show that social learning requires proper institutional set up in order to govern and sustain it. Bylaws and guidelines were used to guide when and how to learn, how to monitor and evaluate soil conservation activities and how to coordinate actors at various levels. In this regard, local institutions had a great role in strengthening the network of local actors with higher level actors at the district or regional level. This shows that local institutions and actors can play a great role in the adoption of soil conservation innovations and relying on government actors can constrain the ability of these local institutions and actors to innovate effectively.

These findings allow driving policy recommendations to encourage the application of social learning, to strengthen or create social capital, and to promote the important role of local institutions and actors in the adoption of innovations. Thus, soil conservation strategies should consider investing in social learning and in establishing effective institutions in order to strengthen or create social capital which encourage voluntary adoption of soil conservation innovations. More research on understanding social learning and farmers' institutions in local innovations need to be investigated in different agriculture and natural resource programs. While this study was limited to understand the role of social learning and institutions in soil conservation, further empirical studies using the methods of this study can be used to analyze social learning in other sectors such as livestock, crop, water management, forestry, or climate change.

Zusammenfassung

Selbst in Gegenden Äthiopiens, in denen Landverödung ein großes Problem darstellt, wurden Maßnahmen zum Schutz der Böden bisher nicht in größerem Umfang umgesetzt. Gemäß der Literatur erfordert das Fördern nachhaltiger Bodenschutzmaßnahmen ein Verständnis der Ko-Produktion von Wissen durch BäuerInnen, ExpterInnen und WissenschaftlerInnen. Eine solche Ko-produktion von Wissen wird durch soziales Lernen möglich, dessen Analyse wiederum auf der Theorie des kommunikativen Handelns basiert. Die Interaktion in Lernprozessen und der Umsetzung von Bodenschutzmaßnahmen erfordert die Vereinbarung von Institutionen (Spielregeln) durch die AkteurInnen. Konzepte wie jenes des Agricultural Innovation System (AIS) werden zur Analyse der Interaktion verschiedener AkteurInnen und ihrer Institutionen angewendet.

Obgleich Kommunikationstheorien und AIS die Bedeutung von Interaktion und Kommunikation für Innovation unterstreichen, können sie nicht erklären wie der Prozess sozialen Lernens in Institutionen nachhaltig geregelt und verankert werden kann. Folglich sind Konzepte zum Verständnis dieser Rolle von Institutionen hilfreich. Weiterhin wird in gegenwärtigen Studien zu Sozialkapital die Annahme betont dass Gemeinschaften natürliche Ressourcen effizienter verwalten können als staatliche und andere Organisationen. Die Rollen, welche soziales Lernen, Sozialkapital und Institutionen in der Umsetzung von Bodenschutzmaßnahmen spielen, werden jedoch selten in Studien zu dieser Problematik angesprochen. Diese Arbeit untersucht deshalb vornehmlich die Bedeutung eben dieser Faktoren für die Umsetzung von Innovationen zum Schutz von Böden.

Zu diesem Zweck wurde von Juli bis Dezember 2010 sowie Juli bis Dezember 2011 eine Fallstudie im Wassereinzugsgebiet Amba Zuria in Nordäthiopien durchgeführt. Um Daten zu erheben wurden halbstrukturierte Interviews, Befragungen sowie Workshops und Gruppendiskussionen eingesetzt. Um die qualitativen Daten aus Interviews, Workshops und Gruppendiskussionen zu analysieren wurde die Software ATLAS.ti verwendet. Die Befragungen zu Sozialkaptial wurden mit Hilfe des Integrated

Questionnaire for the Measurement of Social Capital (SC-IQ) konzipiert und in einem Probit-Modell analysiert.

Die Resultate zeigen dass soziales Lernen die Umsetzung von Bodenschutzmaßnahmen fördert. Soziales Lernen schafft Möglichkeiten für ein verbessertes Verstehen von Bodenschutzmaßnahmen ebenso wie für das Entstehen von Vertrauen und gegenseitigem Verständnis unter den Akteuren. Soziales Lernen spielt auch in der Anwendung lokaler und wissenschaftlicher Kenntnisse sowie zur Schaffung von Sozialkapital eine Rolle. Die Arbeit zeigt Unterschiede im Sozialkapital zwischen AnwenderInnen und Nicht-AnwenderInnen von Bodenschutzmaßnahmen. Vertrauen und Zusammenarbeit war stärker bei AnwenderInnen, möglicherweise aufgrund ihrer Teilnahme in Lernplattformen. Auch das Sozialkapital von Expertinnen, BäuerInnen und VertreterInnen der Verwaltung in Amba Zuria war dort stärker, wo soziale Lernprozesse intensiv umgesetzt wurden. Dies zeigt, dass soziales Lernen ein Grund für die erfolgreiche Umsetzung von Bodenschutzmaßnahmen sein kann.

Die Ergebnisse der Arbeit zeigen weiterhin, dass soziales Lernen einen angemessenen institutionellen Rahmen braucht, um Lernprozesse zu regeln und zu unterstützen. Die AkteurInnen setzten Statute und Richtlinien ein um das wann und wo des Lernens zu bestimmen, um Monitoring und Evaluierung der Bodenschutzmaßnahmen zu regeln und um die Interaktion der AkteurInnen auf den verschiedenen Ebenen zu koordinieren. In dieser Hinsicht spielten vor allem lokale Institutionen eine Schlüsselrolle für die Verknüpfung lokaler AkteurInnen mit AkteurInnen auf Distrikt- oder Regionalebene. Dies zeigt die Bedeutung lokaler Institutionen für die Umsetzung von Bodenschutzmaßnahmen; werden jedoch nur RegierungsvertreterInnen berücksichtigt, kann dies die die Fähigkeit lokaler Institutionen und AkteurInnen zur Innovation einschränken.

Die Arbeit unterstreicht, dass soziales Lernen auch politisch gefördert werden sollte, um Sozialkapital zu schaffen und die wichtige Rolle lokaler Institutionen und AkteurInnen in Innovationsprozessen zu stärken. Demgemäß sollten Strategien zum Schutz der Böden in soziales Lernen investieren wie auch in die Schaffung effektiver Institutionen. So kann Sozialkapital entstehen und gestärkt werden, was wiederum die freiwillige Umsetzung von Bodenschutzmaßnahmen begünstigt. Die Arbeit zeigt auch, dass eine

Kombination qualitativer und quantitativer Forschungsmethoden ergänzende Perspektiven bieten kann um komplexe Innovationsprozesse wie etwa die Umsetzung von Bodenschutzmaßnahmen zu verstehen. Weiterführende Studien sollten dazu beitragen, die Bedeutung sozialen Lernens und bäuerlicher Institutionen für lokale Innovation im Bereich Landwirtschaft und Management natürlicher Ressourcen zu ergründen. Wenngleich sich diese Studie auf die Rolle sozialen Lernens und der Institutionen in Bodenschutzmaßnahmen konzentriert, kann die Methodik der Studie auch angewendet werden zur Analyse sozialen Lernens in Bereichen wie Nutztierhaltung, Wasserwirtschaft, Forstwirtschaft und Klimawandel.

Thesis structure

This doctoral thesis has five sections. The first section, the introduction, highlights soil conservation, social learning, social capital, and institutions. This section also shows the objectives and research questions. The second section, the literature review, discusses concepts related to soil conservation innovations, social learning and institutions in greater detail. The third section, the methodology part, explains the research area, research design, data collection and analysis. The results and discussions are presented in section four. Section five discusses the conclusions and implications of the study. References, CV and appendix are included at the end.

1. Introduction

In Ethiopia, soil degradation due to erosion is recognized as a major problem for agriculture productivity and food security (Betru 2002; Beshah 2003; Bewket 2007). Because of this, for the last 30 years the government of Ethiopia has promoted the adoption of soil and water conservation measures, especially after the famine of 1970s. Considerable efforts were made since then to reverse land degradation. Among the efforts, various soil and water conservation innovations such as stone terraces, checkdams, waterways, and grass strips were introduced and as a result of these efforts some degraded lands have been restored (WFP 2004; Betru 2002). The conservation efforts were supported by incentives such as food-for-work, provision of hand tools and training of farmers (Tefera and Sterk 2010).

In addition, the important role of adopting soil and water innovations in transforming agriculture has been reflected in the Agricultural Development-Led Industrialization (ADLI) strategy of Ethiopia. ADLI outlines the important roles of government organizations (research, extension and education service) as pillars of the country's formal innovation system (MOI 2002). It also promotes the adoption of new agricultural technologies to increase agricultural productivity. The current Growth and Transformation Plan of Ethiopia (GTP) further underscores the important role of agriculture in the economy. The GTP focuses on agricultural productivity, research and natural resource management (MOFED 2010). It also emphasizes the need to strengthen research-extension-farmer linkages through research-extension-farmer councils. The agricultural research strategy programs mainly cover crop sciences, animal sciences, soil and water conservation, and agroforestry.

Until 1994, the agriculture research was taking place under the national Institute of Agricultural Research. After 1994, most of the research centers were transferred to regional governments following the decentralization policy of the country (FDRE 1999). However, the research has limited scope to address the real problems of farmers and most importantly the linkage between research-extension- farmer has not been strong due to the limited interaction between farmers, experts, and researchers. Thus, the dissemination of successful innovation such as soil and water conservation was limited (Belay and Degnet 2004).

Reasons for the limited success stories of soil conservation measures are related to the extension approach. The direction of the technology transfer in the Ethiopian agricultural extension system is considered linear, from the expert to the farmer (Bekele 1997; Gebremedhin et al. 2006). In this approach, experts are considered as knowledge producers and farmers as adopters of that knowledge, which lead to overlooking the farmers' indigenous knowledge on soil conservation. Through this approach, the chance of reaching consensus and understanding by all actors has been a difficult challenge and extension messages were simply transmitted from the experts to the farmers just as messages at churches or mosques during religious holidays or other social gatherings. This type of top-down approach has not enabled the actors to understand the soil erosion problem at hand and neither did it motivate especially farmers to involve in soil conservation.

In the mid-1990s, a participatory watershed management approach was introduced to encourage the involvement of farmers; yet, experts from agriculture still dominated the design and introduction of technologies related to soil conservation. This has been confirmed by recent studies of Gebremedhin et al. (2006) and Spielman et al. (2011). In their studies, three major challenges were identified. The first challenge is related to the design and implementation of soil conservation policies, which places emphasis on formal organizations for the innovation process. A continuous focus exists on linear modes of technology transfer- from experts to farmers. Secondly, facilitation of innovation among farmers with experts, researchers, and NGOs was not an easy exercise. The ability to bring those possessing indigenous knowledge closer to those possessing scientific knowledge determines the facilitation of the innovation process. This was a difficult task due to the top down and supply driven nature of the agriculture extension system. Thirdly, a challenge also exists on how actors interact among themselves and with institutions. This challenge was associated with difficulties related to, for example, agreeing on rules and procedures, creating trust, and the monitoring of opportunistic behavior. As a result of these challenges, the rate of adoption is low and even terraces and checkdams constructed on farm or grazing lands did not stay long, i.e. farmers did not maintain the structures built and most were being destroyed every year. This means that the extension approach has not operated based on learning that can allow knowledge production and skill development (Gebremedhin et al. 2006).

Literature show that social learning is an important component for natural resources management to produce and co-produce knowledge from all actors, to reach common understanding on a problem at hand, and to understand the social aspects of resource use and management (e.g. Röling and Wagemakers 2000; Rist et al. 2006; Jiggins et al. 2007; Rist et al. 2007; Muro and Jeffrey 2008). Social learning here is understood as a process of communication, deliberation and collective learning potentially establishing and changing relationships thus, contributing to transforming existing forms of governance (Rist et al. 2006). It has proved to be useful to overcome the deficiencies of formal decision-making processes that are dominated by local elite, bureaucrats, experts, or researchers by widening the space for communicative action (Wiesmann et al. 2005).

During the learning process, high priority is given to dialogue and participation based on specific patterns of communication such as narratives of practical experiences (Rist et al. 2006). This type of communication paves the way for the formation of social capital elements such as cooperation, trust, common understanding on soil conservation problems and solutions, and social cohesion which encourage adoption. Studies (e.g. Cramb 2004) suggest that the rate of adoption is considerably enhanced where appropriate forms of social capital are being developed and hence, creating or strengthening social capital elements such as trust, cooperation, better understanding, and social cohesion are needed to promote soil conservation. Examination of the few successful examples of widespread and sustained adoption suggest that utilizing or investing in social capital is needed to raise awareness of soil degradation and conservation, develop and test locally adapted soil conservation measures, provide effective farmer-led and group-based training in soil conservation practices, and to disseminate measures within and beyond the community (Mercado et al. 2001).

For social learning to take place, institutions play an important role. An institution here is related to North's (1990) definition, who states that an institution is a rule governing the behavior of actors. Institutional features such as actors' norms and rules that form the basis for action to take place are important (Klerkx et al. 2010). The effectiveness of institutions varies, as suggested by Pahl-Wostl (2009), in creating opportunity to negotiate about goals, on the ways to achieve the goals and to translate the goals into action.

Most of the previous soil conservation studies (e.g. Bekele and Drake 2003; Gebremedhin and Swinton 2003; Bewket 2007) conducted in Ethiopia highlight economic, personal and physical recommendations as a solution for the limited adoption of soil conservation innovations. However, the limited adoption of soil conservation innovations still exists. This means that the factors of adoption that were studied were not exhaustive and other potential factors that may affect soil conservation have to be assessed in order to come up with recommendations that address soil conservation with a broader picture. For instance, the soil conservation studies that were conducted so far have not examined the role of social learning, institutions, and social capital for the adoption of soil conservation measures. In order to fill part of this knowledge gap in soil conservation studies, and to recommend solutions for policy and practice, the objectives of this study are: (1) to examine the role of social learning for soil conservation; (2) to identify the institutions and their roles in social learning and in soil conservation and; (3) to analyze the role social capital play for soil conservation innovations.

The research questions thus remain whether and how social learning, institutions and social capital affect the adoption of soil conservation innovations. Based on this background, the main questions that guided this study are:

1. In what ways does social learning affect the adoption of soil conservation innovations?
2. What role do institutions play in social learning processes and in the adoption of soil conservation innovations?
3. What role does social capital, which emerges from social learning, play in the adoption of soil conservation innovations?

2. Literature review

2.1. Soil conservation

Based on the literature, the soil and water conservation efforts in Sub-Saharan Africa have produced some success, only a few conservation technologies have been adopted on a wider scale (Shiferaw et al. 2009; Ekop and Osuji 2003). The same is true in Ethiopia. Despite some successes exist, the adoption of soil and water conservation technologies in a wider scale still remains low (Bekele 1997; Shiferaw et al. 2009). Reasons for the limited success were related to the top-down approach during planning and implementation of soil conservation measures (Beshah 2003). Farmers were involved in either coercive measures or for the food-for work payments. They were dissatisfied as the conservation measures were neither address their needs nor their farming system (Bewket 2007). Because of this, most of the soil and water conservation structures were destroyed during the Derge regime change in 1991 (Bewket 2007), and demolishing soil and water conservation measures was common in the 1970s and 1980s (Shiferaw and Holden 1998; Beshah 2003).

