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XX CICLO

The Role of Social Capital in the Adoption and the Performance of Conservation Agriculture. The Practice of *Likoti* in Lesotho

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Abbreviations and Acronyms

AFM	Apostolic Faith Mission
AIM	Africa Inland Mission
AIS	Agricultural Innovation Systems
AKIS	Agricultural Knowledge and Information System
BOS	Bureau of Statistics of Lesotho
CA	Conservation Agriculture
CBO	Community Based Organization
CF	Conservation Farming
CFNG	Conservation Farming Network Group
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture (
CV	Conventional Agriculture
DAO	District Agriculture Office
DFID	UK Department for International Development
EIU	Economist Intelligence Unit
FAO	Food and Agriculture Organization
FCS	Food Consumption Score
FFS	Farmer Field Schools
FFSSA	Forum for Food Security in Southern Africa
FFW	Food for Work
FHH	Female Headed Household
FO	Farmer Organization
FPR	Farmer Participatory Research
FSR	Farming System Research
GDP	Gross Domestic Product
HH	Household
IFAD	International Fund for Agricultural Development
IFPRI	International Food policy Research Institute
IIRR	International Institute for Rural Reconstruction
KVL	Royal Veterinary and Agricultural University
LASR	Lesotho Agricultural Situation Report

LDC	Less Developed Countries
LEC	Lesotho Evangelical Church
LVAC	Lesotho Vulnerability Assessment Committee
MAFS	Ministry of Agriculture and Food Security of Lesotho
MCA	Multiple Correspondence Analysis
MFS	Machobane Farming System
MHH	Male Headed Household
NARI	National Agricultural Research Institute
NGO	Non Governmental Organization
NIS	National Innovation System
NRM	Natural Resource Management
NUL	National University of Lesotho
ODI	Overseas Development Institute
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
R&D	Research and Development
SADCC	Southern Africa Development Community Countries
SSA	Sub-Saharan Africa
SWC	Soil and Water Conservation
TOT	Transfer of Technology
UNCCD	United Nations Convention to Combat Desertification (
UNDP	United Nations Development Programme
WB	World Bank
WFP	Word Food Programme
ZT	Zero-Tillage

CURRENCY EQUIVALENTS	Currency Unit = Maloti
	US$1.00 = M 7,1983 (exchange rate effective February 1, 2007. Source: South African Reserve Bank)
WEIGHTS AND MEASURES	Metric System

Introduction

Motho ke motho ka batho. Literally translated as "a person is a person because of other people", this Sesotho idiom means that *people* are such only in their relationships with each other. As in the whole Africa, in fact, also Basotho people used to rely on a complex web of livelihood strategies made primarily of family kinships and strong community networks. More recently, however, in many African countries, including Lesotho, widespread poverty, migrations, HIV/AIDS, and increasing pressure on land and other natural resources, have progressively depleted trust and caused household and community breakdowns. Fragile local institutions and weak social capital, in turn, affect growth and sustainable development.

Extensive land degradation and severe soil erosion, along with declining agriculture productivity, contribute to this vicious circle. Exacerbated by the dramatic effects of climate changes, in fact, they are at the same time an outcome and a cause of poverty and vulnerability. Challenged by so complex problems, national governments, development organizations and civil society necessitate innovative, multi-dimensional solutions in order to enhance the individual and collective capabilities needed to cut the vicious circle described above. This work focuses on two aspects which are likely – among others – to help this process. These are: the use of sustainable agricultural practices and the appropriate inclusion of social capital aspects in development strategies.

After nearly two decades of neglect, the role of agriculture and agricultural research in poverty reduction is once again receiving high-level political recognition. The World Bank's World Development Report 2008 "Agriculture for Development" and the process of radical transformation initiated in the same year by the Consultative Group for International Agricultural Research *(*CGIAR) in order to improve its performance, are just two examples of this renewed interest. The diffusion of conservation agriculture (CA), in particular, is considered by many NGOs and international organizations, including the Food and Agricultural Organization (FAO), as "the principal road to sustainable agriculture and capable of helping solve the world's hunger and environmental crises while improving the quality of life" (Declaration of the Second World Congress on Conservation Agriculture, Brazil, 2003). The potential of CA is regarded with special interest in Africa, where the extent of land degradation and the associated problems are worryingly increasing. This is demonstrated by the recent initiatives to introduce conservation practices in different African countries as well as by the organization of the Third World Congress on Conservation Agriculture in Nairobi in 2005.

The diffusion of conservation farming practices in the African context can be considered as an innovation process with regard to many aspects. Consequently, actors promoting CA should interact with farmers and other relevant stakeholders in order to facilitate the adaptation of the technology to the characteristics of the local farming systems. As emphasized by the most recent literature on agricultural innovation, however, a more participatory approach to innovation should not regard only the phases of technology adoption and adaptation. Rather, the entire course of innovation generation and diffusion should be the result of a social learning process to which several actors – with different objectives and needs, but also with different degree of social and political power – contribute.

Three factors are especially relevant to support the *innovation process*. These are: an adequate policy support to Agricultural Innovation Systems (AIS), the establishment of 'balanced' research partnerships, and social capital. Especially in unfavourable environments, in fact, the equal access to the potential benefits of an innovation depends on building local institutions, networks and organizations that help farmers to mobilize their scarce resources, enhance their innovation capabilities, and link them to external networks. Nonetheless, in spite of the wide support that this new approach to agricultural innovation has received (relevant institutions include, among the others, the International Fund for Agricultural Development (IFAD), the World Bank, and the International Food Policy Research Institute), it has rarely been translated into practice.

Drawing on these premises, the present study seeks two main objectives:

- to assess how social capital affects the effective and sustainable adoption of conservation farming, as an innovative set of agricultural practices capable to contribute to sustainable development in Sub-Saharan Africa (SSA)
- to derive consistent policy implications in order to maximize the benefits stemming from the adoption of innovative conservation practices in SSA, with a special focus on social capital

In order to achieve these objectives, the following hypothesis are discussed and verified:

I. Innovative conservation farming practices provide an effective solution to problems of land degradation, low agricultural productivity and food insecurity, thus contributing to poverty reduction and sustainable development in Sub-Saharan Africa (SSA)

II. Social capital plays a critical role in fostering the processes which enhance farmers' capabilities to innovate. Furthermore, it helps the sustainable adoption of innovation, by promoting its social acceptability also among the non-adopters

III. The preliminary assessment of the social capital characterizing a given group or community may critically influence the sustainability of policies and interventions which aim at supporting innovation processes

The discussion of the hypothesis is supported by a case study which empirically analyses the relationships between social capital and adoption of a particular conservation farming practice – locally called *likoti* – in Lesotho. The choice of the study case is motivated by different reasons. First of all, the impressive extent of land degradation, from which the country suffers, and the impacts that this has on agricultural output and, in turn, on food security, make the introduction of CA in Lesotho a particularly interesting case. Secondly, Basotho have experienced rapid economic and social transformations which are affecting their ability to cope with shocks and vulnerability. In particular, these trends have narrowed the range of livelihood strategies, including relying on social assets and, subsequently, farming. Therefore, understanding the potential role of social capital in the adoption of conservation practices in such a context of growing vulnerability, may be extremely useful also to outline consistent recommendations.

Further reason is the possibility to extend the results to other African countries that, although with some differences, are affected by the negative social and economic trends which characterize Lesotho. Last but not least, part of the baseline survey from which the data have been analysed, was originally conceived as a component of the present Ph.D. research. The questionnaires were designed (and the primary data collected) with the specific objective of describing the existing forms of social capital and the impacts they possibly had on the adoption and the performance of CA practices. The choice of the case study is thus motivated also by the great familiarity the author acquired with the local context under the implementation of the field survey.

The work wishes to offer an original contribution to both the literature on social capital and agricultural innovation. Many international development agencies and non governmental organizations have recently acknowledged the respective relevance of Social Capital, Innovation and Sustainable Agriculture to combat poverty and vulnerability. Nonetheless, relatively few studies so far have attempted to analyse empirically the multiple interactions existing among these three topics in a

specific field context, and the impacts they have on sustainable development. The need to further explore these subjects is particularly urgent in Africa, where people livelihoods are increasingly jeopardized by rapid social changes and ecological emergencies. By providing evidence of the role that social capital aspects may play in the effective adoption of agricultural innovation, the work seeks also to support the need for introducing innovative policies and practices related to innovation generation and diffusion and, more broadly, to rural development.

The methodology employed in the empirical analysis constitutes further original aspect. The use of graphical models, in fact, responds to the need of testing analytical instruments for assessing and measuring the impacts of social capital, alternative to those which have been conventionally used so far and which have shown several limitations. In particular, the empirical literature – both at micro and macro level – mostly rely on econometric tools which do not take into account the multi-dimensional nature of social and institutional phenomena as well as the complex linkages existing among social capital and other socio-economic variables. At the opposite, the use of Bayesian network allows to express interdependency relationships more complex than mere causality directions.

The thesis is divided into six chapters. Chapter One and Two review analytically the literature on social capital and agricultural innovation, with the aim of assessing the potential role of social capital in development processes, and in particular in the generation and diffusion of agricultural innovation. Chapter Three introduces the concept of conservation agriculture and its main principles. It then analyses the potential costs and benefits associated with its use in Africa and, on this basis, identifies the factors which mostly determine the effectiveness and the sustainability of adoption. Chapter Four introduces the case study and analyses the data collected under a household survey in order to assess the socio-economic and the environmental sustainability of the technique employed. Chapter Five seeks to describe the possible relationships among social capital and adoption of CA. To this aim, it tests the possible dependences among socio-economic, farming related and social capital variables through the structural learning of Bayesian networks. Finally, Chapter Six synthesises the key findings of the study and discusses the main policy implications.

Chapter 1 The Concept of Social Capital and its Role in Development

Usually the simplest way to introduce a complex topic is starting from its definition, but in the case of social capital this is not possible, since a (commonly accepted) definition does not exist. While anybody could intuitively describe this intangible entity, to clearly define the sources, the components and the functions of social capital can be a much trickier task. In addition, over the past decade, many new streams of research have been developed, so that the concept of social capital has been enriched, but also complicated, even more. As Portes (1998) observes, like other concepts exported from sociological theory to everyday language, "the original meaning of the term [social capital] and its heuristic value are being put to severe tests" and it "comes to be applied to so many events and in so many different contexts as to lose any distinct meaning".

In the economic literature, in particular since the work of Robert Putnam (1993, 1995), the use of the term social capital has been accompanied by a lively debate. Such debate relates to a number of aspects, of which the most relevant are: the possibility to agree on a single definition of social capital, the possibility to assimilate it to other "classical" forms of capital (namely physical, financial and human capital), and the possibility to detect and measure it. The debate can be summarized in three questions:

What is social capital?

Is social capital really "capital"?

How does social capital contribute to economic and social development?

The objective of this chapter is to introduce the concept of social capital, with a special focus on its potential role in fostering development processes at local level. The following paragraph focuses on the first question, or on the definition of the concept. Paragraph 1.2 tries to answer to the second question, supporting the argument that social capital can be assimilated to other forms of capital and thereby introducing the issue of measurement. Paragraph 1.3 takes into account the literature related to the relationships between social capital and development, mainly with regard to the less developed countries.

1.1 The definition of social capital: an analytical review

The origins of the term "social capital" have been traced back to Lyda Judson Hanifan (1916) who defined it as "those tangible assets [that] count for most in the daily lives of people: namely goodwill, fellowship, sympathy, and social intercourse among the individuals and families who make up a social unit […] If an individual comes into contact with his neighbor, and they with other neighbors, there will be an accumulation of social capital, which may immediately satisfy his social needs and which may bear a social potentiality sufficient to the substantial improvement of living conditions in the whole community." Ever since, the idea was almost completely abandoned until the Eighties, when the concept begun to receive considerable attention thanks to the separate work of the sociologists Pierre Bourdieu (1970, 1986), Mark Granovetter (1973, 1985) and James Coleman (1988, 1990). Most of these recent interpretations maintained at least two basic features of Hanifan's definition: "First, that goodwill, fellowship, and other social attributes have an instrumental value in terms of measurably improved living conditions. Second, that social capital has both private benefits and positive externalities" (Wallis et al., 2003).

To Bourdieu (1986), social capital is "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectively-owned capital." Just as other forms of capital, these resources are fully appropriable, and "the volume of the social capital possessed by a given agent thus depends on the size of the network of connections he can effectively mobilize and on the volume of the capital (economic, cultural, or symbolic) possessed in his own right by each of those to whom he is connected". Therefore, social capital is made of two elements: the social relationship itself, that allows an individual to gain access to the resources possessed by the participants to his or her network, and the amount and the quality of these resources (Portes, 1998). According to Rossing et al. (1999), this view emphasizes the *fungibility* of the resources, since also immaterial forms of cultural or social capital are transformed into the most material types of capital through economic and, most importantly, non-economic exchanges.

Mark Granovetter (1985) focuses on "the extent to which economic action is embedded in structures of social relations, in modern industrial society". All the economic institutions are made of inter-personal relations among agents, who take advantage of these formal and informal networks in order to get access to information more easily. Thus social capital is made primarily of personal

relationships and social networks which generate trust and discourage dishonesty in economic exchanges.