When the Ethiopian people's Revolutionary Democratic Front (EPRDF) government came to power in 1991, some measures such as participatory watershed management were introduced to involve the farmers, but still the experts design the technologies and transfer them to the farmers, without reaching consensus and understanding on the problem at hand. This approach has not succeeded in triggering voluntary adoption of soil conservation measures (Tefera and Sterk 2010).

Different factors may contribute either positively or negatively for the adoption of soil conservation innovations. For instance, individual characteristics of farmers (e.g. age), farm characteristics (e.g. farm size), and wealth indicators (e.g. livestock numbers) and the availability and profitability of the technology can have its own impact on adoption. However, adoption of soil conservation innovations should start from acknowledging the erosion problem and developing a positive attitude towards soil conservation innovations (De Graaff et al. 2008). Processes of internal sense making and actor specific perceptions are important for the spread of soil conservation measures. These specific perceptions are important for the spread soil conservations innovations (Graaff et al. 2008). This leads to understanding a need to strengthen the investigation of the social processes leading to adoption of soil conservation measures. Nowadays, there is growing agreement that the quest for more sustainable natural resource management practices should be understood as social learning processes rather than a transfer of knowledge from research to the farmers (Jiggins et al. 2007). In other words, according to Jiggins et al. (2007), economic, agronomic, farm characteristics and ecological dimensions cannot be understood without consideration of socio-cultural elements such as values, rules, power relationships and opinions of different actors. The values, rules, and power relationships of the different actors can be captured by the concept of social learning (Schneider et al. 2009).

2.2. Social learning

Even though technologies are important, the knowledge required for natural resource use need to be produced from different sources (Rist et al. 2007; Steyaert et al. 2007), and their application need to be integrated with social processes (Woodhill and Röling 2000; Schneider et al. 2009; Schneider et al. 2010). This means that the quest for sustainable soil conservation measures requires the understanding of knowledge co-production of farmers, experts, and scientists (Rist et al. 2006; Rist et al. 2007; Steyaert et al. 2007; Schneider et al. 2009). This type of knowledge production is possible through social learning (Schneider et al. 2009). The literature provides various definitions for social learning based on different contexts. The definitions here are related to natural resource management and are not necessarily pertinent to other contexts. Accordingly, Rist et al. (2006) define social learning as the simultaneous transformation of cognitive, social and emotional competences as well as social capital which includes attitudes and values related to collective or individual social actors emerging from the joint search for more sustainable management of natural resources at the interface between the world of rural actors, experts and public administration. In the same way, Muro and Jeffrey (2008) define social learning as communication and interaction of different actors in a participatory setting which is believed to result in a set of social outcomes such as the generation of new knowledge, the acquisition of technical and social skills, as well as the development of trust and relationships which in turn may form the basis for a common understanding of the system or problem at hand, agreement, and collective action. These definitions indicate that social learning demands the interaction and communication of the different actors.

To analyze the transformation of the existing forms of interaction and to understand the collective action in projects dedicated to soil and water conservation, the theory of communicative action is a key element for social learning (Lebel et al. 2010). The theory of communicative action allows understanding social learning with natural resource governance and is particularly interesting for the analysis of the interrelation between the knowledge of farmers, experts and researchers (Rist et al. 2006). Even though the theory of communicative action provides an interesting background for dealing more systematically with development approaches stressing participation and empowerment (Rist et al. 2007), the potentials and limitations of the theory of communicative action for analyzing the changes in patterns of social interaction still need to be reviewed more systematically (Jacobson and Storey 2004). The changes in the patterns of interactions can be analyzed in certain social learning spaces. In this regard social network, platforms, deliberation oriented policy arenas, and social movements can become central spaces for social learning (Steins and Edwards 1999).

Nowadays, social learning approaches of sustainable natural resource management are getting more and more attention (Röling and Wagemakers 2000; Jiggins et al. 2007; Muro and Jeffrey 2008). The current research literature provides many positive outcomes of social learning with respect to natural resource management (Rist et al. 2006; Rist et al. 2007). Social learning is considered useful for the success of natural resource management if opportunities for interaction, openness, representativeness and facilitation (Mostert et al. 2007), and integration of knowledge (Rist et al. 2006) are considered. It represents a philosophy focusing on participatory processes of social change via broadening the space for reflexive communication, e.g. through platforms or forums for the deliberation about the use of natural resources (Rist et al. 2006). Such reflexive communication involves complex and interrelated aspects and activities which make it necessary to keep space for bargaining and negotiation. However, there are also studies that indicate limitations of social learning such as the intensification of conflict among actors (e.g. Steyaert and Jiggins 2007) or a failure to reach agreement in the process of learning (e.g. Leeuwis 2000; Connelly and Richardson 2004).

Social learning involves internal changes (e.g. attitude change) that are generally hard to qualify and measure. In addition, the lack of consistency in the concept of social learning complicates the task of defining common indicators to evaluate social learning as either process or outcome (Muro and Jeffrey 2008). However, the patterns of communication that may result from social learning can be understood by investigating and making use of some indicators. To understand the outcomes of social learning, Pahl-Wostl and Hare (2004) have used indicators such as understanding other participants, trust, interactions, understanding the management system, and collaboration. In the same way, the main aspects and themes of interaction used by Rist et al. (2007) and Schneider et al. (2009) were trust and self-confidence, patterns of communication, mutual perception, shared values regarding development and interaction and revision of norms and rules.

2.3. Institutions

In order to implement the collective action needed for social learning and soil conservation innovations, actors have to agree on the working procedures and rules in order to govern their interaction during learning and in the adoption of soil conservation innovations. As indicated by Spielman et al. (2009), innovation depends on institutions (i.e. the rules of the game). More broadly, innovation includes endogenous development, social learning, concerted action, emergence from interaction and institutional change (Röling 2009). In this regard, Agricultural innovation systems (AIS) approach is used commonly to explain how innovation takes place and how and by whom benefits are gained out of complex technological and institutional change processes (Assefa et al. 2009). In other words, it is used to analyze complex relationships and innovative processes that occur among various actors, institutions, and endogenously determined technological and institutional opportunities (Spielman et al. 2009).

Among others, the World Bank has begun to use AIS concepts in order to focus on strengthening knowledge and technologies, rules, and the interaction of actors (World Bank 2007). In AIS there is a significant shift from the conventional linear perspectives on technological change to emphasizing the actors' involvement in the innovation process, their actions and interactions and the formal and informal rules that influence their practices and behavior (Spielman et al. 2011). This shift is important when studying agricultural innovations because of the sector's growth and development. This development is increasingly influenced by complex interactions among actors and by rapidly changing market and policy regimes that affect knowledge flows, technological opportunities, and innovation processes (Spielman et al. 2009). Thus, the individual innovation performances of farmers cannot be seen in isolation from the inputs of the other system actors for two reasons. Firstly, innovation such as soil conservation innovation is based on different kinds of knowledge possessed by different actors: indigenous knowledge (which farmers possess) and scientific knowledge (which experts possess) (Hall 2006). Secondly, due to lack of resources and sufficient power, no single actor pursues his/her innovation goals without taking into account other actors (Aarts et al. 2007).

In AIS thinking, innovation process does not always start with formal research, but mainly comes from knowledge and information that originate from the interaction of system actors (Assefa et al. 2009). But from where does the information and knowledge come from? As Hall (2006) pointed out, the capacity for continuous innovation is a product of linkages, working practices and policies that promote knowledge flow and learning among all actors. In other words, innovation may result from new forms of coordination within a network of actors (Leeuwis, 2004) or as Ayele et al. (2012) suggested, it may also result from interactions and learning in networks, and on farms. In this process, actors that contribute to innovation processes, actions and interactions, and the institutions that condition behaviors and practices have to be considered (Spielman et al. 2011). However, in reality the innovation related information flow is actually embodied in various actors who are not networked or coordinated (Hall 2006). For instance, in most cases small farmers do not have adequate human and social resources to integrate within innovative actors' networks or do not operate in an institutional environment in which such networks easily form (Spielman et al. 2009).

Thus, a successful soil conservation innovation process is determined by the extent to which innovative actors acquire sufficient capabilities, resources, and exchange information. Specifically, innovation is the result of networking and interactive learning among a heterogeneous set of actors (Leeuwis 2004). It requires the creative use of different types of knowledge in response to social or economic needs (OECD 1999). This indicates that the adoption of soil conservation innovations requires the interaction of actors and the use of the knowledge of these actors in the innovation process.

While communicative theories and AIS highlight the importance of learning and communication for innovations, they do not explain how the process of social learning can be institutionalized in order to sustain and govern it. Thus, concepts related to institutions help to better understand the role they play in governing the interaction of actors in the process of learning or in the adoption process.

Institutions are comprised of formal rules and/or informal prescriptions that permit, prohibit or required certain outcomes while specifying explicit material or implicit social sanctions for breaking rules (Rudd 2004). Important for natural resource management is the effectiveness of formal and informal institutions. Formal institutions may be effective or ineffective depending on the way they were formulated, designed and implemented or sometimes both formal and informal institutions conflict each other. This is a characterized, as suggested by Pahl-Wostl (2009), most likely by a high degree of corruption, non-transparent decision making processes, and dominance of established power structures. Given a set of institutional constraints, actors consider the costs and benefits of certain behaviors and act as per their underlying values and preferences, specifically based on the information they have about the state of the world, the intentions of other actors and the threat of material or social sanctions (Rudd 2004). Soil conservation actors comprise mainly farmers, agriculture experts, watershed association, researchers and public administrators. The behavior and interaction of these actors could be affected by institutions. As stated by Hagedorn (2008), actors can be confronted in an action situation by institutions. Much of the studies on natural resource management consider institutions as governing factors for the interaction of actors. In addition to institutions, in recent research social capital is getting emphasis on the assumption that communities are more often efficient than state institutions and organizations in managing natural resources such as soil conservation (Grootaert and Narayan 2004).

2.4. Social capital

Research shows that social capital which plays an important role in scaling-out soil conservation innovations has not yet fully implemented in soil conservation strategies (Noble et al. 2006; Tumbo et al. 2011). Studies (e.g. Mercado et al. 2001) underline the importance of social capital in promoting the collective action needed for soil conservation innovations. Examination of successful examples of widespread and sustained soil conservation measures suggest that utilizing or investing in social capital is needed to raise awareness of soil degradation and conservation, provide effective farmer-led and group-based training in soil conservation practices, and to disseminate measures within and beyond the community (Mercado et al. 2001). In other words, the rate of adoption is considerably enhanced where appropriate forms of social capital are being developed (Cramb 2004). Social capital in relation to natural resource management is usually defined as elements of social organization (trust, cooperation, norms, and networks) that facilitate cooperation and coordination and that enable actors to act collectively for mutual benefits (Woolcock and Narayan 2000).

The question is then how do we create or strengthen social capital that encourages the adoption of soil conservation measures? Studies (e.g. Rist et al. 2006; Schneider et al. 2009) have shown the existence of relationship between social capital and social learning. The case studies of Rist et al. (2006) in India, Africa and Latin America showed that social capital elements such as trust, cooperation, less hierarchical pattern of communication, shared values and attitudes were emerged through social learning. The social capital elements may form the basis for a common understanding of the problem at hand, agreement and collective action (Pahl-Wostl 2009). Grootaert et al. (2004) also recommends the importance of social capital elements such as trust, groups and networks, collective action and cooperation, information and communication, social cohesion, empowerment and political action for the uptake of soil conservation measures. Other studies also confirm the suggestions of Grootaert et al. (2004). For example in the case of the role of groups and networks, Robalino (2000) found that in the developing world adoption of innovations was influenced by the density of social networks. In the case of trust, Palis et al. (2002) suggested that trained farmers shared knowledge with their relatives more than with non-relatives. Information and communication also help communities to access information that encourages the adoption of soil conservation measures (DFID-NRSP 2002; Grootaert et al. 2004).

When we look at the focus and contents of the previous soil conservation studies in Ethiopia, less emphasis was given in assessing the role of social learning, social capital, and institutions and it is difficult to get evidence from previous Ethiopian soil conservation studies the impact of social learning, institutions and social capital in the adoption of soil conservation measures. Most of the agricultural innovation studies focus on crops. For instance, in the innovation study by Spielman et al. (2011), it was investigated how practices related to the adoption of oil seeds, apiculture, nontraditional beans, potatoes, and onions fared. Their study shows that public extension and administration exerted over smallholder networks, potentially crowd out market based civil society actors, and thus limit beneficial innovation processes. There are also some innovation studies in non-crop sectors such as fodder production. Ayele et al. (2012) did an innovation study on fodder and their study indicated that interaction and learning in networks; and on farms can promote innovation. Other innovation studies (e.g. Gebremedhin et al. 2006) focus on elaborating the approaches of the agricultural research, education and extension systems of Ethiopia at the macro level.

In order to address the soil degradation challenge and limited adoption practices, factors such as social learning, institutions and social capital have to be examined in order to understand their role either in promoting or impeding the adoption of soil conservation innovations. Thus, this study focuses on examining the role of social learning, institutions and social capital in the adoption of soil conservation innovations.