James Coleman uses the concept of social capital in the effort to import the economic principle of rational action into the analysis of social systems (Rossing et al., 1999). He gives a functional definition in which states that social capital is not a single entity, but "a variety of entities with two elements in common: they all consist of some aspect of social structure; and they facilitate certain actions of actors – whether persons or corporate actors – within the structure" (Coleman, 1988). Coleman sees social capital essentially as a collective resource that can take on three forms: (i) the obligations and expectations which depend on the trustworthiness of the social environment, (ii) the capability of information to flow throughout the social structure, (iii) the presence of norms accompanied by effective sanctions (Rossing et al., 1999). In practice, he includes in the concept vertical as well as horizontal associations, and also the behaviour within and among other entities such as firms (World Bank, 1998).

In the Nineties, a huge amount of literature on social capital flourished drawing on the original work of Bourdieu, Granovetter and Coleman. Several different definitions emerged from the renewed interest of economists, sociologists and political scientists, "mainly in the explanatory power of social capital with regard to spatial variation in economic and institutional performance" (Wallis et al., 2003). It is worthy to note that while the earliest conceptualizations paid attention – using the distinction by Uphoff (2000) – to both structural and cognitive aspects of social capital1, many later definitions emphasized some aspects rather than others. Indeed, two of the most prominent authors, Francis Fukuyama (1995) and Robert Putnam (1993, 1995), built their work on quite a narrow definition of social capital. According to the former, social capital is embedded in cultural factors such as ethical and moral behaviours, and can be measured by the degree of trust (Rossing et al., 1999). Whereas Putnam (1993) focuses mostly on a set of horizontal associations, namely the social networks ("networks of

[1] "Structural social capital facilitates information sharing, collective action and decision making through established roles, social networks and other social structures supplemented by rules, procedures, and precedents. As such, it is a relatively objective, externally observable and time persistent construct. Cognitive social capital refers to shared norms, values, trust, attitudes, and beliefs. It is therefore a more subjective and intangible concept. The two forms of social capital can be, but are not necessarily, complementary" (Uphoff, 2000, quoted in *Grootaert and van Bastelaer*, 2001).

civic engagement") – and the associated norms – that "can improve the efficiency of a society by facilitating co-ordinated actions".

According to Woolcock and Narayan (2000), Putnam's definition belongs to a "communitarian perspective" of social capital, which characterises those authors who equates social capital with local organizations such as club, associations and civic groups. Communitarians tend to identify and promote the positive aspects of horizontal networks – or bonding social capital, in the definition of Gittel and Vidal (1998) – assuming that homogenous groups cooperate in order to improve their own welfare. This approach takes into account only some manifestations (namely community and civil society organizations) of structural social capital and fails to consider that bonding "social capital is a double-edged sword" (Wallis et al., 2003) with a number of important downsides stemming from group isolation, sectarian interests, community pressure, social exclusion and so on. Portes (1998) lists at least four negative consequences of identifying social capital with horizontal networks: exclusion of outsiders, excess claims on group members, restriction of individual freedom, and downward levelling norms (*v. infra* paragraph 1.3).

The "networks view" refers to authors who stress the importance of vertical as well as horizontal associations, and the relations within and among these entities (Woolcock and Narayan, 2000). Intercommunity ties, or bridging social capital (Gittel and Vidal, 1998), counterbalance the negative effects associated with too strong horizontal ties. Moreover, the inclusion of extra-community networks allows for a wider perspective considering also the potential negative consequences of social capital on the society as a whole. In fact, assuming that social capital produces only desirable outcomes, ignores the possibility that these outcomes may be attained at another group's expense, or that desirable outcomes attained today are not sustainable in the future. In addition, including both intra-community and extra-community ties in the definition of social capital permits to avoid making tautological claims regarding its efficacy (Woolcock and Narayan, 2000).

A third and most encompassing perspective draws on North (1990) and Olson (1982) and includes the social and political environment that shapes social structure and enables norms to develop (World Bank, 1998). The "institutional view" refers to social capital also as formalized institutions such as government, the political regime, the rule of law, the court system, and civil and political liberties, on which the vitality of community networks and civil society depends on (Woolcock and Narayan, 2000). The communitarian and the networks perspectives largely treat social capital as an independent variable giving rise to various outcomes. The institutional view instead argues that social

capital is a dependent variable, since the capacity of social groups to act in their collective interest ultimately depends on the quality of formal institutions under which they reside (North, 1990).

Finally, Woolcock and Narayan (2000) use the term "synergy view" to refer to those scholars who integrate the definitions emerging from the network and the institutional approaches and stress the importance of "linking social capital" (Woolcock, 1998). Evans (quoted in Woolcock and Narayan, 2000) argues that synergy between government and citizen action is based on embeddedness and complementarity. Embeddedness refers to the nature and extent of the ties connecting citizens and public officials, while complementarity refers to mutually supportive relations between public and private actors. Communities and firms create the conditions that produce, recognize, and reward good governance. On the other hand, public formal institutions enable citizens to preserve and regenerate social capital in order to reach generalized welfare.

Drawing on the broader perspective of the "synergy view", in this work social capital (SC) is defined as: (i) the social relations within a group and among this and other groups, and (ii) the features and the norms that characterise these relations, (iii) which enable the individuals and/or the groups (through collective action) to reach desirable outcomes. This definition (i) equates social capital to all types of social interactions that can be established within a group or a community (networks, formal and informal associations, kinship and friendship ties,…) – or bonding social capital – and among different groups or communities (such as associations among members of different ethnic or religious groups, networks of associations,…) – or bridging social capital. Secondly, it includes (ii) the attributes (such as behavioural norms2, shared moral values, personalized and generalized trust3, …) as well as (iii) the formal and informal agreements through which these relationships work. Institutions, such as government and governance attributes, as well as traditional and customary rules, are not included in the definition because they can be considered a manifestation, rather than a component, of social capital. However, they are strongly related to the concept, since they play a critical role in the process of social capital (re)generation.

[2] For instance, specific and diffuse reciprocity (Coleman, 1990) and solidarity

[3] Fafchamps, 2004; Durlauf and Fafchamps, 2004

According to this conceptualization, both structural and cognitive manifestations of social capital have to be taken into account. Furthermore, horizontal and vertical ties are considered equally important in order to provide the group or the community members with appropriate combinations of bonding, bridging and linking social capital. In practice, the above definition attempts to establish a number of categories whose elements are chosen, each time, according to the relevance to a particular unit of observation/context. Indeed, a definitive list of elements valid at anytime is not feasible, due essentially to the fact that social capital is a situational and dynamic concept (Piselli, 1999). It is situational because as a result – at least in part – of historical patterns and cultural settings, different forms of social capital characterize different societies at different times. It is dynamic because it forms through a continuous regenerative process. In this process, formal institutions, such as an enforceable law system or an efficient bureaucracy, may be considered as manifestations of high levels of (or mature) social capital. At the same time, they can be included among the sources of social capital, since they can preserve the current set of social interactions and foster new ones, for example by ensuring the enforcement of contracts and fostering trustworthiness and reciprocity among individuals.

The above definition has also a functional connotation: among all the social interactions and the related norms and attributes on which a group and/or its members rely, (iv) only those which foster the achievement of valuable outcomes for the group and/or the group members count as 'capital', no matter what the original purpose of the social interaction was. In fact, beyond having an intrinsic social and cultural value, social interactions (along with their attributes) may positively contribute to the welfare of given groups or individuals also by generating at least one of the following externalities: they enhance the knowledge about other agents, thus attenuating the problems stemming from opportunistic behaviours; they overcome market failures, facilitating access to information and technological knowledge, thus providing forms of informal insurance and fostering innovation; they promote collective action, thus reducing free-riding and, in some cases, improving the effectiveness of existing public services (Narayan and Pritchett, 1997, Collier, 1998).

Although, as already mentioned, all the pioneer definitions are function-oriented, much of the current debate about social capital stems from the fact that the notion is topic-driven and functional, and as such runs the risk of becoming circular and tautological. "If one defines social capital as "those elements of the social structure that contribute to better social outcomes," then obviously it has been assumed rather than shown that social structures do matter for outcomes" (Narayan and Pritchett, 1999; Streeten, 2002). Nevertheless, just as a machinery does not constitute a physical capital until it is put to

work for the production of one or more goods, it is not possible to define social capital as the social interaction or the moral values or the norms *per se*. Indeed, the elements that can be assimilated to social capital, according to the definition given by this work, may be productive with regard to a certain activity or outcome but not to another one. In other words, with regard to the same objective, specific social interactions and related norms and institutions may constitute a capital for a particular unit of observation, but not for another one. Still, the same unit of observation may consider social capital as such in certain social and economic circumstances, but not at another time or in other conditions.

To summarize, social capital has to be defined by its function firstly because functionalism is intrinsic the definition of any type of capital. "Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence. Like physical capital and human capital, social capital is not completely fungible, but is fungible with respect to specific activities" (Coleman, 1990). Moreover, in order to avoid circular patterns of reasoning, it is critical to clearly define from the beginning the scope of the analysis, that is, on one hand, the unit of observation (a group of people, a community, or given individuals within a community), and on the other hand, which outcomes can be considered valuable by the chosen unit of observation.

This exercise is extremely important also to avoid the confusion that often stems from the identification of "negative" or "perverse" social capital. In fact, when the unit of observation and the scope of the analysis are well identified, there can not exist negative forms of social capital. As an example, the Ku Klux Klan certainly constituted a form of capital for those who could achieve their questionable objectives by joining the organization. For the non-members, and especially for its victims, the Ku Klux Klan was not a negative form of social capital. It did not constitute any capital at all. A simple analogy can be made with a factory which produces weapons. Although many would condemn the production and the commercialization of weaponry, no one would define a weapon factory as a form of "negative physical capital". As Rothstein (2001) remarks, social capital can not be negative in itself because "all assets are positive for the individual, group or organization that have them; however, like all other forms of capital, all assets can be used for different purposes without changing their normative quality as such".

Functional definitions of social capital have been criticised by several authors who highlight a frequent tendency "to confuse its sources with consequences or its existence with functions" (Portes, 1998; Durlauf; 1999; Streeten, 2002). This tendency in turn leads to infer the evidence of the existence

of social capital from its positive outcomes, eventually resulting in the exaggeration of its benefits and in circuitous reasoning (Quibria, 2003). Some of those who criticise the functional character of social capital have also pointed out that certain forms of social capital may have both positive and negative effects for some of the members belonging to the same unit of observation. It is often the case when strong horizontal ties, such as religious groups or kinship relationships, can be helpful to certain activities, like job seeking or relocation, but at the same time hamper individual initiative and freedoms (Granovetter, 1985, Portes, 1998). Such cases require careful evaluation, to which a clear definition of the sources, the components and the effects of social capital may be of great help. The functional definition given here comprises bonding, bridging and linking forms of social capital. That is, if bonding social capital hampers the development of some individuals in a certain community, it should be possible to state that this community is endowed with a certain level of social capital with regard to some desirable outcomes but not with regard to others. Moreover, if it is not possible to detect other forms of social capital apart from horizontal organizations, it will be necessary to call attention to the fact that higher levels (or mature manifestations) of social capital still need to be achieved by the community or the individuals under observation to foster additional welfare.

Social capital as an individual versus a collective resource is another source of debate. This issue is related to — but nevertheless distinct from — the question of collective versus individual ownership of social capital. Both positions have been advanced, and Putnam is perhaps the most well-known proponent of social capital as a collective asset (Grootaert and van Bastelaer, 2001). The definition given above comprises a notion of social capital primarily as an individual, appropriable, resource (Bourdieu, 1986; Loury, 1977). According to Loury (2000), "individuals are embedded in complex networks of affiliation […] and one's location within the network of social affiliations substantially affects one's access to various resources". Actors belonging to the same group or community might be endowed with different levels of social capital, depending on their ability to secure benefits by virtue of membership in social networks or other social structures (Portes, 1998). Nonetheless, social capital is also a collective resource (Portes, 1998; Lin, 2001). Due to the fact that it is embedded in social interactions – including those that did not come into existence with the explicit purpose of producing specific benefits – in some cases social capital itself can be considered an externality. Moreover, since the social interaction can result in collective benefits (thus producing externalities, *v. supra*), it might have the features of a public or a club good (Collier, 1998).

Finally, the vagueness of many definitions is a further debated aspect, that can produce ambiguous and even contradictory results (Fine, 1999; Streeten 2002). Narayan and Pritchett (1997) highlight the case in which the same relationships that constitute social capital for a group may at the same time exclude others, even in the same social setting. The case they mention could be the consequence of a badly-defined concept of social capital. However, the fact that two groups may regard the same forms of social capital differently, does not itself contradict itself the definition given here. In fact, a set of social interactions may well accrue to the group which constitute the unit of observation without contributing to more generalized welfare or even being detrimental for other groups or communities belonging to the same society4. This is because – as already stated – social capital is a situational and dynamic entity (Piselli, 1999). Second, this entity has to be identified by its function/s, which in turn depends on the unit of analysis. In order not to extend the concept of social capital too broadly, the research has to give meaningful and pragmatic content to the rich notion of social capital in each context and to define and measure suitable indicators (Grootaert and van Bastelaer, 2001). As it has been argued, the consistency of the results depends dramatically on the clear definition of the concept (which are the categories to be taken always into consideration) and on the accurate description of the scope of the analysis (which is the unit of observation and the relative valuable outcome/s under consideration).