3. Study area and research methods

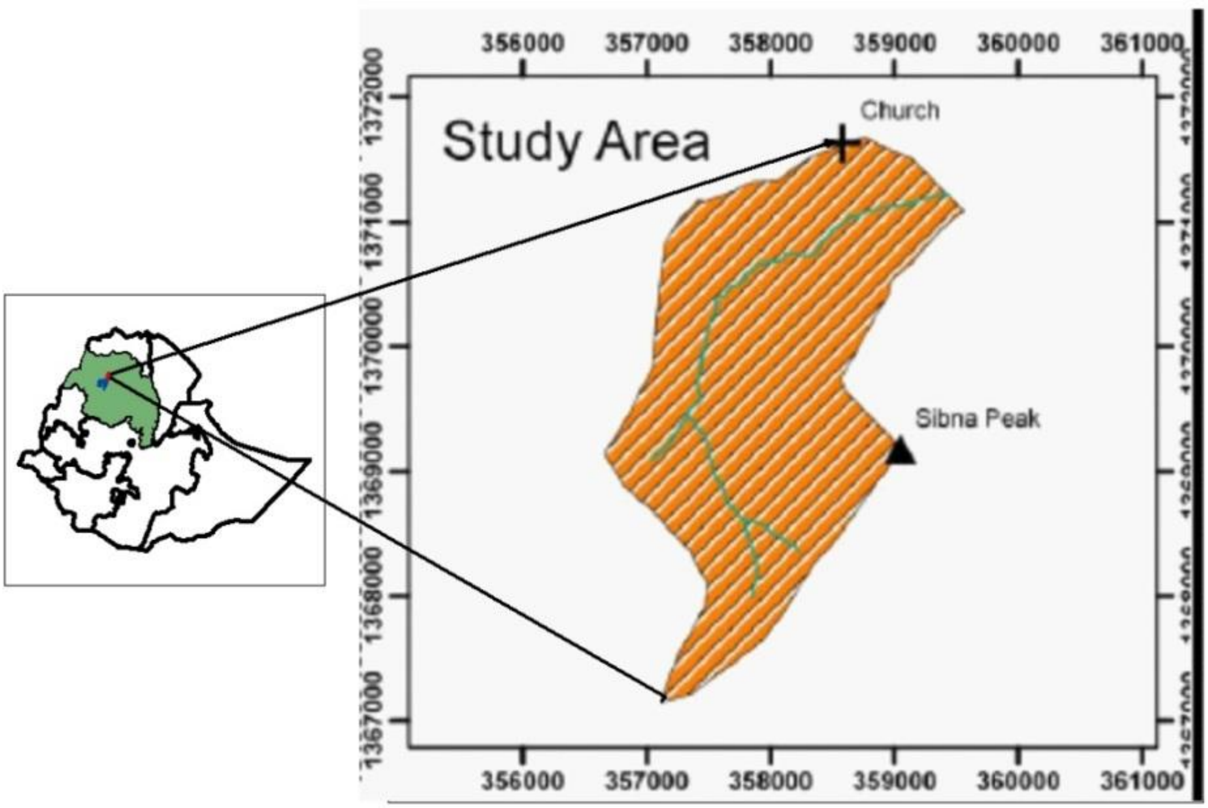
3.1. General overview of the study area

Ethiopia is located in the horn of Africa, neighboring with Sudan to the west, with Eritrea to the north, to the east with Djibouti and Somalia and to the south with Kenya. According to the population census in 2007, Ethiopia had about 73.9 million population, of which 50.5 % were male and 49.5% were female (CSAE 2011). Most of Ethiopians are poor and the poverty rate, i.e. the population living below a dollar a day is 29.6% (MOFED 2010). Ethiopia has about 1.13 million km^2 and about 51.3 million hectares of arable land (MOARD 2010). Nearly 55% of all smallholders operate on one hectare or less, yet, agriculture accounts 41.1% of GDP, 90% of exports (CSAE 2011), and 85% of employment of smallholder households (MOARD 2010).

A majority of farmers depend on subsistence farming and livestock for their livelihood. Cattle, sheep and goat are the dominant types of livestock, but horses, donkeys and camels are also common. According to CSAE (2011), 52.13 million cattle, 24.2 million sheep, 22.6 million goats, 6.4 million donkeys, 1.96 million horses and 0.99 million camels are estimated to be found in Ethiopia. These estimates make Ethiopia the largest livestock populous country in Africa. The livestock sector is the source of food and income. Draught animals are used to plough, crop threshing and serve as a means of transport. In addition, livestock is the source of farmyard manure which can be used either for improving soil fertility or as energy source for cooking food.

For this study, data was collected from Amba Zuria watershed in Northern Ethiopia. Figure 1 shows the map of Amba Zuria watershed. Amba Zuria is located in Gondar Zuria district. It covers 835 hectare of area and has 555 watershed association members. It is about 30 km from Maksegnit, the capital city of Gondar Zuria district. This watershed, according to the local agro-climatic classification of Ethiopia, is categorized under Woina Dega agro-ecological zone (1500-2300 meter above sea level) with 800-1200 mm annual rainfall and average annual temperature between 17.5-20 ^{0}C (MOA 2000). The rainy season starts in June and ends in September. The livelihood of the farmers is based on mixed farming, both crop and livestock production. Barley, wheat, and maize are the major crops growing in the area.

According to Gondar Zuria Agricultural Development Office (GZADO) (2010), around 80 % of the area falls into the category of 8-30 degree slope and soil erosion is immense both in farm and in communal grazing lands. Land degradation is a critical challenge. In order to reverse the land degradation caused by soil erosion, soil conservation innovations such as stone terraces, checkdams, micro basin, and cut off drains were implemented. This was particularly intensified after the start of the sustainable utilization of natural resources project of the Amhara region in 2007. This project was technically supported by the German Agency for Technical Cooperation (GIZ) and financed by the German Development Bank (KfW). The project covers three major objectives: (1) organizational development of land user communities; (2) conservation of soil and water resources; (3) enhancing innovation with respect to agricultural produce.



Source: BOFED 2011

Figure 1 Map of the case study area (Amba Zuria watershed)

To achieve the objectives of the project, experience-sharing visits via farmers' field days (FFDs) were organized for farmers, experts, and public administrators. FFDs were used as social learning platforms. Platform is understood here as a forum for negotiation among the actors (Warner 2006). In such platforms, actors get the opportunity to meet, interact, learn, and take collective decisions (Muro and Jeffrey 2008). During FFDs, farmers gather at a particular farmers' plot and a short, specific topic is demonstrated and discussed with extension agents and other actors (Place et al. 2005).Thus, FFDs provide a forum for sharing information on different farm practices and encourage the adoption of technologies (Amudavi et al. 2009). Adoption is defined here as the mental process an individual passes from first hearing about an innovation to final adoption of technologies (Rogers 1995). Table 1 shows the number of participants in FFDs.

Table 1 Farmers' field days and the adoption of stone terraces (2007-2010)

Year	Farmers' field days			Adoption of stone terraces
	Participants	Facilitators	Location	Area of land (ha)
2007	Farmers (35) Agriculture experts (15) Public administrators (7)	Agriculture experts	Outside Amba Zuria	6
2008	Farmers (50) Agriculture experts (14) Public administrators (6)	Watershed association in collaboration with agriculture experts	Inside Amba Zuria	18.5
2009	Farmers (80) Agriculture experts (15) Public administrators (7)	Watershed association in collaboration with agriculture experts	Inside Amba Zuria	35.5
2010	Farmers (90) Agriculture experts (35) Public administrators 22)	Watershed association in collaboration with agriculture experts	Inside Amba Zuria	300

Note: Numbers in brackets represent number of participants from the respective groups.
Source: GZADO (2010)

Table 1 show that the adoption of stone terraces has increased over the years. Even though there exist limited adoption in the Amba Zuria watershed, there are success stories. Here, success stories in land management are defined by the area of land in which soil conservation measures were adopted (FAO 2002b). In Amba Zuria watershed, adoption of stone terraces and checkdams has been conducted in 43 % the watershed area (GZADO 2010). However, before reaching this adoption level, soil erosion was a big challenge in the watershed.

Literature (e.g. Desta et al. 2000) shows that the North Gondar zone including the case study area has been severely affected by soil erosion and estimates show that between 51 and 200 tones/hectare of soil is lost every year. Moreover, in the watershed the main pedestrian paths were blocked due to the damage caused by gully erosion. Hence, farmers had difficulty traveling to the nearby market or attending any public event (GZADO 2010). The soil degradation problem in this area was the prime reason for the introduction of the Sustainable Utilization of Natural Resources project. With the support of the project, activities such as adoption of stone terraces and checkdams, spring and irrigation development, afforestation, and building access roads were practiced. Especially in soil conservation, many farmlands and gullies were rehabilitated and changes were realized promptly. For instance, after two years of rehabilitation work, the gullies are now grounded at level and no gorges have been seen on the site, and farmers are now harvesting grass and foraging leaves for cattle feed from these rehabilitated gullies (GZADO 2010). In the watershed, stone terraces were adopted in 360 hectares of farmland, 8.5 km of gullies were rehabilitated, and in order to stabilize the checkdams 461,210 tree seedlings, and 300,998 grasses were planted in the years between 2007 and 2010 (GZADO 2010). In addition, institutions and organizations such as watershed bylaws, watershed association and farmer groups also emerged as the result of the implementation of the project. Farmers' field days were used as a learning platform for farmers, experts and public administrators. Hence, examining the story of this project could be an ideal demonstration to assess the role of social learning, institutions and social capital in the process of changing the conventional soil conservation innovation challenges to conditions that are conducive for soil conservation.

In general, the case study was selected mainly for two reasons. Firstly, social learning through farmers' field days was practiced in the watershed since 2007and as a result success stories are observable in the adoption of soil conservation innovations. In addition, the existence of both adopter and non-adopter farmers in the watershed allows us to understand and observe the impact of FFDs on these farmers. Secondly, the documentation of the learning practices in this watershed enables us to easily access secondary data related to who participated, and how the actors were involved. Moreover, the willingness of farmers, experts and local administrators, and accessibility also complement the selection process.

3.2. Research design

Literature related to soil conservation was reviewed in order to understand the factors that were considered in previous studies. The review enabled to identify the low attention given for social learning, social capital and institutions for the uptake of soil conservation innovations. This became evident to study the role of social learning, social capital and institutions for soil conservation. Case studies are the common research approaches that are used to understand the social learning (Rist et al. 2006; Mostert et al. 2007; Steyaert and Jiggins 2007). Cases where social learning was intensified in order to speed up the adoption of soil conservation measures allow us to understand its impact in the process. To understand the role of social learning (Research question 1), qualitative data collection methods, i.e. in-depth interviews, group discussions and workshops were conducted as shown in Table 2. In total 20 key informant interviews were conducted. Adopter and non-adopter farmers are differentiated on the basis of having soil conservation measures on their farmland or not. Participants were asked open-ended questions mainly about their personal attributes, the extent of their understanding about soil erosion damages, adoption of stone terraces, outcomes and limitations of FFDs, the facilitation process, institutions involved, social learning, and the actors involved in the process. Moreover documents of the watershed association, and district agricultural office were examined in order to complement the data collected from in-depth interviews.

Table 2 Types of data gathering methods and participants.

Types of data gathering	Participants			
	Agriculture experts		Farmers	
	male	female	male	female
Interview	3		5	2
Group discussion	6	1	6	2
Workshop	1	2	17	3

Note: One watershed committee member, two researchers, three administrators and four NGO experts were also interviewed. Among the farmers, 25 were adopters and 10 were non-adopters. From the total number of farmers, four women and 21 men were adopters and three women and seven men were non-adopters.

To examine the role of institutions for social learning and soil conservation (Research question 2), qualitative data collecting methods, i.e. in-depth interviews and a workshop were used. The data gathering methods and involved interviewees are summarized in Table 3. Interviewees were asked semi-structured questions mainly on the extent of soil erosion damages, project history, process of soil conservation innovations, institutions, and interactions among actors, social learning, and the actors involved in the process. Participants of the workshop also discussed topics such as the challenges and potentials of the project, interactions among the actors, the role of institutions, and social learning. In total, 20 key informant interviews were conducted. The participants were selected in a purposive way based on their richness in information about the case study (see Patton, 1990).

Secondary data from meeting minutes and performance reports were also used to identify the farmers who were involved in soil conservation innovation. Experts from government and nongovernmental organizations were identified on the basis of their involvement in the activities of the project.

Table 3 Data gathering methods and interviewees from the respective groups.

Type of data gathering	Interviewees						
	Agriculture experts	Public administrators	Watershed committee	Researchers	GIZ	KfW	Farmers
Interview	3	3	1	2	3	1	7
Workshop	2	1	1	1	1	1	17

Note: GIZ (German Agency for Technical Cooperation), KfW (German Development Bank)

In order to assess the role of social capital for soil conservation (Research question 3) both qualitative and quantitative methods were used. The social capital difference between adopter and non-adopter farmers was assessed using two sites, namely Amba Zuria and Meresar. In Amba Zuria, most farmers are adopters and whereas in Meresar village the opposite holds true, i.e. most farmers are against soil conservation measures. Between Amba Zuria and Meresar farmers, there is also difference in their involvement in learning platforms and this may enable to look into whether social learning had made a difference in the creation of social capital and in the adoption process.

This study adapted a social capital measurement known as Integrated Questionnaire for the Measurement of Social Capital (SC-IQ). This framework was suggested by Grootaert et al. (2004) and focuses on five social capital elements i.e. trust and solidarity, groups and networks, collective action and cooperation, information and communication and social cohesion and inclusion. The questions from SC-IQ were used to design, guide and adapt the questionnaire of this study. The queries were adapted to address the social capital elements in soil conservation measures. Accordingly, the social capital elements used in this study include trust, groups, collective action and cooperation, information and communication, and social cohesion. Questions on the questionnaire included: personal attributes of interviewees (age, family size, farm size and education status), the type of soil conservation innovations in the area, the persons or organizations that introduced the innovation, the status of social capital elements such as trust, networks, cooperation and social cohesion in the community between adopters and non-adopters, the type of social learning platforms practiced in the area, and factors that influence innovation adoption. The sample size was 146, which was large enough (n>30) as suggested by Rhiel and Chaffin (1996) and Slater and Curwin (2006). The population of the case study area is 261 (SUNRPO 2010). Random sampling was used to identify respondents for the questionnaire survey.

In order to complement the quantitative data, qualitative data was also collected via interviews and group discussions as shown below in Table 4.

Table 4 Data collection tools and number of participants.

Data collection tools	Number of participants	
	Meresar	Amba Zuria
Questionnaire surveys	74	72
Interview	12	16
Group discussion	7	7

For research question 3, in total, 28 key informant interviewees, 14 group discussants and 146 respondents of questionnaire surveys were involved during the data collection.

3.3. Data collection

Data were collected from July to December 2010 and from July to December 2011. Two research assistants who have experiences in interviewing were selected and trained on data collection methods. There were also two facilitators for the group discussions and workshops. The interview protocol and the questionnaire were tested before going for full scale data collection. The test was mainly to check, among others, whether the questions were clear, simple, non-repetitive, non-irritating, and to check the flow of ideas. Based on the inputs from the test, both the interview protocol and the questionnaire were revised.

In-depth interviews were conducted in most cases in the interviewee's home and sometimes at their farm land. Experts were interviewed in their offices. Personal agreement was obtained from interviewees prior to their involvement in interviews, group discussions or workshops. Each interview was conducted by a research assistant and the researcher. The interviews were tape recorded. All communications were in Amharic language, Ethiopian official language, and the transcripts and questionnaires were translated to English by the researcher.

3.4. Data analysis

In order to assess the role of social learning for soil conservation, the qualitative data from in-depth interviews, group discussions and workshops were translated and transcribed. The data was analyzed with the aid of ATLAS.ti (Version: 6.1.16, Berlin, Germany) computer software. This software has been used in innovation history studies (e.g. Klerkx et al. 2010) to reconstruct actor-institution interactions, and in the study of social interactions and communication skills (e.g. Kurokawa et al. 2012; Yoshida et al. 2012). The frequency of codes and memos were used to identify the major themes from the transcripts. This analysis was complemented with the analysis of a range of internal documents (e.g. meeting minutes) and external documents (e.g. policy documents).

In order to examine the role of institutions in soil the adoption of conservation innovations, as indicated by Spielman et al. (2009), innovation history analysis focusing on important events was used. This method has also been applied in mainstream innovation systems' analysis where it is referred to as innovation journey analysis (Van de Ven et al. 1999). The important institutional events were identified from the analysis of the transcripts of the data. In order to do so, using ATLAS.ti, the frequency of codes and memos were used to identify the major events that shaped the learning and the adoption process.