1.2 Is social capital really "capital"?

In the economic literature, one of the most debated topic is the possibility to assimilate social capital to other forms of capital. That is, does the use of the term 'capital' have a solid foundation or is it just, in Solow's words (1999), "an attempt to gain conviction from a bad analogy"?

A common definition of capital is 'any form of wealth capable of being employed in the production of more wealth' or, more generally, 'an accumulable asset capable of generating a flow of benefits'. According to this generic notion, the entity that has been here defined as 'social capital' may well be considered a form of capital. In fact, it accumulates through a regenerative process and may accrue several benefits to its owner/s. However, the debate about the use of the term capital is not a

[4] Of course, forms of social capital which benefit a specific group but which are exclusive or even detrimental for outsiders are likely to have negative correlation with overall social development outcomes.

merely question of semantics. A major disagreement stems from the fact that it can be extremely difficult to measure and quantify the social capital inherent in a group or an individual, as well as its contribution to one or more outcomes (Solow, 1999, Sobel, 2002).

"While physical and human capital can be measured and their rate of returns calculated, such rigorous measurements are much more problematic in the case of social capital" (Solow, 1999). From a wider perspective, there is also disagreement about the possibility that groups and individuals, as well as external actors (such as government or development agencies), can deliberately invest in social capital in order to ameliorate their welfare. "In other words, although there is a general consensus that social interactions have important influences on economic outcomes, there is not much of a consensus whether these influences can be — or should be — meaningfully codified into such a metaphor as social capital" (Quibria, 2003).

Further characteristics of social capital which may be assimilated to those of other forms of capital are the "extension in time" (Quibria, 2003) (for instance, reputation or trust takes time to develop), and the need to make a deliberate sacrifice in order to attain future benefit. In fact, although social capital does not necessarily entail any material sacrifices, often individuals "make calculated decisions to join clubs, do favour, and maintain relationships with an eye towards future benefits" (Sobel, 2002). Bourdieu (1986) states that social networks are not a natural given and must be constructed through investment strategies. Therefore, the production of social capital is not costless. At the opposite, it often requires an investment — at least in terms of time and effort, if not always money (Grootaert and van Bastelaer, 2001).

The feature that mostly distinguishes social and human capital from physical capital is that the formers can accumulate as a result of their use. Nonetheless, just as these dissimilarities do not prevent assimilating human capital to other forms of capital, neither should be the case with respect to social capital. The key attribute of capital is that it is an accumulated stock from which a stream of benefits flows, and the perception of social capital as an asset means that it is more than just a set of social organizations or social values (Grootaert and van Bastelaer, 2001). Nonetheless, it is important to regard social interactions and civic engagement as a kind of *very special* asset with primarily an intrinsic value and not to ascribe a purely instrumental value to them (Sen, 1999, Wallis et al. 2003).

This work supports the view that social capital can be assimilated to other forms of capital both conceptually and operationally. Conceptually, the definition of social capital given in the previous

paragraph (*v. supra*, paragraph 1.1) incorporates a notion of capital seen as the aggregation of inputs, intermediate goods and final products which can be re-invested in a continuous regenerative process. In fact, several assets of the social capital stock, such as trust but also formal institutions, may be at the same time input and output of the accumulation process. According to Bourdieu (1986), social capital is constructed through intentional investments oriented to the institutionalization of group relations, "usable as a reliable source of other investment".

1.2.1 The issue of measurement

The operative use of the concept of social capital still faces several constraints related to measurement issues. Ideally, it should be possible to identify a contextually relevant indicator of social capital and to establish an empirical correlation with relevant benefit indicators. However, obtaining a single, true measure is probably not possible, for several reasons (Woolcock and Narayan, 2000). First, social capital is a multidimensional entity, incorporating different levels and units of analysis, thus in most cases it is impossible to synthesize all dimensions in one single variable. Second, like human capital, social capital is extremely difficult to measure directly; as a result, it is necessary to draw on proxy indicators. These measurement proxies, in turn, have to be tailored – time by time – to the unit of measurement. Hence, it is and it will be quite unlikely in the future to identify a few 'best indicators' that can be used everywhere and anytime (Grootaert and van Bastelaer, 2001). Due to its strong contextual character, the nature and the forms of social capital change depending on spatial and temporal factors. Finally, it has not been possible so far to identify a set of universally accepted indicators because "no long-standing cross-country surveys were initially designed to measure social capital and contemporary researchers have had to compile indexes from a range of approximate items (measures of trust, confidence in government, voting trends, social mobility, and so on)"(Woolcock and Narayan, 2000).

Nevertheless, several studies have identified useful measures of social capital5, and some have even proposed composite single indicators incorporating different dimensions6. The most recurrent

5 Among the most influential empirical studies: Putnam (1993, 1995) developed a measure of social capital based on density of formal horizontal networks, also known as "Putnam's Instrument", in a work aiming at explaining the different development performance of the Italian regional governments and, later on, to emphasize the loss of social capital in the US society. Knack and Keefer (1997), used data from the World Values Surveys for a sample of 29 countries to get direct

variables in these studies are density of associations (formal and informal, horizontal and vertical), heterogeneity of membership in associations, and degrees of active participation in them. Some take into account also the norms and the values that characterize the associational activities and represent the cognitive dimensions of social capital (Woolcock and Narayan, 2000). Both structural and cognitive dimensions matter in the assessment of social capital, and they must be combined to represent the aggregate potential for mutually beneficial collective action (Krishna and Shrader, 2000).

Some empirical researches have attempted to identify universally valid indicators. For instance, Bjørnskov and Svendsen (2003), drawing on the review of ten well-known empirical studies at the macro, meso and micro level, have inductively identified the four most recurrent proxy variables observed so far: generalized trust, density of voluntary organizations, measure of corruption, and measure of political rights and civil liberties7. By applying principal components analysis, the authors then show that these four indicators all powerfully load onto one single underlying component, concluding that they all can be employed as relevant proxies of social capital. Probably the strongest effort to provide a uniform measure of social capital – at least at micro-level – has been made by the World Bank, that under the Social Capital Initiative8, has developed a Social Capital Assessment Tool (SOCAT) and a Social Capital Integrated Questionnaire (SOCAP IQ)9.

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measures of trust and civic cooperation. These two indicators were then used as proxies for social capital and they showed to be positively related with economic performance. Narayan and Pritchett (1999), undertook a "Social Capital and Poverty Survey" (SCPS) to illustrate the impact of social capital on economic welfare in selected rural villages in Tanzania. The SCPS included questions about three dimensions: membership in various voluntary associations and groups, existence and role of social and civic norms, individual's attitude towards others.

6 Some studies have explored the possibility to obtain a synthesis indicator of social capital, usually employing factor analysis techniques such as principal components. Among the others, Krishna and Uphoff (1999), Bjørnskov and Svendsen (2003), Dekker (2004), Krishna (2004), Sabatini (2005).

7 These are: (i) at the micro-level, generalised trust – measured by the percentage of a population answering confirmatory to the question "do you think that most people can be trusted, or can't you be too careful? – may be an inclusive, horizontal measure of social capital; (ii) at the meso level, the density of voluntary organizations in a given country – also known as Putnam's Instrument – provides a measure of individual network density, which constitutes a more exclusive and less horizontal measure also addressing civic participation; (iii) corruption is an indirect measure of social capital too; at the meso-level, captures illegal asymmetric, horizontal social relations that enable people to extract gains from vertical relations with formal institutions; at the macro-level, captures citizens' trust in institutions; (iv) finally, at the macro level, the measure of political rights and civil liberties – obtained from the Freedom House annual assessment of economic freedom – characterizes the quality of formal national institutions thus capturing the vertical dimension of social capital.

8 The World Bank Social Capital Initiative (SCI), funded by the Government of Denmark, was launched to help advance the theoretical understanding and the practical relevance of the concept. It had three objectives: (i) to assess the impact of social capital on project effectiveness; (ii) to demonstrate that outside assistance can help in the process of social capital

Despite the progress made in identifying social capital measures, the empirical research still encounters several problems in testing correlation between such measures and development outcomes. Sabatini (2006) identifies two main problems affecting the studies conducted at macro level: the first one is the use of macro indicators not directly related to social capital's key components. The studies which rely upon outcomes of social capital as indicators of it, find social capital tautologically present whenever an outcome is observed, adding confusion to what social capital is (Portes, 1998, Durlauf, 1999, Stone, 2001). The second main problem is related to 'aggregation'. A large proportion of existing cross-national studies are based on measures of trust drawn from surveys such as the World Values Survey. But trust measured through surveys is a *micro* and *cognitive* concept, in that it represents the individuals' perception of their social environment. By contrast, "the aggregation of such data creates a measure of what can be called "macro" or "social" trust which looses its linkage with the individuals' subjective perception" (Wallis et al., 2003; Sabatini, 2006). Another problem related to aggregation is that in the presence of fallacy of composition or free riding, individual returns from social capital are poor indicators of aggregate returns. In the case of fallacy of composition, for example when groups or individuals compete for a finite resource, there are groups which benefit from the social capital generated by themselves or others, but society as a whole does not. Free riding is the opposite situation

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formation; and (iii) to contribute to the development of indicators for monitoring social capital and methodologies for measuring its impact on development. Between 1996 and 2000, the SCI implemented 12 original research projects and 23 empirical cases, and produced several publication including 24 Working papers and two books. The SCI also contributed to the formalization of methodologies for the assessment of social capital such as the Social Capital Assessment Tool (SOCAT) and a social capital module was created to supplement the widely used living standards survey instrument (LSMS) in order to integrate social capital analysis into poverty assessment. All the SCI materials are available at the World Bank website.

9 The SOCAT is an integrated quantitative/qualitative tool designed to collect social capital data at the household, community and organizational levels. It is made of three key components that were tested in over 25 studies conducted in 15 countries worldwide. The first component is a community profile which integrates participatory qualitative methods with a community survey instrument to identify features associated with social capital in a particular cultural and institutional context.. The second component is a household survey which includes 39 close-ended items that relate to the structural dimension of social capital and 21 close-ended items that relate to its cognitive dimensions. In order to facilitate the application of quantitative analyses for measuring social capital, this instrument has to be administered to a large number of individuals or households selected through an appropriate process of random sampling.. The third component is an organizational profile designed to delineate the relationships and networks that exist among formal and informal institutions. It integrates semi-structured interview data with a scoring system for assessing organizational capacity and sustainability. The three instruments may be applied separately, sequentially or simultaneously, for a wide range of applications among different countries and cultural contexts (Krishna and Shrader, 1999). The Social Capital Integrated Questionnaire (SOCAP IQ), originally pilot-tested in Albania and Nigeria, is a tool which aims to generate quantitative data on various dimensions of social capital as part of a larger household survey (such as the Living Standards Measurement Survey or a household income/expenditure survey). Specifically, it includes six dimensions: groups and networks; trust and solidarity; collective action and cooperation; information and communication; social cohesion and inclusion; empowerment and political action.

in which social capital generates positive externalities but yields few returns for its holders. It is also possible that the external effects of social capital are fully captured by individuals or groups who are outside the social networks. In these cases the aggregate social gains are larger than those appropriated by the owners of social capital (Durlauf and Fafchamps, 2004).

Wallis et al. (2003) point out that "the empiricists' treatment of social capital indicators as independent variables in neoclassical growth functions makes an unrealistic assumption that social and institutional phenomena can be considered as one- or two-dimensional concepts". According to the author, the practice of modelling social capital can be of little use in investigating such an inherently context-dependent, micro-level concept, since data analysis should express interdependency relationships more complex than mere causality directions (Narayan and Pritchett, 1997; Bjørnskov and Svendsen, 2003; Sabatini, 2006). Dasgupta (2002) argues that the role of social capital in growth cannot be reduced to the addition of a variable to a linear cross-country growth regression, especially since functional notions of social capital are inconsistent with rigorous theorizing. Similarly, Durlauf (2002) raises a more general critique of the empirical social capital literature, asserting that it "seems to be particularly plagued by vague definition of concepts, poorly measured data, absence of appropriate exchangeability conditions, and lack of information necessary to make identification claims plausible" (Durlauf, 2002). Although these features pose serious constraints to the use of econometrics, most of the studies run regressions of some outcome of interest against a set of controls and some asserted empirical proxies for social capital (Durlauf and Fafchamps, 2004)10.

Statistical analyses that compare outcomes for individuals or aggregates that have social capital versus *those who do not*, typically do not incorporate a separate theory of the determinants of social capital formation. Without explaining the sources of the differences in social capital formation, one cannot have much confidence that unobserved heterogeneity11 is absent in the samples under study,

10 Durlauf (2002) identifies three issues that are especially important in evaluating econometric approaches to measure social capital dimensions: exchangeability, model specification and identification, and aggregation. Exchangeability says that a researcher has no prior way of distinguishing errors in a structural model; partial exchangeability says a researcher has no way of distinguishing two dependent variables were they to be associated with the same controls. Many of the standard sources of inconsistency in parameter estimation are interpretable as exchangeability violations (Durlauf, 2002).

11 Unobserved heterogeneity is the case when some kind of correlation between observables and unobservables is expected. This leads to violation of exchangeability – that observations with the same values for all covariates are otherwise identical – and to misspecification of the model.

even where instrumental variables to account for the endogeneity of social capital are employed. A further source of exchangeability violation in studies that employ aggregate data could be the use in a common regression of non comparable observations12. Therefore the data used by these analyses are very likely to possess conditionally exchangeable errors.