To understand the role of social capital for soil conservation, the data from questionnaire surveys was analyzed using a probit model, a binary response model.

Binary models are the common models used to analyze adoption problems related to soil conservation (e.g. Negatu and Parikh 1999; Tenga et al. 2004; Amsalu and De Graaff 2007).

The binary responses were defined as 1 for those who have adopted the soil conservation innovations (e.g. stone terraces) and 0 for those who have not. The probit model estimates the probability of observing event y given x, which is represented as:

$$pr\left(y=1/x\right)=\phi\left(x'\beta\right) \quad (1)$$

Where *pr* denotes probability, and ϕ is the cumulative distribution function of the standard normal distribution. β is slope of the explanatory variable in the function. Mathematically, the binary response function is given as:

$$y_i=\begin{cases}1 & if\ y_i^*>\tau\\ 0 & if\ y_i^*>\tau\end{cases} \quad (2)$$

Where, τ is the threshold generally assumed to be 0.Virtually, what is estimated is the latent variable y_i^*. This means y_i can be viewed as an indicator for whether this latent variable is positive as given in Eq. (2). The latent regression approach (Eq.3) is the basis for the binary models.

$$y_i^*=x_i\beta+\varepsilon_i \quad (3)$$

Where, x_i are predictor or explanatory variables and ε_i stochastic error term $\left(\varepsilon_i\sim N(0,1)\right)$.

The full specification of the probit models for this study is given by Eq. (4).

$$\Pr\left(y=1\right)/x=\beta_0+\beta_1x_1+...+\beta_{10}x_{10}+\varepsilon \quad (4)$$

Where: $\Pr\left(y=1\right)/x$ is the probability of observing event y given x, i.e. soil conservation adoption

β_0 , β_1,... , β_{10} slope functions of the explanatory variables.

χ_1 , χ_2 ,... χ_{10} explanatory variables.

4. Results and discussions

4.1. The role of social learning for soil conservation

From the analysis of the transcripts of interviews, group discussions and workshops, the major themes identified as outcomes of FFDs include ‘understanding of soil conservation’, the ‘application of indigenous and scientific knowledge’, ‘trust’, ‘participation’, ‘collaboration’, the ‘level of interactions’, and ‘facilitation’. These themes are identified as outcomes of social learning and each them is discussed below in greater detail in relation to adopter and non-adopter farmers.

4.1.1. Understanding of soil conservation

Before the start of FFDs, farmers had negative attitude towards soil conservation due to the lack of interaction between experts and farmers and the technical problems associated with soil conservation measures. Among the interviewees, 90% had expressed their negative perception on soil conservation measures. For example, they were expressing their negative perception on agriculture experts by Amharic statements like ‘yeketemasew sileafertibeka mastemar aychilm’, [‘experts who have grown in urban centers do not know soil conservation and they cannot teach us’]. This perception was one barrier that hampered the interaction between farmers and experts. Farmers further argued that soil conservation measures like stone terraces harbor rodents such as rats, which destroy crops. Moreover, they were raising the concern related to the height of the stone terraces, which create difficulty during ploughing.

With all the above-mentioned negative perceptions, it was difficult to go forward and implement the project. However, during the early stages of the project in 2007, FFDs was organized for farmers, experts, and public administrators to Debre Tabor, some 200km from Amba Zuria. Farmers in Debre Tabor are known for their experience on adoption of soil conservation measures (SUNRPO 2010). Farmers who support and oppose soil conservation measures were included in this visit. During the visit, there was farmer-to-farmer, and farmer-to-expert discussion on soil conservation problems and solutions. For instance, there were discussions on how to avoid problems related to rodents and the problem of ploughing in terraced farms. Farmers from Debre Tabor narrated their experiences to Amba Zuria farmers. This discussion was complemented by practically showing how to construct stone terraces. Debre Tabor farmers have already a practice of putting soil in between stones to protect rodents and reducing the height of terraces proposed by experts.

Since the start of the project, various FFDs were organized and the adoption of stone terraces shows an increasing trend over the years (Table 1). The interviews of adopter farmers, 85% of the interviewees, show that FFDs has encouraged the development of positive understanding of soil conservation. For this understanding, the farmer-to-farmer interaction, face-to-face discussion with experts and public administrators, exposure to other localities, and the practical exercise on how to construct stone terraces have primarily inspired Amba Zuria farmers for the development of positive attitude on soil conservation. Farmers who participated in experience sharing started learning with other Amba Zuria farmers on how to adopt stone terraces. This was practiced on a demonstration site. In the first year of the project period, 96% of the farmers who were involved in the FFDs adopted stone terraces. The better understanding and practice of soil conservation that came out of the FFDs could be one potential reason for the increase of the adoption of stone terraces.

In contrast, interviews of non-adopter farmers show that they were not involved in any of the field days or their involvement was low. The interviews show that only 11 % of the non-adopters participated in FFDs. As a result, they still raise issues that indicate less understanding on soil conservation. For instance, these farmers still question the difficulty stone terraces create during ploughing. They are also suspicious of the knowledge of experts on soil conservation. The source of this suspicion and negative understanding was the result of their absence from FFDs that promote opportunities for communication and learning. For non-adopters, due to their poor understanding on soil erosion and its consequences, soil conservation was not their priority and thus they did not go to FFDs and for the adoption of stone terraces. From this, one can suggest that the more the farmers involve in continuous FFDs, the more they understand soil conservation problems and solutions. This understanding could encourage adoption of stone terraces and thus, social learning platforms such as FFDs might have a potential to promote the adoption of soil conservation innovations.

4.1.2. The application of indigenous and scientific knowledge

Interviews of farmers show that experts lack the knowledge related to the amount and direction of flood that may come from different directions in farmlands in order to prioritize and decide the type of soil conservation structure. Expert interviews on the other hand show that the technical knowledge of farmers in designing and constructing the stone terraces was very much limited. As the result of this, stone terraces built without the support of experts collapse very easily and do not stay long. When FFDs started, farmers and experts discussed the knowledge gaps they have in an open way and proposed solutions. Farmers who know their locality explained their experience to the experts about the directions of the flood that may come during rainy periods. This was important information to decide the types of soil conservation measures. The indigenous knowledge of using straw and compost in between stones to solve the problem of leakage of flood through the terraces was proposed by the farmers. Experts had no solution for this problem. The knowledge gap of the experts in such cases was complemented by the indigenous knowledge of farmers. The experts, using their scientific knowledge, had explained to the farmers how to construct stone terraces by using scientific measurements. One of the farmers who were involved in FFDs described his practice of applying both indigenous and scientific knowledge as follows:

> In addition to what the experts are saying, we (the farmers) put straw and other materials, compost for example. (…) This was done to protect the leakage of soil and flood in between the stones of the bund. This was not advised by the experts. But we keep the width of the bund (…) as per the advice of the expert (Interview, 27 October 2010).

The watershed association committee, the committee members are farmers, has facilitated 75 % of the discussions of FFDs (see Table 1). The facilitation role of farmers made other farmers to relax and view their opinions freely. Moreover, the discussion on the field sites enabled farmer groups and experts to learn from each other. These approaches allowed farmers and experts to apply both indigenous and scientific knowledge of soil conservation. This was complemented by the observation that farmers who were more often involved in FFDs were active in adaptations e.g. in the application of straw and other crop residues in between the stones to protect the leakage of flood through the terraces. On the other hand, the non-adopters acknowledge the knowledge of the experts in words, but in practice they did not apply it probably due to their non-involvement in FFDs. In sum, social learning may create better space for communicating the knowledge of farmers and experts by exposing and challenging the status quo of the actors and to learn from each other.

4.1.3. Trust

Interviews with farmers and experts who were involved in FFDs show that at the early stage of the project, the creation of trust between farmers, experts, and public administrators was not a crucial element taken for consideration. As a result, lots of misunderstandings and conflicts were observed between farmers themselves and experts. Lack of excess flood management within the farms was cited by 90% of the respondents a source of conflict among farmers. Some farmers redirect the excess water from their farm to the other farmers' farmland. This individual decision by some farmers was the source of the conflict. There were also conflicts between watershed committee and development agents. Development agents used to interfere with the responsibilities of the watershed association. They wanted to replace the watershed committee without the will of the association members.

The conflicts associated with the farmers were solved through the FFDs by visiting the plot of land which was the source of the conflict. In the field farmers, experts, and public administrators discussed on the conflict and proposed a soil and water conservation measure by making use of their experiences and knowledge. Their decision was also complemented by the watershed bylaw, which stresses that conflicts need to be solved by the watershed association rather than the conventional conflict resolutions mechanisms. In the same way, the interference of the development agents on the internal affairs of the watershed association was also highly criticized by the watershed association members and the discussion convinced development agents to accept their mistake and promised not to interfere with the internal issue of the association. Conflict incidents were minimized when the intensification of the FFDs continue over the years. Interviews show that conflict incidents have been minimized by 75% from the first year of the project period. Over the years, the experts and the public administrators who were involved in field days were very positive to hear and learn from each other. For instance, Table 1 shows that the farmers' organization, i.e. the watershed association was highly involved in facilitating FFDs and this shows that the views of the farmers' were acknowledged.

Farmers who participated in FFDs expressed the current situation of trust in their local language, Amharic like this: 'ahun hulachnim gadegna nen' to mean ['we (experts, farmers, and public administrators) are now friends']. Thus, acknowledging the views and responsibilities of actors was found useful to build trust. This does not mean that trust among all farmers has been achieved. Non-adopters, 85% of the respondents, are still suspicious of the effectiveness of soil conservation measures. This suspicion was the result of their non-involvement in learning spaces. Because of this, sometimes the trust developed among adopter farmers is diluted by the actions of non-adopters, mainly by redirecting flood from their non-terraced farm land to terraced farms of adopters. From this, one can deduce that creating learning space such as FFDs encourage the acknowledgment of the views of actors and the emergence of trust, which is a useful outcome to minimize conflicts and to encourage adoption.

4.1.4. Participation

In the early stages of the project, there was lack of farmers' participation. The lack of participation was cited by 95% of the respondents. Farmers were not consulted well and hence, most of them were not involved in meetings related to the watershed plan. When the FFDs started farmers, experts, and public administrators discussed in detail about the sources of insufficient participation. The problem was associated with experts' influence over the farmers which was practiced for long in the conventional extension system, i.e. transferring knowledge from the expert to the farmer. In this regard, the attitude of experts was challenged when they involve themselves in the FFDs. The experts acknowledged their dominance and agreed to participate as one actor rather than directing the process. Since then, it was the watershed association that primarily led the planning, implementation and monitoring of soil conservation measures. The progress of participation over the years was expressed by an expert as follows:

> At the beginning periods of the project, (…) farmers were not good participants. They did not reflect what they feel. (…) This has been improved over time especially after the intensification of learning platforms via field days. Now, farmers can reflect what they feel and don't hesitate to justify (Experts' group discussion, 23 December 2010).

The non-imposition of the experts' opinion on the farmers and the involvement of their organization, i.e. the watershed association have motivated them to participate and raise their opinions and this has created an opportunity for the farmers to discuss and evaluate the knowledge of experts and public administrators. Thus, the active involvement of the watershed association and the actors' involvement in FFDs have encouraged more participation.

4.1.5. Collaboration

The construction of stone terraces on farmlands is labor-intensive. It requires collecting stones, and arranging these stones to form terraces. The same is true for checkdam construction. Farmer interviews show that some households have labor shortage to adopt stone terraces. For instance, female headed households, elders, and household heads with health problem usually face labor shortages. In order to solve this problem, farmers started to work in groups. Each farmer group has ten members and the members are socially connected. Households headed by women, elders, and those with health problem are members of a farmer group. During the adoption of stone terraces, members of the group adopt terraces voluntarily on the farms of families that have labor shortage and thus, collaboration was observed between farmers who have been involved in FFDs. In addition, farmers also understand that if those farmers who have labor shortage avoid adopting stone terraces, the flood that may come from other farms may damage their farms. Experts also confirmed that collaboration among actors has been improved. The experts provide working inputs like spade for the farmers. One of the discussants from farmers' group discussion expressed his view on collaboration as follows:

> We (members of a farmer group) adopt stone terraces based on farmers group. This has helped to solve the labor shortage problem of some families, because terrace adoption is a labor-intensive process. It needs collecting stone and arranging these stones to form stone bunds. Experts and administrators also support us (the farmers) in providing working materials like spade (Farmers' group discussion, 29 November 2010).

The improved collaboration was the result of understanding the consequences of soil erosion. In addition, the learning process in the FFDs enabled farmers to raise their personal and social problems (e.g. health problems) for their group members. The understanding between members of a group was the result of the development of personal relations that emerged from working in groups. This finding contrasts with the findings of the non-adopters. Non-adopters did not work on other farmers' farms because they did not require any labor as they are non-adopters. In general, the process of social learning has also created opportunity for more collaboration especially in labor contributions.

4.1.6. The level of interaction

The conventional agricultural extension approach is characterized by one way communication, from the agriculture experts to farmers. According to interviews, during FFDs, farmers were expressing their views freely and criticize the knowledge of the experts. Experts started to recognize the views of farmers through time and paved the way for the development of a two-way interaction. This was shown in particular when farmers facilitate the FFDs (Table 1). For this type of interaction, the participants' recognition that different people have different knowledge was primarily important. This encouraged all actors to develop positive attitude to learn from each other. Farmers who were involved in field day visits had interactions and discussions about soil conservation in informal meeting places that further helped the creation of a strong establishment of personal relations. This has usually been observed during traditional meetings and in various farming periods. A farmer described his feeling on interactions as follows:

> Experts tell us (the farmers) how to adopt stone terraces. We (the farmers) also tell them (the experts) how we adopted stone terraces. This type of two-way interaction was unusual before we started to know and learn from each other. (…) In traditional meeting places and during harvesting, ploughing, and weeding, we also discuss (Interview, 27 October 2010).

On the other hand, interviews with non-adopters show that they still believe in one-way interaction, may be their status quo on the convention extension approach has not been challenged in their mind due to their less exposure in FFDs. In general, the findings of this study show that the space created for communicative action between actors has led to changes in interactions. This was an important precondition to understand and exchange views on soil conservation problems and solutions.

4.1.7. Facilitation

The conditions for the emergence of positive interactions in FFDs can be positively influenced by the facilitation process. The findings show that farmers were free to express their views when the watershed association committee facilitates the discussion. According to 92% of adopter farmers' interviewees, this was because farmers know each other very well in their formal and informal interactions. Experts also confirm that information flow within the farmers was simple when the watershed association started involving in the facilitation process. This was the result of the more interaction developed between the watershed association and the group leaders of the farmers. The farmers' group leaders in turn, have good communication with their group members. This network of interaction made the flow of information much easier. During the learning process, each group leader narrates how they adopted stone terraces. Then discussions follow on the experiences of each group. In this process, experts and farmers share their views and explain the weaknesses and strengths of the performance of each group. The best practices from good performing groups were identified with full participation of the farmers and experts. Farmer groups that did not perform well correct their mistakes based on the comments from other well performing farmers and experts. The comments were mostly on the dimensions of checkdams and stone terraces, and the techniques of arranging stones to form terraces and checkdams. The implementation of the feedbacks was followed by the watershed association committee.

In general, the finding of this study show that social learning creates space for more communicative action between the actors, and enables the existence of an environment conducive for the adoption of stone terraces. The findings suggest that social learning enabled the development of positive attitudes among the actors on soil conservation measures. This finding is similar to the social learning outcome of the 'farmer-to-farmer' project of Swiss agriculture, in that: participants have gained new insights about soil conservation from different standpoints (Schneider et al. 2009). In this project, films were used as a social learning platform and the films were about soil protection. Apart from the positive understanding of soil conservation, cooperation and an atmosphere of trust among experts, scientists and farmers were observed as outcomes of social learning.

When the social learning intensified, the development of trust over time was one of the key features observed as the result of the social learning. Other studies (e.g. Rist et al. 2007; Schneider et al. 2009) show similar results with our finding. Thus, social learning can result in the emergence of trust among the participants, which is an important input for the actors to work together on soil conservation problems and solutions. In addition, a specific form of social learning involving different actors can lead to more equitable forms of participation, and mutual understanding (Rist et al. 2007). This finding contrasts with the finding of Jiggins et al. (2007). They argue that social learning platforms aimed at changing farming practices to reduce diffuse pollution in the case of Drentshe Aa area, in the Netherlands, has not led to any change in trust among the actors. This was because farmers felt that their entrepreneurial freedom would be threatened if they started making any concessions.

In this study, many actors including farmers' organizations such as watershed association and farmer groups were involved in social learning and in adoption of stone terraces. The findings show that the involvement of farmers organization i.e. watershed association, has created conducive environment to facilitate the process of social learning. For instance, the involvement of the watershed association as a facilitator has created a communication space beyond the conventional one, a communication that does not acknowledge the farmers' facilitation role. In addition, this has enabled the change in the conventional expert led approach of the agricultural extension system. The effectiveness of farmers' organization for the adoption of stone terraces has also been confirmed by the study of Qasim et al. (2011). In addition, the participation of farmers in their group has enabled the involvement of more farmers in the learning process. Group membership seems to support social learning in the sense that group processes help to create a common understanding (Muro and Jeffrey 2008).

The present study makes it possible to have a differentiated perspective on the involvement of individual farmers raised by Rist et al. (2006). They state that when individual farmers, experts, and public administrators involve in social learning, they can create an intersubjective understanding of their situation regarding soil conservation. However, participating individual farmers via their local organizations in social learning was somewhat implicit in their study. From this, it can be suggested that farmers in groups or in organized form also play important role for the emergence of communicative action in the process of social learning.

The findings also show that the formerly unilateral knowledge transfer has been changed into a knowledge production based on the knowledge all actors. The changes in interactions and communication allowed flattening the hierarchical relationships between the actors. This encouraged the space for mutual questioning of the conventional approaches of experts and farmers on natural resource management. The case studies of community based forestry initiatives in USA by Cheng et al. (2011) show that social learning is an important element in building the knowledge of individuals and groups involved in community based forestry initiatives. Schneider et al. (2009) also state that social learning enables the acknowledgment of indigenous and scientific knowledge of actors involved in the process. In sum, the findings indicate that social learning creates more space for communicative action that may encourage the adoption of soil conservation measures.

However, social learning should be governed by institutions in order to manage and sustain the behavior of actors. The following section discusses the role of institutions in social learning and its role in adopting soil conservation innovations.

4.2. The role of institutions in social learning and soil conservation innovations

In order to examine the role of institutions in relation to social learning and in soil conservation, we described the important events that shaped the specific interactions between the innovation actors and their institutional environment, as suggested by Spielman et al. (2009). After analyzing the transcripts of the in-depth interviews using ATLAS.ti, three themes, based on the frequency of codes and memos were identified. These themes are the major events that shaped the social learning and the adoption process. These themes are as follows: 'events that encouraged the interaction of actors with their institutions', 'institutional events that shaped the facilitation of the social learning and the adoption process', and 'institutional events that encouraged the accommodation of the views of actors'. In order to go through the detail of each theme, the timeline of the project was divided into locus a, b and c (Figure 2). 'Locus a' shows the events that encouraged the interaction of actors with their institutional environment. 'Locus b' describes the institutional events that shaped the facilitation of the social learning and adoption process. 'Locus c' shows the institutions that encouraged the accommodation of the views of actors.

4.2.1. Locus a: Interaction of actors with their institutions

According to interviews and meeting minutes, the Federal Food Security and Disaster Prevention Office (EFSDPO) initiated the establishment of a project in Amba Zuria watershed in 2004. In the same year, EFSDPO was in talks with potential partners such as GIZ and KfW to mobilize technical and financial support. After a series of discussions, a memorandum of understanding (MOU) was signed between EFSDPO, GIZ, and KfW in 2004. The MOU at the federal level was an important institution in getting support for the project and to continue further discussions with the regional authorities. In the same way, at the regional level, MOU was signed between the Amhara Disaster Prevention and Food Security Office (ADPFSO), GIZ, and KfW in 2005. In order to achieve the different objectives of the project, a regional steering committee was established. The members of this committee include representatives from ADPFSO, the Amhara Agricultural Development Bureau, the Amhara Rural Road Authority, the Amhara Water Resources Development Bureau, GIZ, and KfW.

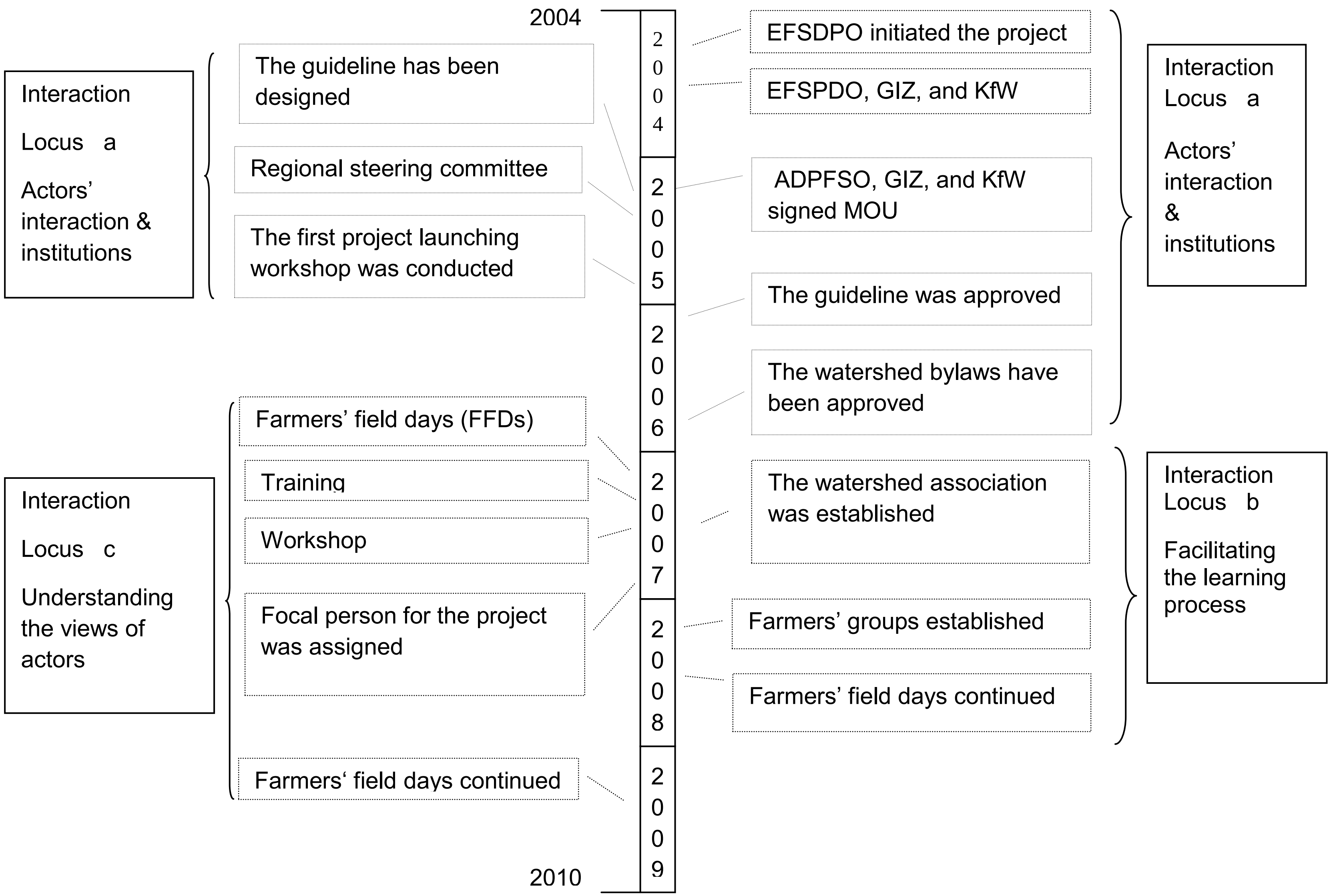


Figure 2 Timeline of SUNRPA project, interaction loci, and important events

Note: EFSDPO represents Federal Food Security and Disaster Prevention Office, ADPFSO (Amhara Disaster Prevention and Food Security Office), GIZ (German Agency for Technical Cooperation), KfW (German Development Bank), MOU (Memorandum of Understanding), and SUNRPA (Sustainable Utilization of Natural Resources Project of Amhara).

In collaboration with federal partners and spearheaded by regional representatives, the inauguration workshop bringing together farmers, experts, GIZ and KfW was launched in 2005. Ever since the launch of the first inauguration workshop, subsequent discussions about soil conservation were held with farmers, public administrators, GIZ, KfW, and experts. The interviews with experts show that at the early stage of the project, there was no binding guideline for actors to work together. Whenever public organizations met, they acted mainly as representatives of their organizations and they did not negotiate over their organizational interests. Narratives suggest that such lack of consensus building prevailed during the initial project phase. In addition, interviewees state that government actors were overloaded with other activities that were not related to soil conservation and they were not serious on attending meetings related to the project. The following statement made by KfW reveals:

> District agricultural offices were overloaded with a lot of activities in addition to the watershed activities. The same was true for local public administrators. This was one of the limitations in the network (Interview, 23 November 2010).

In addition, during the initial project phase, the interaction between actors was characterized by conflicts as discussed in the previous chapter. Interviews with experts suggest that some farmers, mostly non-adopters of soil conservation measures, continued their traditional practice of redirecting floods from their farm to others' farms which was against the project's flood management approach. The project's approach to reduce flood related conflicts was through the adoption of gullies and terraces. Evidence for such forms of non-compliances of farmers with project interventions is found across several interviews. 92% of the interviewees have confirmed the non-compliance of non-adopters.

Interviews also suggest that at the initial project phase there were conflicts between the watershed committee and experts due to the expert's interference with the responsibilities of the watershed association.

An important institution that promoted the interaction of actors was the introduction of watershed bylaws. This was an important event. The section of the bylaws which outline the need for learning was an important instrument to create more understanding on soil conservation and to encourage the interaction of actors. Interviews with farmers show that after the introduction of bylaws the number of learning platforms increased from 57 in 2007 to 147 in 2010. Farmers and experts were exposed to FFDs which have brought a solution for some of the conflicts related to flood management. For instance, Amba Zuria farmers having observed the activities of model farmers how adopting soil conservation innovations can reduce flooding and the need to develop a positive relationship between experts and farmers, new understandings on soil conservation started to emerge. These field visits were the source of inspiration for Amba Zuria farmers to adopt soil conservation innovations. A farmer described his view on the section of the bylaws that encourage learning as follows.

> We focused on learning from each other rather than applying the punishment of the bylaws (Interview, 22 October 2010).

Therefore there was much emphasis for learning rather than punishment. However, there were different views on the implementations of the watershed bylaws between experts and the watershed committee. In this regard, 90% of the interviewees have recognized the important role of bylaws for learning, and for encouraging adoption whereas 10 % of the interviewees have complained on the implementation of the bylaws. The following statement exemplifies how the expert complained on the implementation of the bylaws:

> Sometimes watershed committee members may not be serious about implementing the bylaws due to social reasons such as relative issue. In such cases the association members complain (Interview, 22 October 2010).

Some of the relatives of the watershed committee members have favored their kinfolks which allowed them to attend more field day visits and trainings than nonfamily members. However, watershed committees do not share this complaint. The chairperson of the watershed association explained the implementation of the bylaws as follows:

> […] I am following the implementation of the bylaws. Any member of the association who is not abiding by the bylaws will be punished (Interview, 22 October 2010).

However, most of the interviewees indicated that the bylaws have encouraged learning by indicating when and how to learn and this in turn had positive impact on the adoption practice by developing positive attitude for soil conservation.

In addition to the bylaws, the regional steering committee has developed additional institution i.e., guidelines. The guideline was formulated to govern the interaction of actors. Especially, the section of the guideline which gives due attention to monitoring has encouraged the coordination and functioning of regional, district and local organizations. According to meeting minutes and interviews with steering committee, after the formulation of the guideline, 48 steering committee meetings were conducted to monitor and evaluate the performance of the project. Steering committees meet and evaluate the performance of the watershed activities every three months. The practice of judging members of the watershed committee either as a good or bad performer enabled bad performers to correct their mistakes before they came to the next meeting. This evaluation was complemented with discussions at the field level. From the total interviewees, 96 % of them have appreciated the important role of the guideline for its role in encouraging the interaction of actors and to follow up of activities on the ground. For instance, an expert from GIZ expressed his opinion as follows:

> […] regional and district representatives meet and evaluate the progress. […] after finishing the meeting, evaluation on the spot, in the watershed, follows. Discussion on the site was part of the learning process. […] everybody accepts his/her assignment and acts according to the consensus reached in the meeting. (Interview, 22 October 2010).

However, sometimes, the involvement of the district agricultural development and public administration offices was limited in attending meetings. The expert from KfW expressed his experience as follows:

> Because of a lot of responsibilities, some district office heads sometimes did not attend meetings (Interview, 22 October 2010).

In addition, there was no involvement of researchers in this project due to the weak link they had with the local organizations.This means that there were some weaknesses during the application of bylaws and guidelines. On the other hand, the sections of the bylaws and guidelines that encourage learning and monitoring had a positive outcome for the interaction of actors and this could be one potential reason for the increase of soil conservation innovations over the years (see Table 1).

In general, the findings of 'interaction locus a' indicate that formalization of partnership helps to integrate the actors at various levels. For instance, the MOU outlines the major activities of the project (e.g. soil and water conservation, irrigation, and road construction), the source of the budget support, performance reporting procedures, and monitoring and evaluation schedules. The MOU has created an opportunity for federal and regional actors to interact and work together.