The specification of the models may be biased by the problem of endogeneity13. In many contexts social capital is an endogenous variable. For instance, membership in organizations is a choice variable; similarly, trust presumably is related to trustworthiness in actual behaviour. Many researchers have recognized that social capital is endogenous and so have employed instrumental variables to allow for consistent estimation of parameters. But in many social capital studies the choice of instrumental variables appears to rely on ad hoc and untenable exogeneity assumptions14, due to the absence of explicit modelling of the process by which social capital is created.

Durlauf and Fafchamps (2004) conclude with a number of recommendations. First, empirical analyses should move from the "grandiose approaches to social capital" towards the analysis of specific social components of individual behaviour. On the other hand, the importance of experimental evidence should not be exaggerated since results can not be always generalized. Moving the focus away from generalities to specific mechanisms should also allow us to deal with issues of endogeneity

12 For instance, Helliwell and Putnam (1993) regress regional output growth in Italy against initial output and measures of civic community, institutional performance, and citizen satisfaction. They find that these three measures explain persistent differences in regional growth rates and conclude that this supports social capital influence on economic performance. One questionable hypothesis that underlie such a conclusion is the assumption that the regression they employ is using comparable objects as observations. In other words, the analysis assumes that each observation is generated by a common growth process, that is not compatible with the conclusion they reach (Durlauf and Fafchamps, 2004).

13 Endogeneity refers to the fact that an independent variable included in the model is potentially a choice variable, correlated with unobservable variables relegated to the error term. Endogenous variables in causal modeling are the variables with causal links (arrows) leading to them from other variables in the model. In other words, endogenous variables have explicit causes within the model.

14 For example, Narayan and Pritchett (1997, 1999) study the role of social capital in influencing household outcomes in rural Tanzania. They recognise that their social capital measure is endogenous and so used trust variables, namely individual's trust in strangers and trust in various government officials, as an instrumental variable. They assume that these trust variables do not affect directly – and are not affected by – household income, but are positively associated with the village social capital. The variable that measures trust in strangers is likely to be determined by trustworthiness, i.e. it reflects the actual behaviour of others in a society. According to Durlauf (2002), assuming that individual expenditures/income depend on the expected level of trust in society is quite a controversial assumption. Whereas the use of the trust in government officials measure as an instrument poses a question of exchangeability. Usually differences in trust of officials have something to do with differences in their performances. But if so, families who live in villages with high levels of trust in officials would not be partially exchangeable with families in villages that have low trust (Durlauf, 2002).

and exchangeability more effectively, since it can facilitate more precise and comprehensive modelling of causal mechanisms. Survey data collection is a second area that can facilitate the study of social capital. Future data collection exercises should explicitly attempt to gather information on group-level influences, for instance including measures of the quality of leadership, rather than on social capital alone. Moreover, the effectiveness of surveys is augmented when attention is paid to the uses to which the data will be applied. Third, the authors recognize the limits of statistical analysis in the evaluation of social capital, and recommend integrating it with the use of non-statistical evidence to better motivate assumptions and suggest appropriate ways for formulating hypotheses.

1.3 The Role of Social Capital in Development

The interest in social capital often stems from the view that its absence represents a major impediment to social and economic development (Durlauf and Fafchamps, 2004). Traditional approaches which measure development opportunities on the basis of natural capital, physical or produced capital, and human capital explain only partially the improvements of social and economic conditions, because they overlook the way in which the economic actors interact and organize themselves to generate growth and development. *The missing link is social capital* (Grootaert, 1998). At a broad level of conceptualization, there is little disagreement about the relevance of social capital to development processes. However, no consensus has been reached so far about which aspects of social interaction and organization merit the label of social capital. Nor in fact it is still clear if these aspects of social interaction can be actually assimilated to other forms of capital and if, as such, it is possible for development practitioners to include them in investment strategies. The previous paragraphs dealt with the issues of the definition of social capital and the appropriate use of the term 'capital', along with a discussion of the measurement challenges. The present section reviews briefly the literature on social capital and development, defined broadly as the achievement of improved living standards through the enhancement of individual and collective capabilities. It first describes – at a general level – the potential effects of social capital on development and the channels through which it works. It then reviews specific fields of application, focusing on developing countries. Finally, it introduces the debate on the possibility to deliberately invest in social capital as part of broader development strategies.

As already mentioned in paragraph 1.2, social interactions (along with their attributes) may positively contribute to the well-being of given groups or individuals by improving the efficiency of

their actions through at least one of the following externalities: they enhance the knowledge about other agents, thus attenuating the problems stemming from opportunistic behaviours; they overcome market failures, facilitating access to information and technological knowledge, thus providing forms of informal insurance and fostering innovation; they promote collective action, thus reducing free-riding and, in some cases, improving the effectiveness of existing public services (Narayan and Pritchett, 1997; Collier, 1998). Drawing on an extensive review of the empirical literature, Durlauf and Fafchamps (2003) identify three types of channels by which social capital improves efficiency of social and economic activities thus contributing to well-being objectives. The first one is (i) information sharing. The sharing of information is a by-product of social interaction; to the extent that the shared information is economically useful, socialization generates a positive externality. However – the authors argue – guaranteeing that accurate information is transferred through social networks requires the existence of punishment mechanisms such as the loss of reputation or penalizing false reporting. Moreover, beyond imperfect information there often are other sources of inefficiency, such as imperfect contract enforcement and insufficient protection of property rights. This is why other important channels by which social capital works are (ii) group identity, and (iii) explicit coordination.

It has been often argued that social capital favours altruism and raises concerns for the common good. Economic experiments using the "dictator game" and the "trust game" suggest that group identification may induce agents to exhibit more altruism and play more cooperatively. This is true even if members of the group are unknown and even if they do not even see each other during the experiment. (see, fro instance, Fershtman and Gneezy, 2001). Group identification may foster social capital effects also through mimicry and by magnifying the effectiveness of reputation related sanctions. However, whenever the benefits of social capital require some degree of coordination and purposeful group action in order to be achieved, two factors become critical: leadership, or capable agency (Krishna, 2004), and rules regarding group decision making.

In very informal groupings, leadership is likely to be essential to alter individual preferences and elicit voluntary contributions to the common good (Durlauf and Fafchamps, 2004). Studying the development performance of 64 rural villages in Rajastan, India, Krishna (1999, 2001, 2004) finds that

social capital, capability of new agents15, such as recently elected young village leaders, and literacy, are significantly associated with high development performance. However, using a regression model, he shows that it is the combination of social capital and agency which mostly affects local development. Social capital represents a potential for beneficial collective action, but it needs to be activated, and new leaders, or capable agents, can help citizens to get access to information about the processes of decision making and to gain access to the officials who make and implement these decisions. That is, agency is important since it enables the effect of social capital to flow from localized social networks into decision making at higher level, thus enabling the achievement of more general development outcomes (Krishna, 2004. See also Fafchamps, 200216, Maizen-Dick, 2004, Reid and Salmen, 2000).

Explicit coordination can also be obtained through formal rules. When the enforcement of rules decided by the group is guaranteed by the existence of efficient institutions (usually at higher stages of economic and institutional development), leadership also becomes less critical. In *Governing the Commons* Elinor Ostrom (1990) stress the importance of the "logic of collective action" and states that congruent rules, graduated sanctions, and recognized conflict resolution mechanisms – among other factors – are fundamental characteristics for the successful exploitation of common pool resources. Based on a study of groups of forest users in Nepal, Varughese and Ostrom (2001) find that measures of ethnic, caste, and religious homogeneity are not good predictors of the levels of collective action, while institutional design, how decisions are made, etc, may well overcome barriers to cooperation that are induced by heterogeneity. Table 1.1 summarizes the discussion above on the potential role of social capital in the achievement of development outcomes.

15 According to the definition provided by Sen (1999), agent is "someone who acts and brings about change, and whose achievements can be judged in terms of her own values and objectives, whether or not we assess them in terms of some external criteria as well". Agency is important particularly in situations where institutions are not available that enable citizens to connect with the state and with markets (Krishna, 2003).

16 Author's discourse at the Roundtable "Social Capital: The Value of the Concept and Strategic Directions for World Bank Lending", held at World Bank headquarters on March 1, 2002.

Table 1.1 Social capital related positive effects on development and main channels through which they manifest

SC "by-products" and related positive effects	Main channel/s by which positive effects manifest themselves	Related aspects
Enhanced knowledge about other agents discourages opportunistic behaviours	Transparent information sharing Group identity	Reduced imperfect information Enhanced cooperation Reputation related sanctions
Facilitated access to information and technological knowledge overcomes market failures provides forms of informal insurance fosters innovation		
Enhanced collective action reduces free-riding improves effectiveness of existing public services	Explicit coordination	Leadership and capable agency Respect of rules regarding group decision making

Source: Author's elaboration

The forms of social capital – or the features of the social interaction – also matter for the achievement of development outcomes. It is now commonly accepted that homogeneous, horizontal organizations, or bonding social capital, are very important to poor communities in order to "get by", but that vertical interactions and heterogeneous group, or bridging social capital, are even more important in order to "get ahead". In Woolcock's words (1999), "development is more than just a matter of playing a good defence; it also entails knowing how to initiate and maintain strategic offence". However, due to the dynamic and situational essence of social capital, it is very difficult to establish which characteristics and in which combinations count most within each context. Optimal combinations of bonding and bridging social capital, in relation to different outcomes, change over time for the same group or society.

In spite of all the potential positive effects that have been identified, the links among social capital and overall development outcomes are not straightforward. As already mentioned, the same resources that are regarded as social capital by given individuals or groups can have less desirable consequences either for the rest of the society or even for members of the same group. For instance, bounded horizontal networks are very often exclusive of outsiders, but they can also have possible negative consequences for insiders (Portes, 1998, Streeten, 2002). Community closure may prevent the success of business initiatives by their members, and can also lead to excess claims on group members, if free-riding problems arise due to less diligent members. Furthermore, usually community closure creates demand for conforming, resulting in the restriction of individual freedom. Finally, when group

solidarity is cemented by a common experience of adversity to mainstream society, individual success stories undermine group cohesion. The result is downward leveling norms that operate to keep members of a down-trodden group in place and force the more ambitious to escape from it (Portes, 1998). Frankenberger and Garret (1998) highlight the risk stemming from the breakdown of generalized trust based mechanisms. The increasing inequalities in the distribution of income, resources and opportunities have exacerbated the economic vulnerability of the poor, leading to high rates of mobility and unemployment. As people are becoming more mobile, decentralized choice-based networks17 based on balanced reciprocity are becoming more important than community based groups founded on generalized reciprocity. Choice-based networks tend to be more resilient in terms of membership (Fafchamps, 1992), but at the same time they often remain small, local, and fragile, since they may easily break up over trust concerns. Members can receive support for short-term shocks through loans, and through provisions of advice, information and connections, but the most vulnerable, marginal ones are often excluded because they have little to offer in exchange. "Essentially, social capital as a community asset available to everyone is evolving to an individual asset based on the ability to meet reciprocal obligations" (Frankenberger and Garret, 1998). All these issues need to be taken into account in the analysis of the possible relationships among social capital and development.

Since the Nineties, several studies have analysed the relevance of social capital to socio-economic development, both in developing and developed countries. While the results of the empirical literature on developing countries usually agree with the above statements about the channels and the forms by which social capital works, when focusing on advanced economies, the effects of social capital on social and economic improvements are less obvious (Durlauf and Fafchamps, 2004). One possible explanation is that the optimal features of social interactions change depending on the historical background and the cultural setting. Also diverse levels of economic development may count for the different extent to which social capital affects positive outcomes. For instance, clubs and networks seem to be important at intermediate levels of development, when their function is to broaden

17 Choice-based networks are informal and formal networks based on choice and gained through experience or institutional membership. People may create friendships through school, work, service, political affiliation, church, or sports clubs (Frankenberger and Garret , 1998).

the range and speed of social exchange beyond the confines of inter-personal trust in order to achieve high level of generalized trust (bridging social capital) (North, 2001).

Societies which rely on modern political and economic systems, have developed formal institutional mechanisms, such as legal institutions and state organizations, in order to overcome possible inefficiencies stemming from scarce enforcement of rules, high transaction costs, imperfect information and so on. In these contexts, networks and other collective action strategies are rarely embedded in a local community; rather they mostly correspond to choice-based networks, and thanks to the modern technologies they may assume disparate, original forms. Even though these networks seem not to affect directly the overall system, they play a major role in monitoring the operation of governments and other formal institutions (including markets), thereby influencing the course of democracy, the effectiveness of institutions, and ultimately development. This virtuous cycle contributes also to the (re)generation of social capital, for example by strengthening the cohesion of the civil society. In other cases, the substitution of traditional rules and informal networks for formal, macro-institutions may lead to the progressive decline of social interaction and trust, due to an increasingly lazy collective action. Differently, societies affected by severe market failures and inefficiencies of formal institutions, such as in most African countries, are more likely to rely on 'local' social capital in the form of community based networks and kinship relations. But, as it has been said, even though bonding social capital may work through the channels described above in order to enhance collective action at group or local level, it rarely helps achieve broader development outcomes.

In accordance with the purpose of this work, the review of the empirical literature presented in the next section, focuses primarily on the studies regarding less developed countries and in particular rural development issues.

1.3.1 The empirical literature on social capital and development

The literature on the effects of social capital on development may be divided into two types: macro-level aggregate studies and micro-level studies. Aggregate social capital studies focus on both developed and developing countries and focus mostly on country-level politics18, policies and public

18 Among the others: Easterly and Levine (1997) show that a measure of "ethnic heterogeneity" is empirically associated with the adoption of bad economic policies, which they attribute to the importance of distributional conflict among groups;

sector efficacy19 and economic growth20. Among the most important variables identified by this branch of research are civil and political liberties, political stability and the absence of political violence, and measures of contract enforcement, expropriation risk, corruption and the quality of government bureaucracy (Grootaert and van Bastelaer, 2001).

Probably one of the most influential studies at aggregate level is the work of Putnam (1993), who explains the different institutional performances of the Northern and the Southern Italian regional governments with different degrees of 'civicness' and horizontal connections. He identifies a positive correlation between social participation and institutional performance, and argues that a community characterized by social networks, strong civic engagement, and generalized trust and reciprocity improves the efficiency of the public institutions, thus fostering economic development and, in the long run, the growth rate. Putnam attributes the different features of the civil society in Northern and Southern Italy to the different historical and cultural backgrounds, leaving small room for appropriate policies to change the course of history. His deterministic conclusions have been strongly criticized and also refuted by subsequent studies (Mutti, 1994; Trigiglia, 1999; Bagnasco, 1999). Similar critiques have been applied to Fukuyama, who identifies the values embedded in the cultural roots as the determinants of social capital, equated with trust (Bagnasco, 1999). Further critiques of Putnam's work

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Paldam and Svendsen (2001, 2004) argue that heavy power centralisation during communism may explain why the general level of social capital in former communist societies in Eastern Europe is roughly half of the level found in Western Europe.

19 Among the others: Putnam, Leonardi and Nanetti (1993) conclude that regions of Italy in which people had greater degrees of horizontal connections had more efficacious governments; Alesina, Baqir and Easterly (1997) show that greater ethnic fragmentation in U.S. cities leads to lower spending on productive public goods and is negatively related to the share of local spending on welfare; Uslaner (2001) and Bjørnskov (2003), both using generalized trust as proxy for social capital, find that the influence of trust on corruption is substantially stronger than the reverse causal link; Lutz (2004, 2005) using cross-sectional time series data from a large group of African countries, examines the effects of income, institutions and social capital—with emphasis on the latter—on literacy and life expectancy. The empirical results confirm that income has a positive contribution to both, while an improvement in institutions has positive influence on literacy but does not seem to affect life expectancy. Moreover, interaction between good institutions and high social capital produces a positive contribution to human well-being, suggesting that social capital and institutions are complements.

20 Among the others: Fukuyama's (1995) focus on the relationships between trust and the various attitudes toward different "civilizational" cultures and economic modernization; Knack and Keefer (1997) examine the relationship between trust, norms of civic cooperation, associational activity, and aggregate economic growth and investment rates; Whiteley (2000) incorporates a measure of social capital (constructed by a principal components analysis of three trust variables from the third wave of the World Value Survey) as an explanatory variable into an endogenous growth model, and regresses GDP per capita in a sample of 34 countries along with several other explanatory variables.

relate to the narrow notion of social capital, mainly seen as bonding social capital[21] (*v. supra*; paragraph 1.1) (Knack and Keefer, 1997, Wallis et al., 2003), and to the use of econometric analysis.

Most empirical studies at macro-level in fact rely on econometric cross-country analysis whereby indicators of economic performance are regressed on conventional growth determinants and measures of social capital (for instance, the work of Knack and Keefer, 1997). Yet, the econometric approach has been subjected to several methodological critiques (see paragraph 1.2.1). First, there is a problem related to the choice of control variables. This problem may be exacerbated by the fact that social capital models are often not well specified. Moreover, social capital studies often fail to meet exchangeability requirements. Finally, beyond questions concerning the choice of variables and the comparability of observations, there may be problems in the causal interpretation of the regression results, especially if endogenous variables have been used or if instrumental variables have been chosen on the basis of weak assumptions.

Generally speaking, scholars agree that macro-level aggregate studies have been less convincing in explaining the relationships between social capital and development outcomes, compared to those focusing on specific development aspects at micro-level (World Bank, 1998; Foley and Edwards; 1998; Portes, 1998). Micro-level empirical research can be divided in studies that focus on OECD countries – interested in explaining the persistence of social exclusion and poverty in richer societies – and studies that focus on developing countries – interested in more general socio-economic development problems (Durlauf and Fafchamps, 2004). According to the purpose of the present work, the rest of this paragraph briefly reviews the literature focusing on developing countries. These studies are quite disparate; however they share some common features. For example, they usually focus on measures describing social networks in which individuals participate. Furthermore, they focus on social interactions that can provide economic benefits through information sharing and the production of public goods. Narayan and Pritchett's study on the impact of social capital on income in rural Tanzania (1997) is a standard citation in this branch of the literature. They use a combined quantitative measure of cognitive and structural social capital to examine the links between social capital and village-level

21 Moreover, Knack and Keefer (1997), in their cross-country investigation, find that horizontal networks – measured as membership in groups – are unrelated to trust and civic norms and to economic performance. While trust and civic cooperation are associated with stronger economic performance, associational activity is not – contrary to Putnam's findings.

economic performance (*v. supra,* paragraph 1.2.1) and find a positive strong correlation between them. Drawing on the most influential literature, Narayan and Pritchett (1997, 1999) also identifies five broad fields of application (common pool resources, diffusion of innovations, imperfect information, markets for insurance, and effectiveness of public services) and verify that their findings confirm the relevance of social capital to all of them. In the following section, for each field of application a brief literature review is presented.

Common pool resources

Drawing on an investigation into the different dimensions of social capital in Western Uganda, the International Centre for Tropical Agriculture (CIAT, 2004), showed that endowments in certain dimensions of social capital, along with synergies between social capital and local policies, decreased the occurrence of conflicts, and played a significant role in minimizing conflicts in natural resource management (NRM). Studying the implications of social capital and connectedness for agriculture, rural development and natural resource management, Pretty (2003) identifies seven sectors to which social interactions and community participation mostly matter; these are: watershed management, irrigation management, micro-finance delivery, forest management, integrated pest management and farmer field schools (FFS), wildlife management, and farmers' research groups. That is, four out of seven sectors concern the management of common pool resources; two deal with diffusion of innovation and one – micro-finance delivery – deals with imperfect information and markets for informal insurance.

Indeed, there are several studies that focus on the importance of social capital for the successful exploitation of common pool resources. Ostrom's (1990) suggests that the ability of local groups to cooperate (the "logic of collective action") plays a key role in avoiding the negative consequences of either excessive exploitation or under-maintenance of assets that are likely to occur under open access. Ahuja (1998) shows that in Cote d'Ivoire the degree of land degradation is worse in more ethnically heterogeneous villages, suggesting that a difference in the effectiveness of community controls and cooperation depends on social factors. In a study on watershed management in Rajasthan, India, Krishna and Uphoff (1999) develop a social capital index that combines an equal number of structural and cognitive factors and then show that this index, along with political competition and literacy, has a significant and positive association with both watershed management and broader development outcomes. Nyangena (2004) shows that in Kenya, the adoption of soil conservation technology

increases with trust, group activities and past adoption, while learning effects from other farmers are significant but declining over time.

Diffusion of innovations

In his review of the empirical research on the diffusion of innovations, Rogers (1983) finds out that "social participation", "interconnectedness with the social system", "exposure to interpersonal communication channels", and "belonging to highly interconnected systems" are each positively associated with the early adoption of innovations (Narayan and Pritchett, 1999). Among the studies that document the importance of social interactions to the diffusion of innovation, Reid and Salmen (2000) find that in Mali trust – measured with indicators of trust between farmers and extension agents – is the key factor in making agricultural extension successful. The study also documents the importance of dynamic external agents and pre-existing social cohesion, implying that extension workers, and development agencies in general, need to gain an operationally relevant understanding of the social and institutional fabric in places where they work. The relevance of social capital to the diffusion of innovation has been documented also by: Narayan and Pritchett (1997) in their village-level study in Tanzania; Heemskerk and Wennink (2004), with an extensive piece of research on the role of farmer groups in agricultural innovation; Isham (2000, 2002), who implements a model of technology adoption with data on fertiliser adoption in Tanzania. It is worthy to notice that most of the studies mentioned here focus on innovations in rural contexts, and often deal with agriculture. Nonetheless, there exists also a wide literature on the role of social interactions in other kinds of systems of innovation. The next chapter treats extensively the relationships among social capital and the generation and the diffusion of agricultural innovation.

Imperfect information

Narrow access to scarce information leads to large transaction costs and failures in a wide range of markets. Social links may increase agents' ability to participate in economic transactions that involve some uncertainty about compliance. They can also lead to a better flow of information and hence may involve less adverse selection and moral hazard in contract accomplishment. Social capital also potentially expands the range of enforcement mechanisms for defaulting on obligations in environments in which recourse to the legal system is costly or impossible.

Several studies have documented the relevance of social interactions to overcoming information related problems in a wide range of applications. For instance, Fafchamps and Minten (1999) suggest

that cognitive social capital — in the form of trust emerging from personal contacts — can increase incomes of agricultural traders and their families in Madagascar, by reducing transaction costs and acting as an informal channel for acquiring insurance against liquidity risk. Lyon (2000), analyzes the means through which trust is created among farmers, traders and agricultural input suppliers and finds that whenever actors can not rely on formal legal institutions, trust is necessary for the development of a vibrant private sector. Johnson, Suarez and Lundy (2002), measure the contribution of social capital to the performance of 50 agro-enterprises in Colombia. Using qualitative analysis, they document how social capital performs a variety of functions in firms, including providing access information via networks of contacts, reducing transactions costs in contracting via trust, and sustaining capacity for collective action. Katungi, Edmeades and Smale (2006), investigate the interactions between gender, social capital and information exchange in rural Uganda, finding that social capital is an important factor in information exchange, with men generally having better access to social capital than women. They also find strong evidence which supports group-based technology dissemination systems.

Markets for insurance and risk management

Social relationships may contribute to informal insurance where insurance markets, and particularly income insurance, are plagued, often to the point of non-existence, by the problems of adverse selection and moral hazard. Informal income insurance systems allow households to engage in more risky activities and production techniques and so pursue higher returns (Narayan and Pritchett, 1999). In rural contexts, social capital in the form of local level farmer associations, networks or cooperatives can contribute to manage risk more efficiently, also reducing the hazards faced by farmers (Sorensen, 2000). For instance, farmers association and strong social networks can provide the institutional environment necessary for the scattering of strips and diversifying the crops (Eggertson, 1990); also they play an important role in lowering the opportunity cost of migration and in providing information that will make it easier for the family to decide if the benefits of migration are high enough to justify the monetary cost (Taylor, 1986). Informal mutual risk-sharing arrangements in rural areas often include cash and goods transfers, and labour assistance. Social relations can help increase the stability of these insurance systems, as lineage and kinship relations can change the way the members perceive and experience the benefits of deviation and compliance (Sorensen, 2000). For instance, Mogues (2006) uses household survey panel data from Ethiopia to examine the role of social capital in recovery and growth of households' endowments. Both local social relationships as well as 'bridging'

social capital seem to have a positive effect on asset holdings both directly and indirectly, by mitigating the impact of income shocks on livestock capital.

Effectiveness of public services

Finally, Narayan and Pritchett (1997) argue that coordinated collective action and participation may positively affect the delivery and the access to public services. Comparing the data of the Social Capital Poverty Assessment with those from the Human Resources Development Survey, they find that higher social capital is associated with higher levels of school quality, higher parental participation in school, and attendance at community meetings. Further empirical studies on the links among social capital and effective public services include, for example, Grootaert (1999), who analyses the link between social capital and household welfare and poverty in Indonesia by estimating the role of voluntary organisations in determining access to services and affecting household welfare and poverty outcomes. Isham and Kähkönen (1999) analyse the ability of villagers to organize themselves to design and manage water supply systems in Indonesia and find that a stronger presence of social networks, along with higher levels of trust, increase the efficacy of water projects. Similarly, Pargal, Huq and Gilligan (2000) conclude that solid waste removal in urban neighbourhoods in Bangladesh is improved when a good combination of structural and cognitive social capital is present.

On the basis of this short literature review, and taking into account the above considerations, the potential role of social capital in contributing to socio-economic development can be summarized as follows. A general first premise is that social capital can be considered a the 'missing link' in the explanation of development processes, since its role is to lubricate the gears which connect the other forms of capital. Secondly, the impact of social interactions and related values and norms on development depends on the social and economic context. For instance, in societies characterized by low economic development and weak formal institutions, social capital – supported by traditional institutions and capable agency – has proved to be an effective means to enhance the effectiveness of individual and collective action in several circumstances. At the opposite, in presence of efficient formal institutions, meso- and macro-organizations that guarantee contract enforcement and effective sanctioning may represent a better alternative to informal networks.

Therefore, while it is intuitively possible to affirm that social capital ultimately helps achieve social and economic development, it is much more difficult to identify the optimal forms and the specific channels by which it actually works. These will change depending on cultural, spatial and

temporal factors. Nonetheless, it is possible to draw some general conclusions, especially relevant to less developed countries. First of all, poor communities should be endowed with appropriate levels of both bonding and bridging social capital in order to initiate and maintain sustainable development processes. Secondly, horizontal interactions should coexist with vertical relations, or linking social capital. Linking to meso-institutions – such as local government, but also different actors such as NGOs and churches (Bebbington and Carroll, 2000, Wallis et al., 2003) – often constitutes a critical step for communities to transform local grassroots collective action into broader development outcomes. Finally, clear rules for explicit collective action, capable agency, and education, have been identified as complementary or enabling factors. That is, often it is the combination of social capital with one or more of these elements that mostly affects development.