The MOU was also complemented by bylaws. The bylaws were mainly used to govern the interaction of actors at the local level. The major components of the bylaws that were outlined in it include: the number of meetings supposed to be conducted every year, agreed sanctions, procedures to prevent conflicts, when and how to learn, procedures to elect watershed committee members and their removal procedure when found guilty of wrong-doings. Especially, the section of the bylaws which outline when and how to learn had a positive impact on the interaction of actors and on innovation adoption. The performance evaluation of the watershed committee by the association members every three months was instrumental to encourage accountability and transparency. This type of monitoring and evaluation increased the number of interactions among actors and their participation in meetings. Moreover, the implementation of the sanctions of the bylaws does not give more space for punishment. The emphasis for reaching more understanding rather than applying monetary punishment has enabled farmers to gain more time to understand soil conservation problems and solutions.

In addition to the bylaws, the guideline was also used to monitor and evaluate soil conservation activities and to coordinate actors at various levels. In the guideline topics such as committee meeting schedules, members of the steering committee, the responsibilities of the steering committee (e.g. approving the annual work plan, budget support for the watershed activities, supporting learning platforms, supervising and evaluating watershed activities), and monitoring schedules were included. The project's activities were evaluated both at the field and desk by the steering committee. This type of evaluation allowed every actor to understand the performance of the project. The field evaluation enabled farmers to present their experiences on their farm land. A mixture of field and desk evaluation was found useful to reach all actors, especially farmers. This approach was outlined in the guideline. In general, the guideline encouraged the monitoring and evaluation of activities and created more opportunity for interactions. It also created more possibilities to identify the weaknesses and strengths of the interaction. Weaknesses such as insufficient participation of some government representatives in meetings were observed.

In addition to the bylaws and guidelines, the start of FFDs was instrumental. The participants of the FFDs were inspired by the success of model farmers. This inspiration encouraged experts and farmers to develop a positive attitude that encourage interaction and learning from each other. Every year, more farmers were participating in FFDs (Table 1). Farmers and experts were interacting with the support of bylaws and guidelines which opened a communication space for the development of positive interaction and the emergence of more understanding of soil conservation solutions. This is possible may be because, as Hocdé et al. (2009) suggested, bylaws enhance the capacity for partnerships and enforce sanctions when potentially counterproductive deviations emerge. Thus, the presence of institutions such as MOU, bylaws and guidelines have a potential to increase the participation of farmers and experts in learning learnig platforms, and this in turn may lead to more understanding of soil conservation solutions.

4.2.2. Locus b: Facilitating the learning process

Interviews with agriculture and GIZ experts show that at the early stage of the project, there was a lack of farmers' participation in plenary meetings which were organized by experts. In these meetings, farmers who attended did not express their views due to the lack of awareness of soil conservation measures and this view was cited by 78% of the respondents. As a result, only a few farmers showed interest in the project ideas while most of them opposed it. An important event, which initiated farmers' participation, was the establishment of watershed association and farmers groups. The idea of establishing a watershed association and farmers' groups was the result of the first FFDs. Amba Zuria farmers have realized from that visit the important role of the watershed association in promoting participation of farmers and in facilitating discussions. After the visit, the need for establishing watershed association and farmer groups was approved in the bylaws and after several meetings the watershed association was established in 2007. The association is headed by an elected farmer committee. During FFDs and formal meetings, enough space and time was provided by the chairperson of the committee for experts and farmers to interact and voice their opinion freely. The interviews show that farmers were more willing to express their views when the watershed committee facilitated the discussion due to the existing relationship between the farmers and their facilitator which paves the way for the emergence of mutual trust. An interviewee from GIZ expressed his view as follows:

> After the establishment of the watershed association, […] the participation level increased. […] the farmers' group was organized based on their closeness in social interaction. This has made the mobilization of farmers possible (Interview, 22 October 2010).

This shows that establishing farmers' organization based on local bylaws has a potential to increase the participation level of actors especially farmers. Interview transcripts also show that the formation of farmers' groups in 2008 enabled farmers to work together and to challenge the labor intensive work of soil conservation measures. This type of group work has contributed positively to interaction and for the establishment of personal relations and the emergence of emotional ties among the farmers. This view was shared by 97% of the interviewees. For instance, a farmer explains his experience on working in groups as follows:

> Working in groups has contributed a lot, because it has created an opportunity to interact and know each other and share knowledge. (Interview, 22 October 2010).

According to the interviews, the watershed committee evaluates the performance of farmers' groups. Experts, the watershed committee and farmers' group members participate in the evaluation. During this process, each group reports the way they adopted the soil conservation measures. After evaluating the performance of each group, innovative practices were identified and these practices were recommended to the poor performers. An agricultural expert explains his experience as follows:

> After the daily work gets finished, group members, group leaders, watershed committee, and development agents discussed the activities performed on that day. […] Bad performers are advised to see the work of good performers. The good performers explain how they did it. This way of communication has helped a lot. (Interview, 29 October 2010)

This type of evaluation and discussion created opportunities especially for farmers to express their personal experiences. This encouraged experts with a scientific background to discuss soil conservation innovation on the level of personal experiences rather than based on theoretical explanations. This process helped experts to learn from farmers and led participating actors to believe that people have different knowledge and these different types of knowledge are complementary to each other. A farmer who participated in group discussions described his practice of applying indigenous and scientific knowledge as follows:

> We use straw and other materials, compost for example, […] to protect the soil from flood leakage between the stones of the bund. This was not advised by the experts. […] but we accept the width of the stone bund. […] as per the advice of the experts (Farmers' group discussion, 29 November 2010).

Summarizing, the findings of ‘interaction locus b’ indicate that the organizational set up and localizing power creates a conducive environment for the emergence and application of knowledge of actors. For learning to take place local organization such as watershed associations, and farmers’ groups were important intermediaries between the community and government offices. The effectiveness of farmers’ organization for the adoption of soil conservation innovations was also confirmed by Qasim et al. (2011) and Hocdé et al. (2009). Once the watershed committee started managing and facilitating the learning processes, farmer groups were used mainly to disseminate information among the group members. In this case, group membership seems to support social learning in the sense that group processes help to create a common understanding (Muro and Jeffrey 2008). Thus, localizing power has to be considered in order to encourage social learning and the emergence of new local actors. The emergence of new actors such as farmers’ groups and the watershed association have played an important role in facilitating the learning process during FFDs and in disseminating knowledge through performance evaluations. However, local level organizations may not be able to perform their duties without being supported by bylaws. Thus, the existence of local level institutions such as bylaws encourages the facilitation role of local level organizations in the process of learning and in the adoption process.

4.2.3. Locus c: Understanding the views of actors

Interviews with public administrators show that during the initial stage of the project most farmers were against the project ideas due to their negative perception on soil conservation measures. An important event which challenged the negative perception farmers had on soil conservation was the start of the FFDs. After the start of FFDs the participation of farmers increased from 35 in 2007 to 90 in 2010 (Table 1) may be because the participation of farmers in FFDs has enabled them to look into the solutions for the negative perceptions they had on soil conservation. For instance, to avoid rodents in the terraces, putting straw and soil in between stones was recommended by model farmers. The adoption of stone terraces has also increased over the years from six in 2007 to 300 hectare in 2010 (Table 1). Interviews also show that when experts and farmers started to learn from each other, farmers understood that experts lack some knowledge. A farmer who was involved in FFDs expressed his view as follows:

> From experience, we know in which areas high pressure flood comes. So we tell the group or the experts what to do in such cases. […] the experts based on this information tell what to construct and how to construct. In this way we learn from each other. (Interview, 29 October 2010)

Interviews with experts show that farmers also lack the knowledge of designing checkdams. The checkdams constructed by farmers collapse very easily. One of the agriculture experts described the farmers' experience on checkdam construction as follows:

> The soil conservation measures did not protect against soil erosion for long due to technical problems, so experts technically supported the farmers (Interview, 29 October 2010).

In general, 'Interaction locus c' shows that the exposure of farmers, experts and public administrators to continuous FFDs has brought positive results in formation of positive understanding of soil conservation. The finding of this study is consistent with the findings of Cheng et al. (2011). Their study showed that social learning is an important element in building the knowledge of individuals and groups. The findings of this study are also consistent with Rogers (2003) and Kroma (2008), who state that learning platforms for communicating an innovation is a key to successful diffusion.

The application of the FFDs was the result of the bylaws. In the bylaws the need for learning through various means has been outlined. Thus, institutions are important for learning to take place. In sum, emphasizing the need for FFDs and other learning platforms in the outline of institutions can serve as an important event to fill the knowledge gaps of all actors and to understand the views of actors. Apart from this, this study also examined whether there exist differences in social capital between adopter and non-adopter farmers as the result of the differences in the application of social learning. The following section shows the role of social capital for soil conservation in greater detail.

4.3. The role of social capital for soil conservation

The data from the questionnaire surveys was analyzed using the probit model by considering adopter and non-adopter farmers and the result shows differences in social capital between them. The social capital variables included in the probit estimation were: the number of participation levels in social learning platforms which were considered as sources of information and communication, i.e. information obtained from farmers' conference (FC), farmers' field days (FFD), group discussions (GD), and informal learning approaches (INF). Trust (LST) between famers, experts, and public administrators, and social cohesion (LSC) are also included in the model.

Table 5 Description of predictors of adoption of soil conservation measures

Social capital variables	
FC	participation in farmers' conference (1=participating 0=otherwise)
FFD	participation in farmers' field days (1=participating 0=otherwise)
GD	participation in group discussions (1=participating 0=otherwise)
INF	participation in informal platforms (1=participating 0=otherwise)
LST	level of social trust (1=low, 5 =high)
LSC	level of social cohesion (1=low, 5 =high)

As shown from Table 6, social capital variables related to information and communications such as farmers field days, farmers conference, and group discussions have statistical significance for the adoption of soil conservation innovations. The result shows a strong correlation between adoption and information and communication. The potential reason for the existence of such relationships in adopter farmers may be due to the high involvement of farmers in social learning platforms such as FC, FFD and GD (e.g. as shown in Table 7, 85 % of the farmers were involved in FFD alone). The less involvement of non-adopters in social learning platforms (e.g. 11% of the interviewees participated in FFD) might contribute negatively to the adoption of soil conservation measures.

Table 6 Probit model estimation result

Variable	Coefficient	Std. Error	z-Statistic	Prob.
FC	1.343895**	0.539641	2.490347	0.0128
FFD	1.942114**	0.407307	4.768181	0.0000
GD	0.981246**	0.398878	2.460012	0.0139
INF	0.683807*	0.415018	1.647656	0.0994
LST	-0.028568	0.202093	-0.141362	0.8876
LSC	0.717320**	0.216383	3.315047	0.0009
Obs with Dep=0	74	Total obs		146
Obs with Dep=1	72			

* Significant at 0.05 level; ** significant at 0.01 level

Social cohesion has statistical significance for adoption. As indicated in Figure 3, the level of social cohesion is higher for adopters than non-adopters. The closeness or togetherness of farmers observed in the adopter farmers was probably the result of the intensification of interactions and discussions in the learning process. The interaction of farmers, experts and public administrators via social learning was higher for adopters than non-adopters. For instance, as shown in Table 7, only 11% and 16% of on-adopter farmers participated in FFDs and farmer group discussions respectively. The low participation rate of farmers in information and communication pathways might be a potential reason for being non-adopter.

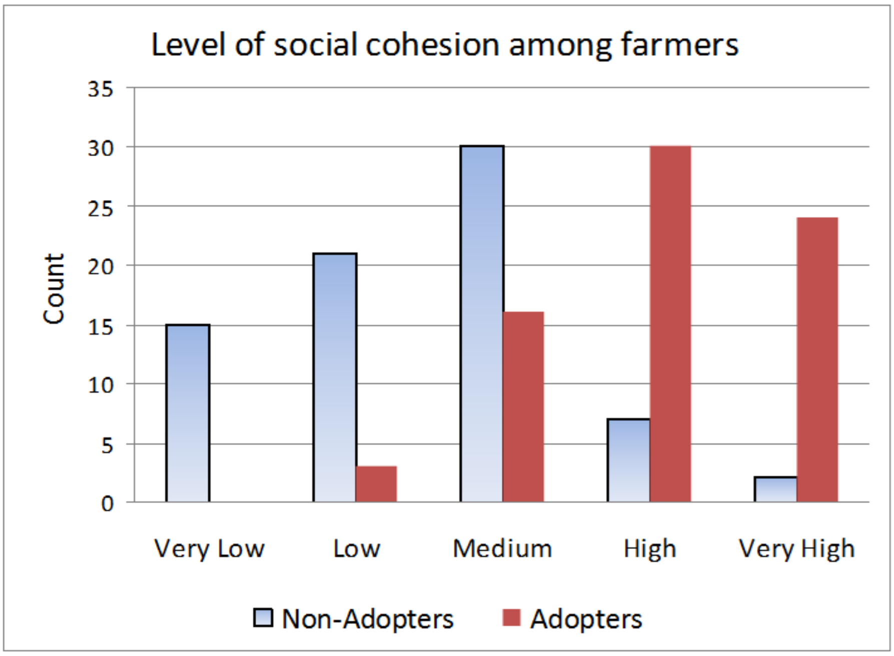


Figure 3 The level of social cohesion among adopters and non-adopters

The result of the analysis also shows that trust was not statistically significant with adoption. A further analysis of interviews and group discussions reveal that trust develops slowly. It took some time to minimize or avoid conflict incidents observed between farmers, experts and public administrators as the level of understanding of the soil conservation problems and solutions vary among the actors. For instance interviews show that conflict incidents were observed at the initial phase of the project due to the mismanagement of floods across farmlands. However, these conflicts were minimized after investing in social learning and after adoption of soil conservation measures. The participation level of adopters in social learning platforms is generally higher than non-adopters (Table 7). Among the different social learning platforms, the participation rate of adopters in farmers' field days is significantly higher than for non-adopters. For instance, in farmers' field days only 11% of the respondents from the non-adopters participated compared to an 85 % participation of adopters. Interviews with adopter farmers in Amba Zuria reveal that after the intensification of the learning platforms (e.g. after organizing more and more farmers' field days), the trust between farmers themselves and with experts started to emerge and conflicts were minimized. On the other hand, interviews indicate that enough time and energy was not invested in social learning to create understanding and consensus with non-adopter farmers in Meresar village thus, conflict incidents related to flood management are observable as their farmlands are still non-terraced.

The low investment in social learning in Meresar village could be one potential reason for their low adoption rate.

Table 7 Farmers' participation in social learning platforms

Adopters/non-adopters	Farmers' participation in social learning platforms			
	Farmers' field days	Farmers' conference	Group discussions	Informal learning
Adopters	85%	92%	59%	47%
Non-Adopters	11%	60%	16%	21%

As indicated in Table 7 and in Figure 4, the participation level of adopters and non-adopters in social learning varies. This difference might lead to differences in social capital between adopters and non-adopters. As shown from the probit estimation result, social capital elements have positive correlation with adoption and the social capital elements were higher for adopters than non-adopters. This difference could result from differences in investing on social learning platforms.