If one accepts the evidence that social capital can affect development, the question of investing in social capital naturally follows (Grootaert and van Bastelaer, 2001). Taking into account what has been said about the forms and the channels by which social capital affects development, it is possible to list the possible means through which external actors may invest in social capital. Firstly, it should be possible fostering propensity for associational and collective action. Formal associations and associations networks can be created and supported by central governments and local institutions through proper legislation, economic incentives and counselling, while local institutions and donors, especially NGOs, may strengthen informal groups and collective action by promoting diffuse voluntarism and participation under community-driven development projects. Secondly, governments, local administrations and donors should be able to promote bonding as well as bridging ties. Through so called *community building* strategies that build up the sense of community and group identification, external actors can strengthen the linkages within groups. Whereas links among diverse associational types can be promoted by facilitating access to information, and developing communication and information technologies to support networks. As mentioned before, since the optimal combinations of bonding and bridging social capital change over time and among cultural settings, it is not possible to provide universally valid prescriptions. Instead, it is important to assess the social and cultural background as well as the characteristics of the economic and institutional settings. Such an assessment entails a certain degree of multi-disciplinarity among economics, sociology and anthropology. In general, any intervention should be preceded by a social institutional analysis in order to identify correctly the range of stakeholders and their interrelations, with special attention to the potential for dominant groups to mobilize in ways that undermine the public good (Woolcock and Narayan, 2000).

Thirdly, donors and local institutions may support local organizational capacity (whenever it is not embedded in the socio-cultural roots) and the establishment of clear rules for explicit coordination. This can be achieved mostly by introducing effective contract enforcement mechanisms and recognized punishment rules for non-accomplishment, and by promoting self-governance, participation and "social learning"[22] (Pretty, 2003). To this aim, also the access to and diffusion of information matter. Government should support information disclosure policies at all levels to encourage informed citizenship and accountability of both private and public actors; at the same time, it should improve physical access and modern communications technology that can foster information exchange across social groups (Woolcock and Narayan, 2000).

Fourthly, governments can favour the activities of meso-institutions as linking bodies between local communities and decision makers. This aim can be reached, for instance, through administrative decentralization as well as by supporting NGOs and other community-based organizations such as churches. Fifthly, especially when formal institutions are lacking, donors and local institutions should promote capable agency in order to enable local groups to reach decision makers and so strengthen their capacity of taking action. This implies capacity building of capable agents (such as village chiefs, committed agricultural extension workers, community influential actors,…), identification and training of local leaders, and support to civic and political freedoms. Finally, as a transversal measure, it is necessary to develop ways to measure and monitor social capital improvements (Pretty, 2003). More generally, social capital – and its previous assessment - should be a component of all development policies and projects, including the most "orthodox" ones, such as dams, irrigation systems, schools etc. On the other hand, all development interventions should be viewed through a social capital lens, and the impact assessments should always include the potential effects on the social capital of the beneficiaries (Woolcock and Narayan, 2000).

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22 According to Pretty (2003), "the process of learning, if it is socially embedded and jointly engaged upon, provokes changes in behaviour (Argyris and Schön, 1978; Habermas, 1987; Kenmore, 1999) and can bring forth a new world (Maturana and Varela, 1992). The past decade has seen an increasing understanding of how to develop these operating systems through the transformation of both social and human capital. This is social learning – a process that fosters innovation and adaptation of technologies embedded in individual and social transformation. It is associated, when it works well, with participation, rapid exchange and transfer of information when trust is good, better understanding of key ecological relationships, and rural people working in groups."

Several authors have faced the issue of investing in social capital reaching different conclusions. While there is a general consensus about the possibility of improving both the quantity and the quality of social interactions, also with the help of external actors, not everyone agrees that this would have a positive impact on development outcomes or that this would be the easiest or the most efficient way. Amongst those who support the need to invest in social capital, Collier (1998) argues that external interventions are justified by that social capital is usually underprovided. This occurs because the establishment of social interaction involves an externality, and because many of its benefits manifest themselves through an externality. Further authors who call for intentional investments in social capital are – among the others – Frankenberger and Garret, 1998, Reid and Salmen (2000), Bebbington and Carroll (2000), Katungi, Edmeades, and Smale (2006), Pretty, 2003. Among the scholars who reach opposite conclusions, some, as Foley and Edwards (1998) refuse the idea that social interactions and related values, albeit important, may have any positive impact on development outcomes. According to this approach, the "dark sides" of social capital prevail over the possible benefits. Others, like Gugerty (2002), albeit recognizing the potential positive impacts of social capital on development, are less confident that social capital can be easily created, and especially through funding or policies that usually have short-term objectives.

Indeed, drawing on the empirical research undertaken under the Social Capital Initiative (SCI, see footnote 8), Grootaert and van Bastelaer (2001) remark that there is clear evidence that social capital can be destroyed and rebuilt, but the rebuilding process requires often significant investments of time and resources. They also admit that while there appears to be some scope for donors or NGOs to build external linkages (bridging social capital), especially in a well-defined structural setting (such as supra-communal organizations), providing external funds to groups or associations may have mixed effects on internal social capital. External support can also contribute to reforming governmental institutions in a way to provide a more conducive environment for local social capital to develop. However, the authors conclude, "it seems fair to say that the SCI studies, as the social capital literature at large, have been more successful at documenting the beneficial impact of social capital than at deriving policy prescriptions and providing guidelines about how to invest in it" (Grootaert and van Bastelaer, 2001). One problem arises from the difficulty to identify the possibly best form of social capital. As discussed above, both positive and negative effects can be associated with social capital. Further complications stem from the fact that, as economic and institutional development proceeds, substitution takes place between different optimal types of social capital. Secondly, also the choice of

the mechanisms through which invest will change depending on the social and institutional analysis of the context. Finally, since investing in social capital may be a costly and time consuming process, and the investment activities may need to be carried out over a long-term period, investors must be convinced that such effort will produce sufficient benefits to exceed the costs. On the other hand, for beneficiaries to participate in the social capital building process, they must be convinced that the benefits derived from collective approaches will be greater than those from individual ones (Pretty, 2003).

Beyond the concerns intrinsically related to the nature of social capital, its effects on development and the possible investment mechanisms, some attention has to be paid also to analyse the role of social capital in relation to other development factors. According to Durlauf and Fafchamps (2004), social capital can mostly have a beneficial effect whenever it resolves or compensates for sources of inefficiency resulting from lacking institutions, market failures and so on. In these circumstances, usually social capital is a less expensive or simpler institutional solution, but it will never be the only possible one. For instance, Knack and Keefer (1997) find that trust's relationship to growth is especially large in poorer countries, which may be attributed to less developed financial sectors, insecure property rights, and unreliable enforceability of contracts. Interpersonal trust seems to be more important in facilitating economic activity where formal substitutes are unavailable. But where interpersonal trust is low and unlikely to improve rapidly, institutional reforms providing better formal mechanisms for the reliable enforcement of contracts and access to credit are even more important than where trust is higher. In such cases promoting horizontal associations through encouraging the formation of and participation in groups may even be counterproductive (Knack and Keefer, 1997).

To sum up, the debate about the possibility to invest in social capital relates, on one hand, to the capability of external actors to foster social interactions and associated attributes, on the other hand, to the properness of such strategy in comparison to alternative ones. Several mechanisms have been reported through which external actors may invest in social capital in order to reach development outcomes. However, the choice of employing one or more specific mechanisms depends on the identification of which social capital aspects, and in which combinations, should be fostered. This, in turn, depends on the assessment of the socio-economic and the institutional features of the unit of analysis. A previous assessment of the context may also help to evaluate the relative importance of social capital, in comparison to other factors, with regard to development objectives; therefore it may help identify complementary enabling factors to invest in, as well as alternative, more efficient

strategies. Finally, since building (or re-building) social capital often requires a strong effort in terms of time and resources, investors must carefully compare benefits and costs over a long-term period.

1.4 Concluding Remarks

This chapter has attempted to clarify the concept of social capital, especially with regard to its potential role in development. The first section deals with the definition of social capital and the appropriate use of the term 'capital', along with a discussion of the measurement challenges. This work supports a functional definition of social capital, which implies a multi-dimensional and dynamic nature and the need to take into account different scopes of analysis and different units of observation. Such an approach has been criticized because it entails an all-encompassing notion of social capital, which sometimes risks resulting in vague and chaotic assumptions with neither conceptual nor operational consistency (Woolcock, 1998; Fine, 1999). However, it is argued here that a clear identification of the concept *(which are the items that, depending on the contexts, fall under the social capital accruing to a given individual/group/community)*, along with the accurate description of the scope of the analysis *(which is the unit of observation and the relative valuable outcome/s under consideration)* may help overcome the theoretical and empirical problems related to vague and tautological definitions.

It is also argued that the functional notion of social capital, seen primarily as an appropriable resource, is compatible with a definition of capital seen as the output of a dynamic, regenerative process. That is, social capital can well be assimilated to other forms of capital and, as such, it has a potential to foster development processes both at micro and macro levels. A major source of debate relates to the feasibility of measuring this kind of capital and to quantify its impact on development.

The empirical literature has proposed several instruments to measure social capital and its components. The major achievements so far have been reached with regard to structural aspects of social capital, assessed at micro-level (Grootaert and van Bastelaer, 2001). However, the possibility to identify a universally valid set of indicators is still a controversial issue. Some researchers have developed detailed measurement frameworks, applicable in different socio-cultural settings, where the choice of the specific variables depends on the context. "While the scale of social capital may have to be constructed separately for each different context, instruments can be devised that will assist in the construction of such a scale among each different context. Critical to the construction of such instruments is the identification of broad analytical categories relating to the dimensions of social

capital. These instruments need to be flexible in application but rigorous in analysis, ideally combining complementary methodologies" (Krishna and Shrader, 1999). Indeed, when trying to analyze a complex and innovative concept such as social capital, it is especially important to integrate complementary data collection techniques including both quantitative and qualitative methods.

Generally speaking, some progress has been made in the identification of relevant indicators of social capital – or at least in the identification of useful methodologies to build relevant indicators, case by case. However, most of the statistical techniques that have been used to assess the relationships between social capital and development outcomes are still the subject of debate. In particular, the econometric approach has been the subject of several methodological critiques. In this regard, Durlauf and Fafchamps (2003) recommend the empirical literature to pay more attention to formal issues of identification, self-selection and unobserved group characteristics. Further recommendations concern data collection and analysis. Survey data collection should be designed paying more attention to the uses the data will be applied to and it should also include measures of different social factors rather than of social capital alone. Secondly, data analysis should rely on both quantitative and qualitative methods that allow the expression of interdependency relationships more complex than causality directions.

The second section of this chapter reviews briefly the literature on social capital and development, focusing on developing countries. It starts with the description of the potential effects of social capital on development and the channels through which it works. It then reviews the different fields of application and eventually introduces the debate on the possibility to deliberately invest in social capital as part of broader development strategies. Beyond having an intrinsic social and cultural value, social capital can contribute to the achievement of development outcomes by improving efficiency through at least one of the following externalities: enhanced knowledge about other agents; resolution of market failures and better access to information and technological knowledge; promotion of collective action. The channels by which these externalities and the relative outcomes manifest themselves are mostly information sharing, group identity, and explicit coordination. Explicit coordination, or purposeful collective action, in turn, requires either capable agents (Krishna, 2004) or clear rules on group decision making, or a combination of the two, in order to become effective.

The links between social capital and development, however, are not straightforward. Some authors are concerned that the "dark sides" of social capital may overcome its positive effects. For instance, the resources regarded by given individuals or groups as social capital can have less desirable

consequences either for the rest of the society or even for the members of the same group. Others highlight the risks for marginalized society members to be excluded following the breakdown of generalized trust based mechanisms. These examples are among the main sources of debate about the possibility as well as the appropriateness of investing in social capital. Another major concern is that the building (or re-building) social capital may require significant efforts in terms of time and resources, whereas development policies often have short-term objectives.

Generally speaking, while there is a certain consensus about the capability of external actors to improve both the quantity and the quality of social interactions, not everyone agree that this would be an easy or efficient development strategy. Whenever social capital resolves or compensates for sources of inefficiency resulting from lacking formal institutions, market failures and so on, then it usually represents a less expensive or simpler institutional solution. Nonetheless, it will never be the only possible one. For instance, whenever formal institutions that oversee contract enforcement and effective sanctioning, work efficiently and properly, they may represent a better alternative to traditional rules and informal networks. In addition, often the potential of social capital needs to be 'activated' by one or more enabling factors such as capable agency or intermediary institutions. All these considerations make clear that the appropriateness of investing in social capital depends critically on an accurate assessment of the socio-cultural as well as the institutional contexts. In fact, once it has been verified that there is the scope for external actors, to intervene, a thoughtful understanding of the context may help identify which aspects of social capital mostly matter for development outcomes and how much they matter in relation with other factors.

So far, empirical studies focusing on specific development issues at micro-level have been more successful than aggregate studies in explaining the relationships between social capital and development. With regard to less developed countries, five broad fields of application have been identified; these are: common pool resources, diffusion of innovations, imperfect information, markets for insurance, and effectiveness of public services. This work aims to analyse the impact of social capital on the adoption and diffusion of agricultural innovation in developing countries. The following chapter reviews the literature on agricultural innovation, analyzing if and how it has taken social capital into account, and considers more in detail the most recent empirical cases.

Chapter 2 Agricultural Innovation and Social Capital

The present chapter reviews the theory of agricultural innovation through the lens of social capital. The objective is to highlight since when and how the two concepts have been interrelated, and how they have been embedded and translated in agricultural development policies.

As was argued in the previous chapter, social capital may affect development outcomes mainly through three mechanisms: information sharing; the impact on transaction costs and risk mitigation, and the reduction of collective action dilemmas. In spite of a substantial body of economic literature existing on information diffusion and technology adoption in rural villages, the issue of how interpersonal network exchanges affect diffusion and adoption of agricultural innovation has been only partially addressed (Isham, 2002)23. More recently, the application of the innovation system approach to agriculture has filled this gap, given growing relevance to institutional settings and social capital. Especially in unfavourable environments, successful innovation for poverty reduction depends on building local institutions, networks and organizations that help communities mobilize their scarce resources, and link them to external networks.

2.1 The Concept of Agricultural Innovation and its Role in Poverty Reduction

According to the definition given by Rogers and Shoemaker (1971), "Innovation is an idea, practice, or object perceived as new by an individual. It matters little, so far as human behaviour is concerned, whether or not an idea is objectively new… if the idea seems new to the individual, it is an innovation".

Innovation in agriculture has happened for millennia through the informal but purposive action of rural people, who have been the major source of new knowledge and practices. The process and rate of agricultural research and innovation were accelerated by the formal application of scientific methods in the relatively more advanced economies in the 18th and 19th centuries. Subsequently, the creation of formal national research systems, together with the philanthropic activities of private foundations and

[23] For a review of empirical study cases see for example: Parthasarathy and Chopde (2000), Isham (2000, 2002), Adamo (2001), Lyon (2000), Coughenour (2003), Nyangena (2004), Sanginga (2006), Padmaja (2007), Monge et al. (2008).

the strengthening of public national and international organisations, have extended the use of formal research methods also to the agricultural systems of developing countries. While rural people's own creative responses have continued to be an important source of improvement to agricultural productivity in many regions of the developing world, there has been a limited, slow and incomplete convergence of the informal and the formal innovation systems, and with mixed results (Poole, 2006).

The strengthening of the formal agricultural research systems has led researchers, extension workers and development agencies to attribute progressively less importance to indigenous knowledge systems (albeit they still are the major source of innovation for a wide share of rural people). In addition, it has helped to several ambiguities with regard to the concept of agricultural innovation. For instance, innovation is often confused with invention. Indeed, the notion of novelty is fundamental to invention. But while invention culminates in the mere supply of knowledge, "innovation encompasses the factors affecting demand for and use of knowledge in novel and useful ways" (Goel et al., 2004). In other words, for invention to turn into innovation, it must be put successfully into practice. Further ambiguity stems from equating innovations only with breakthroughs at the frontier of science and technology. In reality, innovation can well comprise radical improvements, but usually consists of new combinations of existing elements, many small improvements and a continuous process of upgrading (Hall, 2004). In fact, technology adaptation cannot be separated from technology adoption, in that adaptation frequently occurs in the process of implementing the innovation on-farm (Cramb, 2003). Furthermore, innovative improvements are not only technical, but also of managerial, institutional, or policy nature.

Assefa (2006) refers to an "endogenous agricultural innovation system" as those "new initiatives and innovation processes of the local people (groups or individuals), trying to address the issues of poverty and the environment and includes the interwoven interactions of the technical, institutional, marketing or management innovation performances of the local people". At the opposite, in exogenous innovation systems the promotion of innovation is controlled mainly by outsiders. Different societies are characterized by different combinations of endogenous and exogenous innovation systems. In Sub-Saharan Africa (SSA), where many people struggle to survive and serious natural resource constraints affect the environment, "grassroots agricultural innovation systems" of smallholders, pastoralists and agro-pastoralists, are characterized by complex dynamics of exogenous and endogenous innovation, with the latter having a much greater importance than in the industrialized world.

The role of agricultural innovation in poverty reduction has been widely acknowledged. According to Berdeguè and Escobar (2001), agricultural innovation can have both direct and indirect effects on the income and employment opportunities of the poor. The direct effects include those benefits captured by the farmers who actually implement the changes, and usually comprise higher incomes (which include both profits and remuneration of their labour) from agricultural production. New technologies can improve farmers' income when they reduce the marginal cost per unit of production. Until prices are driven by the prevalent (old) technology, early adopters benefit the most. Once all or many farmers have adopted the new technology, causing increases in output and a possible reduction in prices, the profit margin may disappear, depending whether the prices are already determined by the new technology. Late adopters or non-adopters, especially in a closed economy, may be negatively affected. It is worthy to notice that this mechanism, as described by Berdeguè and Escobar, draws mostly on the classical "diffusion of innovation" paradigm and its S-shaped adoption curve (Rogers, 1962). This model best suits situations where farmers produce the same product for the same (well-functioning) market. In the case of subsistence farmers, instead, the direct effects of innovations which improve production efficiency, will depend on whether the produce is or may become tradable as well as on the features of the reference market (if any). However, improved efficiency of the production is only one of the aspects through which innovation may reduce poverty. At small-scale level, in fact, higher yields and more stable output can have a dramatic impact on households' welfare also by enhancing food security, stabilizing income flows, and ultimately reducing risk and uncertainty.

The indirect effects of technological innovation on poverty reduction are those benefits that are captured by individuals different from the farmers who implement the changes. Such indirect effects may include: lower food prices due to higher agricultural productivity and output; employment generation in agriculture; broad-based economic growth through production and consumption linkages with the non-farm economy. The net impact of direct and indirect effects on poverty reduction depends mainly on the combination and the respective influence of three factors: (i) the tradable status of the product concerned by the innovation; (ii) whether the household is a net buyer or net seller of the product; and (iii) if the household is a farming family, its position as an early or a late- or non-adopter of the technology (Berdeguè and Escobar, 2001).

Because of their lower access to information and other resources, poor farmers usually are not among the early adopters of technological innovations. Moreover, only a small fraction of the world's

subsistence farmers are directly involved in formal agricultural research, extension and/or development projects. It follows that larger, commercial farmers who can keep the pace of continuous innovation are likely to gain more from the direct effects, and the adoption of agricultural innovation by commercial farmers can lead to poverty reduction only if conducive institutional environments enable the sharing of benefits across society. Conversely, the largest impact of innovation on the poorest is likely to be through their indirect effects. In the long run, small scale family farms and poor farmers can benefit from the direct effects of agricultural innovation only if adequate policies allow them to significantly increase productivity and/or to diversify into production systems in which they can have a competitive advantage (ibid.). In all these cases, institutions play an important role since they have to "get the innovations right" in order to guarantee distribution and equity issues.

2.2 Agricultural innovation and social capital: historical review

2.2.1 Linear models and the Induced Innovation Theory

Since the Fifties and then during the post-colonial period up to the mid-Seventies, agricultural development policies were dominated by a modernistic perspective which saw innovation as a result of a linear process which aimed to transfer technical knowledge from the industrialized world to less developed countries. The theoretical foundations of such approach lie mainly in the work of Rogers (1962, once it has been introduced by an external agent, the "diffusion of innovation" is an autonomous process propelled by market forces), Schultz (1964, traditional farmers are efficient but remain poor because traditionalism is a "non-growth" system of agricultural economy), and Boserup (1965, farmers respond to increasing population pressure and depletion of natural resources by further intensifying production methods) – among others. While these theories differ among each other with respect to several aspects, they are all linked to the idea of modernisation and share a number of key concepts such as: the dichotomy of the modern and the traditional; agricultural development as the transformation from the traditional to the modern, and measurable as production growth; the existence of development stages following a linear process; the transfer of technology and institutional models (Biggs and Clay, 1981).

The major critics of modernization theories dealt with the idea of transferring technologies, farming methods and institutional models from one country to another. In response to these critics, most of the subsequent literature on agricultural innovation and technical change was concerned with issues of factor endowments, factor prices and choice of techniques. Probably the most influential

theories belonging to this stream of literature are the Induced Technological Innovation theory (Hayami and Ruttan, 1971) and the Induced Institutional Innovation theory (Binswanger and Ruttan, 1978; Hayami and Ruttan, 1984). According to the former, innovation patterns are guided by changes in relative factor scarcities, reflected in changes of relative factor price variations. Since in less developed countries (LDC), technology generation is mainly a public sector activity, the State is expected to respond to market signals and develop new technologies which enable farmers to reduce the use of the production factors that become relatively more expensive. As it has been recognized by its own founders, the Induced Technological Innovation theory presents several weaknesses. First of all, it views innovation essentially as a technological product and focuses on innovation adoption rather than on its generation. Secondly, it is based on the assumption that certain markets do work, while they often tend to fail or simply do not exist, especially in rural areas. Furthermore, even in the case of well-functioning markets, the theory would better apply in the long run, when (according to a neoclassical interpretation of price formation) relative factor scarcities are fully reflected in relative factor prices. Finally, widely spread technologies more often respond to the interests of trans-national companies which may not correspond to those of individual countries (Ahmed and Ruttan, 1988).

As a sequel to these critics, Binswanger and Ruttan (1978) and Ruttan and Hayami (1984) have developed the Induced Institutional Innovation theory. Changes in relative factor endowments (and factor prices), along with the induced technological changes, bring about institutional adjustments which favour innovation generation and diffusion. Since, especially in LDCs, markets are not perfect and agricultural technology is a public good, the State has to promote the institutional innovations needed for the generation of appropriate technology. Albeit taking into account the problems stemming from market failures and though recognizing a relationship between technological and institutional innovation, this approach presents most of the same problems as its predecessor. The generation, the adoption and the diffusion of innovation is interpreted as a linear, mechanistic process, which does not reflect what happens in reality. The determinants of innovation taken into account are few and do not comprise social and environmental features, nor farmers' needs and priorities. The focus on institutions does not turn into a higher consideration of the local resource endowments. Just like technology, institutions can be built on models offered by more industrialized countries. On the other hand, the focus on institutions itself is problematic since in LDCs formal institutions are often expression of powerful groups. In fact, the public sector research and extension activity is very often characterized by three types of bias: extension bias (a higher share of resources goes to extension rather than research

since it is assumed that technology can simply be borrowed from industrialized countries); commodity bias (research usually targets commercial crops, while neglecting subsistence food crops); public sector bias (priorities are guided by interest groups such as large commercial growers, urban population representatives, and so on) (Ahmed and Ruttan, 1988).

Notwithstanding the attention to local resource endowments, both the induced technological and the induced institutional innovation theories still share with the linear mechanistic approach the idea of innovation mainly as a new, widespread technology. Moreover, they "support a particular way of doing agriculture24 and oversimplif[y] the issues relating to institutional innovation, including questions of efficiency, distribution, and the environment" (Hogg, 2000). Indeed, although concerned with the local factor endowments, the induced innovation theories could not provide an alternative to the Transfer of Technology (TOT) model which had been influencing the agricultural development practices during the colonial period and afterwards, during the so called Green Revolution. Under the Green Revolution, a huge amount of financial resources were committed to international research centres (like the CGIAR agencies) and to the National Agricultural Research Institutes (NARIs). Agricultural scientists and other technology developers were asked to provide technological solutions (mainly) to production constraints, paying limited or no attention to the environmental and the social contexts these solutions were directed to. The new technologies were then introduced and diffused locally through the extension systems. The Training and Visit (T&V) model, promoted extensively by the World Bank in the 1970s and 1980s, exemplifies this top-down approach: extension units were endowed with a kind of "innovation package" (containing the technology plus the instructions) to be diffused through dissemination and training. They rarely utilized local people's knowledge and experience, nor took into account their real interests and requirements. Moreover, the T&V system reached only a small fraction of the intended recipients, since many extensionists used to visit only better-connected villages and, among these, more powerful villagers (Roy and Clark, 1994). Within this framework, farmers were seen as clients, ultimately adopters or rejecters of innovations developed by others (Probst, 2003).

[24] Hayami and Ruttan (1985) are concerned with agricultural growth, which they measure as increasing productivity with respect to land and labour, the latter considering per male worker productivity only. Also Binswanger (1978) looks exclusively at modern agriculture, assuming that farming equates with mono-cropping.

As for the kind of technology promoted through the TOT models, agricultural research in the Sixties and the Seventies addressed mainly production constraints, assuming that the farmers living in the same country were all characterized by common features and faced homogenous conditions. In reality, farmers work in continuously changing environments (Biggs and Clay, 1981), so that standard technological solutions were often inadequate to solve existing problems as well as to cope with those which came into existence then. Moreover, the TOT methods promoted mostly high external-input agriculture (HEIA), helping to worsen genetic uniformity and related problems. However, in some regions, modern HEIA was and still is simply unfeasible and "alternative" agriculture is all that is available (Hogg, 2000). The problems with HEIA practices have been widely discussed in the everlasting debates on the impacts of the Green Revolution in LDCs. The Green Revolution technology has brought about impressive increases in agricultural production in some rural areas of the developing world, and especially in Asia. On the other hand, also due to the system of incentives used, it produced significantly adverse impacts on the rural ecology and the environment. On the economic and the social sides, the use of the newly developed technologies suited mostly (few) large farmers, while worsened the conditions of already marginalized groups (such as less educated people, women, landless and resource poor farmers), exacerbating inequality and poverty (Roy and Clark, 1994).