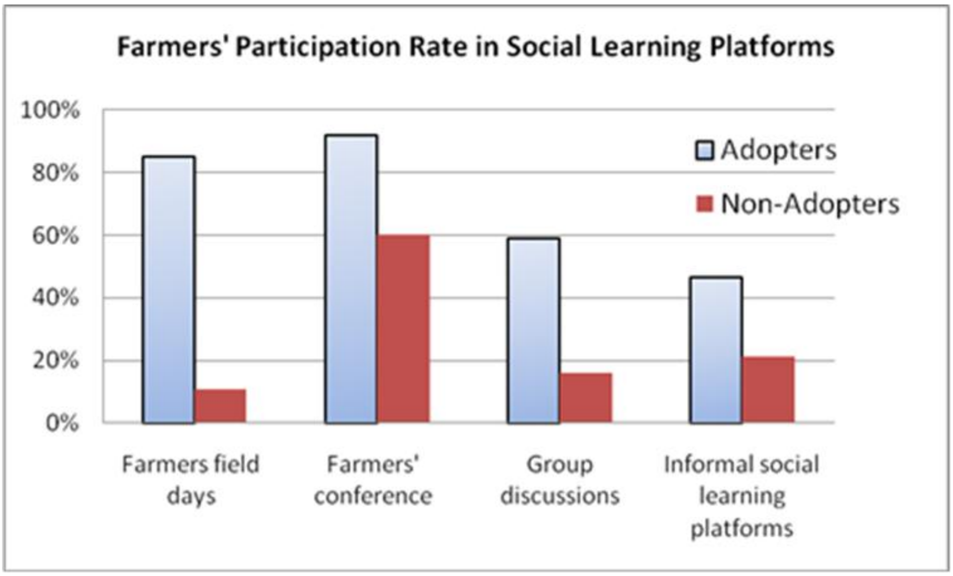


Figure 4 Adopters' and non-adopters' participation in social learning platforms

The findings show that social capital is higher in on farmers where social learning was intensified. As discussed in the previous sections, local level organizations (e.g. watershed association) and institutions (e.g. watershed bylaws) have played an important role in the process of creating conducive environment for social learning and for the emergence of positive interaction among the actors. This increased level of interaction enabled farmers, experts and local administrators to develop a deeper understanding of each other and build a relationship, i.e. social learning can lead to a new and broader social interaction between internal and external actors (Rist et al. 2007). This means that social learnig could be one source for the strengthening or creation of social capital which is an important element for the collective action needed for soil conservation. This was true where social learning was intensified. As Leahy and Anderson (2010) and Sanginga et al. (2010) suggested, learning encourages the development of social capital, which is an important element for scaling-out the adoption of technologies in natural resources management. Other studies (e.g. Cramb 2004; Amsalu and De Graaff 2007) also confirm that access to information through learning positively influence farmers' conservation decisions. The learning process in addition to creating awareness enables actors to overcome conflicting personal and institutional interests, as well as economic and educational differences, and to develop a shared understanding and consensus (Muro and Jeffrey 2008).

In general, the findings suggest that exposing farmers and experts to practical and interactive communication techniques such as farmers' field days enables the emergence of social capital and social capital in turn encourages the adoption of soil conservations.

5. Conclusions and implications

5.1. Conclusions

In order to facilitate the limited adoption of soil conservation innovations, social learning approaches can serve as a new window of opportunity to create positive understanding on soil conservation. This approach may bring a major shift from the conventional linear learning and knowledge transfer practice, i.e. from the expert to the farmer. This means that social learning may have a potential to tackle the deficiencies of the top-down technology transfer (e.g. hierarchical, less transparent, lack of trust) by allowing more interaction and understanding among the actors. The study indicates the need for changing the conventional agricultural extension approach of how farmers learn to how farmers, experts and researchers learn from each other. The findings of this study suggest that the negative perceptions of farmers on soil conservation can be changed to conditions that are conducive for the adoption of soil conservation innovations. This is possible through social learning. Those actors who were exposed to social learning had developed positive understanding on soil conservation. The emergence of social capital elements such as cooperation and trust, and the chance of applying the knowledge of farmers and experts in soil conservation were observed in adopters. The findings also show that social capital positively correlates with adoption. From the non-adopters side, apart from their lack of understanding the consequences of soil degradation, the social capital elements such as trust, cooperation and social cohesion was low. This may result from their low involvement in social learning platforms. Thus, social learning and social capital could be taken as potential factors for the successful adoption of soil conservation innovations. This implies that social learning and the formation of social capital should be encouraged in soil conservation strategies. In order to do so, institutions have to be place. Institutions, in particular local institutions (e.g. bylaws), can play positive roles in encouraging and sustaining the learning process, and in governing the interactions of the relevant actors. This implies that relying more on government institutions than local institutions for innovation adoption has to be revisited and attention should also be given to community based institutions and organizations.

In order to scale out the lessons of social learning and institutions of the project to a wider geography, farmers and experts from other localities need to learn from the experiences of this project. This would be more effective if efforts are made to change the project-based learning to organizational learning. In addition, the important outcomes and events that shaped the project, e.g. institutions, organizational set ups, partnership building, and monitoring and evaluation, are important inputs to scale-out the adoption of soil conservation measures to other localities.

Soil conservation studies in Ethiopia generally emphasize the technical, financial, and ecological dimensions of technology adoption. From the mainstream policy point of view, however, social learning is very seldom prescribed as a useful component of soil conservation policy. It is thus important to take into account how learning oriented understanding of soil conservation can be practiced and how actors' behavior can be governed by institutions.

5.2. Implications

5.2.1. Theoretical implications

Agricultural innovation systems emphasize the need for actors' involvement, actions and interaction of actors, and formal and informal institutions in the innovation process. This is an important shift from the conventional linear perspective of technology transfer approach. While agricultural innovation systems highlight the importance of actors' interaction and institutions, it does not fully embrace how interactions should be governed and sustained in the short or long run, and how interactions lead to organizational and institutional transformation. In this study, local level institutions and organizations were core for learning to take place and in the adoption process. This may indicate that local level organizations and their institutions may be more effective for innovations than organizations and institutions at the higher administrative level. Thus, incorporating the institutional and organizational theories in soil conservation studies could help to better understand the potentials and limitations of institutions at various levels. In addition, farmers were more active in their group form and in the form of their associations. This may imply that soil conservation innovation adoption may be more successful if farmers act collectively rather than deciding at the individual basis. This may take us to consider how to improve group performance and theories related to group performance and collective action.

Studies (e.g. Tumbo et al. 2011) show that social capital has not been well incorporated in soil conservation related studies and strategies. This case study shows the important role of social capital in soil conservation and social capital has to be considered as one component in the analysis of agricultural innovation systems. In sum, to address soil degradation, this thesis points the need to combine different theories and concepts to understand the complex processes in soil conservation.

5.2.2. *Implications for policy and practice*

The social learning approach has become increasingly important in environmental policy making (Parson and Clark 1995; Wollenberg et al. 2001), as it focuses on participatory processes of social change (Woodhill and Röling 2000). However soil conservation policies still emphasize factors such as economic, physical, and personal. These factors are important, but cannot be understood without capturing the social processes through social learning. More specifically, social learning has to be incorporated in the strategies of soil conservation and in order to do so, training on the concept and application of social learning for agriculture experts, farmers, researchers, policy makers and public administrators is essential. These trainees could serve as training of trainers (TOTs). At the national level, the Ethiopian Ministry of Agriculture is responsible and can take the initiative. The TOTs can be drawn from regional agriculture bureaus, NGOs working in regions and from regional research institutes. When the TOTs return to their organizations and regions, they have to train their employees. The regional agriculture bureaus are also responsible to coordinate soil conservation issues at the regional level. A training manual can be used to train local level experts, farmers and public administrators.

When agriculture experts, farmers, researchers, policy makers and public administrators meet together for training, farmers have to narrate their experiences and these narrations, in most cases, have to be a starting point for discussions. In this process, agriculture experts, researchers, policy makers and public administrators all have to act as learners rather than directing the process. In addition, documented events that positively shaped the progress of the project can also serve as learning points. Farmers, experts, public administrators from other localities have to complement their training by visiting the project site. In this regard, farmers' field days are important. After trainings and discussions, social learning has to be incorporated as one important pillar in soil conservation strategies.

In this way, scaling up the concepts and the application of social learning could be possible. However this can not happen without institutions. In order to sustain the learning process, appropriate institutions have to be in place. Introducing watershed bylaws in the current configuration of institutions might help a lot to govern the interaction of actors. In addition, promoting the establishment of watershed association is important to encourage community participation. The introduction of bylaws and watershed associations has to be included in soil conservation strategies as well. The need for strengthening or creating social capital has to be considered instead of focusing on the technological prescriptions of innovations.

In general, this thesis offers valuable insights into the type and contents of institutions that encourage learning and adoption of soil conservation innovations. Analyzing the relationship between social learning, social capital and institutions with soil conservation suggests additional perspective in the design and implementation of soil conservation policies in the future.

5.2.3. Perspectives for future research

This study used a case study approach and employed a mix of qualitative and quantitative methods. However, the results have to be interpreted in a project based scope and within the context of certain methodological limitations: the empirical data are derived from one case study in Ethiopia and related to soil conservation. These outcomes are thus dependent on the institutional and socio-political context which needs to be taken into account when the results are interpreted.

Further study can investigate how project based learning can be transformed into organizational learning. In addition, apart from soil conservation, more research on understanding social learning and farmers' institutions in local innovations need to be investigated in different agriculture and natural resource programs. While this study was limited to understand the role of social learning and institutions in soil conservation, further empirical study using the methods of this study can be used to analyze social learning in other sectors such as livestock, crop, water management, forestry, or climate change.

6. References

Aarts, N., Van Woerkum, C., Vermunt, B., 2007. Policy and planning in the Dutch countryside: the role of regional innovation networks. *Journal of Environnemental Planning and Management* 50 (6): 727-744.

Amsalu, A., De Graaff, J., 2007. Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecological Economics* 61 (2): 294-302.

Amudavi, D., Khan, Z.R., Wanyama, J.M., Midega, A.O., Pittchar, J., Hassanali, A., Pichett, A., 2009. Evaluation of farmers' field days as a dissemination tool for push-pull technology in Western Kenya. *Crop Protection* 28(3):225-235.

Assefa, A., Waters-Bayer, A., Fincham, R., Mudhara, M., 2009. Comparison of frameworks for studying grassroots innovation: agricultural innovation systems and agricultural knowledge and information systems, In: Sanginga P, Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasinha, C., (ed.), Innovation Africa: enriching farmers' livelihoods. Earthscan publishing for a sustainable future, London and Sterling, pp. 35-56.

Ayele, S., Duncan, A., Larbi, A., Khanh, T.T., 2012. Enhancing innovation in livestock value chains through networks: lessons from fodder innovation case studies in developing countries. *Science and Public Policy* 39(3): 333-346.

Bekele, A., 1997. A participatory agroforestry approach for soil and water conservation in Ethiopia. Tropical resource management paper17, Wageningen University, The Netherlands.

Bekele, W., Drake, L., 2003. Soil and water conservation decision behaviour of subsistence farmers in the eastern highlands of Ethiopia: a case study of the Hunde Lafto area. *Ecological Economics* 46(3):437-451.

Belay, K., Degnet, A., 2004. Challenges facing agricultural extension agents: a case study from South Western Ethiopia. African Development Review, 16 (1): 139-168.

Beshah, T., 2003. Understanding farmers: explaining soil and water conservation in Konso,Wolaita and Wello, Ethiopia. Tropical Resource Management Papers, vol.14. Wageningen University, 245 pp.

Betru, N., 2002. Background to the homestead development approach, paper presented on the second review workshop of homestead development activities of the ETH-2488 project January 30 to February 1, 2002, Ministry of Agriculture, Addis Ababa, Ethiopia.

Bewket, W., 2007. Soil and water conservation intervention with conventional technologies in North-Western highlands of Ethiopia: acceptance and adoption by farmers. *Land Use Policy* 24 (2): 404-416.

Bureau of Finance and Economic Development [BOFED]. 2011. Watershed projects in Amhara Region. Bureau of Finance and Economic Development. Bahir Dar, Ethiopia.

Central Statistics Authority of Ethiopia [CSAE]. 2011. Agriculture sample survey, Volume II. Report on livestock and livestock characteristics. CSAE, Addis Ababa, Ethiopia.

Cheng, A.S., Danks, C., Allred, S.R., 2011. The role of social and policy learning in changing forest governance: an examination of community based forestry initiatives in the US. *Forest Policy and Economics* 13(2):89-96.

Connelly, S., Richardson, T., 2004. Exclusion: the necessary difference between ideal and practical consensus. *Journal of Environnemental Planning and Management* 47(1):3-17.

Cramb, R.A., 2004. Social capital and soil conservation: evidence from the Philippines. Paper presented for 48th annual conference of Australian Agricultural and Resource Economics Society, 10-13 February 2004, Melbourne, Australia.

De Graaff, J., Amsalu, A., Bodnar, F., Kessler, A., Posthumus, H., Tenge, A., 2008. Factors influencing adoption and continued use of long term soil and water conservation measures in five developing countries. *Applied Geography* 28 (4): 271-280.

Department for International Development-Natural Resources Systems Program [DFID-NRSP]. 2002. Scaling-up and communication: guidelines for enhancing the developmental impact of natural resource systems research. NRSP, UK, 8 pp.

Desta, L., Kassie, M., Benin, S., Pender, J., 2000. Land degradation and strategies for sustainable development in Ethiopian highlands: Amhara Region. Socio-economics and policy research, working paper 32, Nairobi, Kenya.

Ekop, O.E., Osuji, E.E., 2003. Participatory methodology in information dissemination: A case study of Oyo State Agricultural Development Projects in

Ogbomosho Zone. Food Africa, Internet Forum 31st March-11th April 2003, Internet Paper for Food Security, 7 pp.

FAO, 2002b. Land and agriculture: Challenges and perspectives for the world summit on sustainable development, Johannesburg 2002.

Federal Democratic Republic of Ethiopia [FDRE]. 1999. Agriculture research and extension project: Ethiopian research-extension-farmer linkages strategy, Ministry of Agriculture, Addis Ababa, Ethiopia.

Gebremedhin, B., Swinton, S.M., 2003. Investment in soil conservation in Northern Ethiopia: the role of land tenure security and public programs. *Agricultural Economics* 29(1):69-84.

Gebremedhin, B., Hoekstra, D., Tegegne, A., 2006. Commercialization of Ethiopian agriculture. Extension service from input supplier to knowledge broker and facilitator. Improving productivity and market success (IPMS) of Ethiopian farmers project working paper No. 1. International Livestock Research Institute. Nairobi, Kenya.

Gondar Zuria Agricultural Development Office [GZADO]. 2010. Summarized annual performance reports of Amba Zuria watershed. Maksegnit, Ethiopia. 22 pp.

Grootaert, C., Narayan, D., 2004. Local institutions, poverty and household welfare in Bolivia. *World Development* 32 (7):1179-1198.

Grootaert, C., Narayan, D., Nyahan, J.V., 2004. Measuring social capital: an integrated questionnaire, World Bank publications, 72 pp.

Hagedorn, K., 2008. Particular requirements for institutional analysis in nature-related sectors. *European Review of Agricultural Economics* 35 (3):357-384.

Hall, A., 2006. Enhancing agricultural innovation: how to go beyond the strengthening of research systems, World Bank. Washington DC.

Hocdé, H., Triomphe, B., Faure, G., Dulcire, M., 2009. From participation to partnership: a different way for researchers to accompany innovation processes-challenges and difficulties, In: Sanginga, P., Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasinha, C., (ed.), Innovation Africa: enriching farmers' livelihoods. Earthscan publishing for a sustainable future, London and Sterling, pp. 135-154.

Jacobson, T.L., Storey, J.D., 2004. Development communication and participation: applying Habermas to a case study of population programs in Nepal. *Communication Theory* 14(2): 99-121.

Jiggins, J., Van Slobbe, E., Röling, N., 2007. The organization of social learning in response to perceptions of crisis in the water sector of the Netherlands. *Environmental Science and Polic*y 10(6):526-536.

Journal of Statistics Education 4(3)

Klerkx, L., Aarts, N., Leeuwis, C., 2010. Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment. *Agricultural Systems* 103 (6), 390-400.

Kroma, M.M. 2008. Organic farmer networks: Facilitating learning and innovation for sustainable agriculture. *Journal of Sustainable Agriculture* 28(4):5-28.

Kurokawa, I., Yoshida, T., Lewis, C.H., Igarashi, R., Kuradate, K., 2012. The Plurilingual lounge: creating new world views through social interaction. *International journal of Intercultural Relations* In press, corrected proof, Available online 19 May 2012.

Leahy, J.E., Anderson, D.H., 2010. "Cooperation gets it done": social capital in resource management along the Kaskaskia River. *Society and Natural Resources* 23 (3):224-239.

Lebel, L., Grothmann, T., Siebenhüner, B., 2010. The role of social learning in adaptiveness: insights from water management. *International Environmental Agreements: Politics, Law and Economics* 10(4):333-353.

Leeuwis, C., 2000. Conceptualizing participation for sustainable rural development: towards a negotiation approach. *Development and Change* 31(5):931-959.

Leeuwis, C., 2004. Communication for rural innovation: rethinking agricultural extension. Blackwell Science, Oxford.

Mercado, A.R., Patindol, M., Garrity, D.P., 2001. The land care experience in the Philippines: technical and institutional innovations for conservation farming. *Development in Practice* 11(4): 495-508.

Ministry of Agriculture [MOA]. 2000. Agro-ecological zonation of Ethiopia. Addis Ababa, Ethiopia. 20 p.

Ministry of Agriculture and Rural Development [MOARD]. 2010. Ethiopia's agricultural sector policy and investment framework, 2010-2020. Ministry of Agriculture and Rural Development, Addis Ababa, 48p.

Ministry of Finance and Economic Development [MOFED]. 2010. Growth and Transformation Plan (2010/11-2014/15), Volume I main text, MOFED, Addis Ababa, Ethiopia

Ministry of Information [MOI]. 2002. Agricultural development led industrialization strategy. Addis Ababa, Ethiopia. 280p.

Mostert, E., Pahl-Wostl, C., Rees, Y., Searle, B., Tabara, D., Tppet, J., 2007. Social learning in European river basin management: barriers and fostering mechanisms from 10 river basins. *Ecology and Society*, 12(1):19 [online] http//:www.ecology andsociety.org/vol12/iss11/art19/.

Muro, M., Jeffrey, P., 2008. A critical review of the theory and application of social learning in participatory natural resource management processes. *Journal of Environmental Planning and Management* 51 (3):325-344.

Negatu, W., Parikh, A., 1999. The impact of perception and other factors on the adoption of agricultural technology in the Moret and Jiru Woreda of Ethiopia. *Agricultural Economics* 21:205-216.

Noble, A.D., Bossio, D.A., Penning de Vries, F.W.T., Pretty, J., Thiyagarajan, T.M., 2006. Intensifying agricultural sustainability: an analysis of impact and drivers in the development of bright spots. Comprehensive assessment research report 13.Comprehensive Assessment Secretariat, Colombo, Sri Lanka.

North, D.C., 1990. Institutions, institutional change and economic performance. Cambridge: Cambridge University Press.

Organization for Economic Cooperation and Development [OECD]. 1999. Managing national innovation systems. OECD, Paris, France.

Pahl-Wostl, C., 2009. A conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change* 19:345-365.

Pahl-Wostl, C., Hare, M., 2004. Processes of social learning in integrated resources management. *Journal of Community & Applied Social Psychology* 14(3): 193-206.

Palis, F.G., Morin, S., Hossain, M., 2002. Social capital and diffusion of integrated pest management technology: A case study in central Luzon, Philippines. IRRI paper. 14p. http://webapp.ciat.cgiar.org/src/pdf/irri_fpalis.pdf

Parson, E., Clark, W., 1995. Sustainable development as social learning: theoretical perspectives and practical challenges for the design of a research program. In: Gunderson, L., Holloing, C.,Light, S., (ed.) Barriers and bridges to the renewal of ecosystems and institutions. Columbia University Press, NY. pp. 428-460.

Patton, M.Q., 1990. Qualitative research and evaluation methods. 3rd ed. Thousand Oaks (CA): Sage.

Place, F., Adato, M., Hebinck, P., Omosa, M., 2005. The impact of agro forestry based soil fertility replenishment practices on the poor in Western Kenya. Research report No.142. International Food Policy Research Institute (IFPRI). Washington, DC.

Qasim, S., Shrestha, R.P., Shivakoti, G.P., Tripathi, N.K., 2011. Socio-economic determinants of land degradation in Pishin sub-basin, Pakistan. *International Journal of Sustainable Development and World Ecology* 18(1):48-54.

Rhiel, G.S., Chaffin, W.W., 1996. An investigation of the large-sample/small-sample approach to the one-sample test for a mean (sigma unknown). http://www.amstat.org/publications/jse/v4n3/rhiel.html.

Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., 2006. 'It was hard to come to mutual understanding...' the multidimensionality of social learning processes concerned with sustainable natural resources use in India, Africa and Latin America. *Systemic Practice and Action Research* 19(3):219-237.

Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., Zimmermann, A., 2007. Moving from sustainable management to sustainable governance of natural resources: the role of social learning processes in rural India, Bolivia, and Mali. *Journal of Rural Studies* 23(1):23-37

Robalino, D.A., 2000. Social capital, technology diffusion and sustainable growth in the developing world. 286 pp.

Rogers, E.M., 1995. The diffusion of innovations. 4th ed. New York (USA): The Free Press.

Rogers, E.M., 2003. Diffusion of innovation. 5th ed. New York: Free Press.

Röling, N., 2009. Conceptual and methodological developments in innovation. In: Sanginga, P., Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasinha, C., (ed.), Innovation Africa: enriching farmers' livelihoods. Earthscan publishing for a sustainable future, London and Sterling, pp. 9-34.

Röling, N., Wagemakers, A., 2000. Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty. Cambridge (UK): Cambridge University Press.

Rudd, M.A., 2004. An institutional framework for designing and monitoring ecosystem-based fisheries management policy experiments. *Ecological Economics* 48 (1):109-124.

Sanginga, P.C., Abenakyo, A., Kamugisha, R., Martin, A.M., Muzira, R., 2010. Tracking outcomes of social capital and institutional innovations in natural resources management: Methodological issues and empirical evidence from participatory bylaw reform in Uganda. *Society and Natural Resources* 25(8):711-725.

Schneider, F., Fry, P., Ledermann, T., Rist, S., 2009. Social learning processes in Swiss soil protection the 'from farmer-to- farmer' project. *Human Ecology* 37 (4): 475-489.

Schneider, F., Ledermann, T., Fry, P., Rist, S., 2010. Soil conservation in Swiss agriculture: approaching abstract and symbolic meanings in farmers' life-worlds. *Land Use Policy* 27(2):332-339.

Shiferaw, B., Holden, S., 1998. Resource degradation and adoption of land conservation technologies in the Ethiopian highlands: a case study in Andit Tid, North Shewa. *Agricultural Economics* 18(3):233-247.

Shiferaw, B., Okello, J., Reddy, R.V., 2009. Adoption and adaptation of natural resource management innovations in small holder agriculture: reflections on key lessons and best practices. *Environmental Development and Sustainability* 11: 601-619.

Slater, R., Curwin, J., 2006. Quantitative methods for business decisions. 5th ed. UK: Thomas Learning.

Spielman, D.J., Davis, K., Negash, M., 2011. Rural innovation systems and networks: findings from a study of Ethiopian smallholders. *Agriculture and Human Values* 28(2), 195-212.

Spielman, D.J., Ekboir, J., Davis, K., 2009. Developing the art and science of innovative systems enquiry: alternative tools and methods, and applications to sub-Saharan African agriculture, In: Sanginga, P., Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasinha, C., (ed.), Innovation Africa: enriching farmers' livelihoods. Earthscan publishing for a sustainable future, London and Sterling, pp.72-78.

Steins, N., Edwards, V., 1999. Platforms for collective action in multi-use common pool resources. *Agriculture and Human Values* 16(3):241-255.

Steyaert, P., Barzman, M., Billaud, J., Brives, H., Hubert, B., Ollivier, G., Roche, B., 2007. The role of knowledge and research in facilitating social learning among stakeholders in natural resources management in the French Atlantic coastal wetlands. *Environmental Science and Policy* 10(6):537-550.

Steyaert, P., Jiggins, J., 2007. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy, and practice. *Environmental Science and Policy* 10(6):575-586.

Sustainable Utilization of Natural Resources Project Office [SUNRPO]. 2010. Annual plan of Amba Zuria watershed. Bahir Dar, Ethiopia. 11p.

Tefera, B., Sterk, G., 2010. Land management, erosion problems, and soil and water conservation in Fincha watershed, Western Ethiopia. *Land Use Policy* 24 (4):1027-1037.

Tenga, A., De Graaff, J., Hella, J.P., 2004. Social and economic factors affecting the adoption of soil and water conservation in West Usambara highlands, Tanzania. *Land Degradation & Development* 15 (2):99-114.

Tumbo, S.D., Mutabazi, K.D., Byakugila, H.F., Mahoo, M., 2011. An empirical framework for scaling-out of water system innovations: Lessons from diffusion of water system innovations in the Makanya catchment in Northern Tanzania. *Agricultural Water Management* 98 (11):1761-1773.

Van de Ven, A.H., Polley, D.E., Garud, R., Venkatamaran, S., 1999. The innovation journey. New York: Oxford University Press.

Warner, J.F., 2006. More sustainable participation? Multi-stakeholder platforms for integrated catchment management. *International Journal of Water Resources Development* 22(1):15-35.

Wiesmann, U., Liechti, K., Rist, S., 2005. Between conservation and development: pathways to management of the first world natural heritage site in the Alps by means of participatory processes. *Mountain Research and Development* 25(2):128-138.

Wollenberg, E., Edmunds, D., Buck, L., Fox, J., Brodt, S., 2001. Social learning in community forests. CIFOR and East-West Centre.

Woodhill, J., Röling, N., 2000. The second wing of the Eagle: the human dimension in learning our way to more sustainable futures. In: Röling N, Wagemakers, A, editors. Facilitating sustainable agriculture: participatory learning and adaptive management in times of environmental uncertainty. Cambridge (UK): Cambridge University Press. p. 46-71.

Woolcock, M., Narayan, D., 2000. Social capital: implications for theory, research and policy. *World Bank Research Observer* 15, 225-249.

World Bank. 2007. Enhancing agricultural innovation: how to go beyond the strengthening of research systems. The World Bank, Washington DC.

World Food Program [WFP]. 2004. Cost-benefit analysis and impact evaluation of soil and water conservation and forestry measures, the World Food Program, Ethiopia, Draft report.

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7. CV

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- Integrated rural development management. University of Wales, Bangor, England. 1-27/ 3/2007.
- Donor fund coordination and management course. Global Training Consulting, London, UK. 1-12/12/ 2008.
- Project management, monitoring, evaluation and coordination. Global Training Consulting, London, UK. 30 June- 11July 2008.

Awards

- Certificate award by the United Nations Volunteer Office for the recognition of my support and contribution to the success of United Nations Volunteer Program in Ethiopia
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Publications

Dessie, Y., Wurzinger, M., Hauser, M., 2012. The role of social learning for soil conservation: The case of Amba Zuria land management, Ethiopia. *International Journal of Sustainable Development &World Ecology*.19 (3): 258-267.

Dessie, Y., Wurzinger, M., Hauser, M., 2012. Assessing the impact of social learning and social capital for the adoption of soil conservation innovations: A case study in Northern Ethiopia. In: Tielkes, E. (eds.) Resilience of agricultural

systems against crises. Book of Abstracts. International research on food security, natural resources management and rural development. pp.416.

Dessie, Y., Schubert, U., Wurzinger, M., Hauser, M., 2012. The role of institutions and social learning in soil conservation innovations: Implications for policy and practice (The paper has been resubmitted after the first review at the *Environmental Science & Policy* journal)

Dessie, Y., Schubert, U., Wurzinger, M., Hauser, M., 2012. The role of social capital for soil conservation (The paper is submitted to *Society and Natural Resources* Journal and it is under review)

Poster presentation

Dessie, Y., Wurzinger, M., Hauser, M., 2012. Assessing the impact of social learning and social capital for the adoption of soil conservation innovations: A case study in Northern Ethiopia. Tropentag 2012 Conference. 19-21 September, 2012.Göttingen, Germany.

Conference participation

Farmers' markets: market-oriented approaches to Sub-Saharan African agriculture. 21 March, 2012. University of Natural Resources and Life Sciences. 21 March, 2012. Vienna, Austria.

Social development and poverty reduction in East Africa: the role of social work. 26 June, 2012. Vienna, Austria.

Access to energy for all: the role of local initiatives for energy management. 5 July, 2012, UNIDO, Vienna, Austria

My life in Austria: Transforming social skills into intercultural competence. 25 February, 2012. Vienna, Austria.

Access to energy for all: the role of local initiatives for energy management. 5-6 June, 2012. International Institute for Applied Systems Analysis (IIASA), Luxemburg, Austria.

8. Appendix

Appendix 1: Soil degradation

Gully erosion (Picture: Yinager)

Appendix 2: Soil conservation innovations

Checkdam- to rehabilitate gullies (Picture: Yinager)

Stone terraces and plantations to rehabilitate a gully (Picture: Yinager)

Rehabilitated gully (Picture: Yinager)

Stone terraces on farm lands (Picture: Yinager)

Appendix 3: Data collection

Interview (Picture: Yinager)

Experts' group discussion (Picture: Yinager)

Farmers’ group discussion (Picture: Yinager)