All the modernization related theories on innovation and technological change did not take into account social and cultural factors. Social capital was not considered among the relevant variables nor among the context variables in any of the phases belonging to the process of innovation generation and diffusion.

2.2.2 The Appropriate Technology Movement and the Farming System concept

The other major theme of writers concerned with factor endowments has been the issue of appropriate technology. According to a general definition, "appropriate technology" (AT) is designed with special consideration to the environmental, ethical, cultural, social and economic aspects of the community it is intended for. With these goals in mind, AT typically requires fewer resources, is easier to maintain, has a lower overall cost and less impact on the environment compared to industrialized practices (Darrow and Saxenian, 1986). A related concept is that of "intermediate technology", a term

coined by Ernst Friedrich Schumacher25 to describe technology which is significantly more effective and expensive than traditional methods, but still much cheaper than industrialized countries' technology. The AT related theories made researcher and development agencies reconsider how understand – and promote – agricultural development, and led to a number of theoretical and practical alternatives to the TOT model that have been included under the broad heading of "Farming System Research" (FSR)[26].

According to the Farming System (FS) approach, the development of agricultural technologies has to take into account that farmers operate in complex systems, consisting of crops, livestock, and off-farm enterprises. Due to this complexity, the search for innovative solutions cannot start in the laboratories and address production and other constraints as if these were standard problems. Only the farmers, who have always been "natural experimenters" (Biggs and Clay, 1981), have a whole understanding of the complex environment in which they operate (Röling, 2006); this is why their involvement in the identification of the appropriate technology is a critical step of the innovation generation process. The FSR also recognizes that environment, agriculture and rural society are mutually interdependent, and therefore the evaluation of technology appropriateness has to take into account not only technical and economic variables, but also social, cultural and environmental factors.

Since the mid-Seventies the appropriate technology models and the FS concept have gained growing importance. By the mid-Eighties, many agricultural researchers, donors and international development agencies started to re-think the transfer of technology model and shift the emphasis towards the role of farmers. Due also to decreasing investment in agricultural research, NARIs were re-oriented towards a wider client participation and a more efficient management. Different types of participatory approaches (Participatory Rural Appraisal (PRA), Rapid Rural Appraisal (RRA), Farmer

[25] In an article published in the Observer in 1965, E. F. Schumacher pointed out the limitations of aid based on the transfer of large-scale technologies to developing countries which did not have the resources to accommodate them. He argued that there should be a shift in emphasis towards intermediate technologies based on the needs and skills possessed by the people of developing countries. Such technologies should be easily purchased and used by poor people, leading to greater productivity while minimizing social dislocation. In 1966, along with some associates, he founded the Intermediate Technology Development Group, an advisory organism to promote the use of efficient labour-intensive techniques. In 1973 he wrote his most important and well-known work, Small Is Beautiful.

[26] "A farming system is a natural resource management unit operated by a farm household, and includes the entire range of economic activities of the family members (on-farm, off-farm agricultural as well as off-farm non-agricultural activities) to ensure their physical survival as well as their social and economic well-being". H. Wattenbach and K.H Friedrich, 1996. "Farming Systems Indicators for Sustainable Natural Resources Management". FAO, AGS Division.

Participatory Research (FPR), Participatory Technology Development (PTD), etc.), summarized also under "Farmers First"[27] (Chambers et al., 1989), have been developed and applied by both formal research institutions and development government and non-governmental agencies. These methods have been first applied to technical change in agriculture – especially by NGOs – to support farmers in identifying the opportunities and constraints they faced in agricultural development, and in meeting these needs by themselves if possible (Farrington, 2000). The main outcome expected is the generation and adoption of new, appropriate technologies by small, resource-poor farmers in order to increase farm productivity and income (Selener, 1997). To this aim, farmers are asked to contribute to the process of generating, testing and evaluating technologies for sustainable agricultural production. Education, both of farmers and extension workers, plays a central role, not only because it may facilitate the understanding and the adoption of innovation, but also with respect to the cultivation of basic human qualities such as tolerance and receptivity to others' views and ideas (Roy, 1994).

Notwithstanding these elements of novelty, the positivist paradigm is still prevalent. Chambers (1989) highlights how early Farmers First methods constitute a complementary – and not an alternative – paradigm to the TOT approach, since some elements such as "commodity research, on-station and in-laboratory basic investigations and so on, will always be needed". Local knowledge is often viewed as a uniform "stock" available for assimilation and incorporation into formal agricultural research (Probst and Hagmann, 2003). Agricultural research, on the other hand, remains essentially extractive, with the researcher in a dominant position. Even under Participative Rural Appraisal (PRA) techniques, in which both rural people and extension workers "learn to listen and listen to learn" (Chambers, 1989), farmers often act just as respondents and are directly involved only in on-farm experimentation of exogenous technologies. While it is acknowledged that agricultural innovation is not just a technical matter, and farmers play a role in the identification of innovation priorities, there is always the underlying assumption that eventually technology is transferred from the researchers to the farmers. As a result, much research output is simply not appropriate while the small windows of opportunities for farmer-led innovation are left out (Findsen, 1994; Hagmann, 1999; Röling, 2006).

[27] In their book *Farmer first: farmer innovation and agricultural research*, Chambers, Pacey and Thrupp (1989) included under the "Farmer First" approach all the methodologies which, complementary to the conventional TOT model, focused on farmers' participation and priorities.

Furthermore, in spite of the focus on participation and the local socio-cultural context, some have argued that early Farmer First approaches have often overlooked fundamental issues of power and knowledge among the communities members, therefore encountering many of the same problems as TOT strategies (Scoones and Thompson, 1994). Indeed, the unconditional thrust in local people involvement, sometimes fails to consider the impact of power on relations between different groups belonging to the same community or between local people and outsiders. Further, participative approaches may also disregard the complex socio-cultural and political dimensions of knowledge creation and transmission. In fact "people knowledge" is not a given, uniform stock to which all communities members have access. Rather, it emerges as a product of interaction and dialogue between different actors and networks, often with competing interests (Scoones and Thompson, 1994). In other words, early Farmers First approaches have not adequately addressed important dimensions of social capital, including some of its "dark sides", such as exclusion of outsiders and marginalization of poorest community members.

On the other hand, social capital – in the form of 'indigenous social systems' and 'local culture' – is taken into account by the Farmer First methods mainly in two ways. On one hand, the local social, cultural and organizational context has to be fully understood in order to assess the feasibility of promoting technical innovation as well as to project the possible effects of adoption. On the other hand, the interaction among farmers and other agents – development workers, scientists, local institutions, etc. – needs a facilitator (often an extensionist), who must effectively connect with the local culture (Roy, 1994). However, as it has been already said, even under the Farmers First approach, ultimately innovation is not an (exclusively) indigenous product, but more often it is promoted and introduced by external agents (even if through a collective process). In this framework, social capital counts, but it does not't have an active role in innovation generation and diffusion. To this respect, the following comment by Roy (1994) is quite eloquent: "many local customs, traditions and taboos act as a hindrance to adoption of new technologies; but on the other hand there are many customs and traditions which should be incorporated in the new technology".

2.2.3 1990s: Towards the Social Organization of Innovation

The experiences gained under the Farmers First approach and the Appropriate Technology movement, made clear that pro-poor agricultural innovation can not be created in the laboratories and cannot be transferred through linear, top-down processes. Instead, it is the result of an unending social

enquiry stemming from the desire for improvements; to this aim, social actors permanently create or re-create, rather than find or discover. Since the end of the Eighties, a growing attention has been given to the role of knowledge as the result of a social learning process. According to Long (1992), "knowledge processes are embedded in social processes that imply aspects of power, authority and legitimation". Under this perspective, innovation is not directly induced by any particular force (market, environment, etc.), but any phenomenon capable to influence innovation is mediated by social interactions. Innovation may be considered essentially as a social learning process, embedded in and intrinsically interwoven with the ongoing evolution of agricultural practice (Engel, 1997). Two components are critical to this approach: knowledge (and the extent to which it is accessible and transferable) and social interactions (such as networking).

Knowledge includes the ideas, concepts, routines and skills that people acquire over time to support their livelihood. This concept includes informal experimentation and indigenous knowledge, which are as much important as scientific knowledge to innovation generation. "Farmers First" promoters have often assumed that farming communities share common goals, access to resources (including information) and worldviews, and that local knowledge is unitary, systematized and available for assimilation and incorporation with western scientific knowledge. In the mid-Nineties, Scoones and Thompson28 proposed a "Beyond Farmer First" approach which counter advocates that different types of local and non-local people hold many divergent, sometimes conflicting, interests and goals, as well as differential access to resources. Also local knowledge is the outcome of the irregular and often inequitable interaction between competing actors and, as such, is always manifold, discontinuous and dispersed (Scoones and Thompson, 1994).

According to this view, social interactions play an important role in innovation generation with respect to several dimensions. Innovation emerges from the interplay in and between social practices, and its quality is directly related to the organization and quality of the interplay. The way in which social actors organize themselves and perform this interplay may be defined as the "social organization of innovation". While interactions may emerge spontaneously, to a certain degree they can be managed and/or facilitated. For example, networking, intended as any situation in which a multiplicity of social

[28] The title of the book *Beyond farmer first: rural people's knowledge, agricultural research and extension practice* (Scoones and Thompson, 1994) was a clear reference to the book published by Chamber in 1989 (see previous footnote).

actors manage interactive relationships to develop innovation in order to anticipate and to adapt to market forces, ecological deterioration, financial constraints and so on, can be seen as a particular social practice aimed at innovation (Engel, 1997).

"The linkages which emerge from the interactions among people, organizations and institutions reflect not just the use of communicative interaction for the transfer of knowledge and information, but also the use of power and influence for coordination and coalition building" (ibid.). Therefore the principal challenge for translating the Farmer First approach into mainstream practice involves the effective combination of professional and institutional elements, including a deeper understanding of the linkages between social interactions, knowledge, power, research and extension. In order for researchers and extensionists to engage in meaningful dialogue with farmers, they must recognize the complexity of knowledge generation, transmission and adaptation, as well as understand the irregular and often inequitable social interactions from which it emerges (Scoones and Thompson, 1994). In this process, scientists are no longer observers or external actors; they learn from farmers and at the same time they can help them "to enhance their capacity for adaptive management, favouring on-field experimentation as well as platforms for negotiation and action learning at community level and with service providers" (Probst and Hagmann, 2003).

In practice, also the "Beyond Farmers First" perspective founds on participatory R&D techniques, but it adopts a soft-system approach more centred on networks and relation of power. Participation does not aim anymore at finding consensus on problems and solutions identified through development activities; rather it should aim at dispute resolution and negotiated agreements between different interest groups through processes of adaptive learning and planning (Scoones and Thompson, 1994). The more and more extensive use of such "enhanced" participatory methods approaches during the Nineties (such as Farmer Field Schools (FFS), PRA, FPR, PTD, Participatory Innovation Development (PID), and so on) is the logical follow-up of the actual shift from the linear technological model to multiple-source models of innovation such as the Agricultural Knowledge and Information System (AKIS)29.

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[29] Two programmes funded between 1994 and 2001 by the Directorate General for International Cooperation of The Netherlands, may well exemplify how the concepts of 'participation' and 'participatory innovation development' have improved during the Nineties. These are Indigenous Soil and Water Conservation (ISWC, Phase I and II) and Promoting

The concept of AKIS has been developed in the early 1990s by Niels Röling and it can be broadly defined as "the articulated set of actors, networks and organizations, expected or managing to work synergically to support knowledge processes which improve the correspondence between knowledge and environment and/or the control provided through technologies use in a given domain of human activity" (Röling, 1992). According to FAO and the World Bank (2000), "an AKIS links people and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information. The system integrates farmers, agricultural educators, researchers and extensionists to harness knowledge and information from various sources for better farming and improved livelihoods".

In an AKIS, agricultural research and extension are still necessary but, by themselves, insufficient elements in complex innovation oriented institutional arrangements. Several conditions, different from technology related variables, are necessary for widespread and sustainable agricultural innovation to take place, and they include also conductive policies, effective governance and, last but not least, functional institutions (markets, property rights, trust and reciprocity norms, legal systems, etc.) (Berdeguè, 2001). Further important elements are local connectedness and networking for technology dissemination. A study on AKIS conducted jointly by the Kenya Agricultural Research Institute, the Ministry of Agriculture and the Overseas Development Institute (ODI) in different district divisions in Kenya (Rees and al., 2000), has documented the significance of different actors and organisations as potential uptake and dissemination pathways for agricultural technologies. In spite of the co-existence of several diverse AKIS, varying with agricultural enterprise, agro-ecology, and from district to district, friends, relatives, neighbours, women's groups and school/youth groups were reported as major sources of agricultural information in every division. The Ministry of Agriculture was also reported as a major source of information by almost all interviewees (although quality and frequency of interactions often received negative comments), and many also mentioned *barazas* (local

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Farmer Initiatives (PIF). Both projects operated in several African countries with the aim of improving the effectiveness of traditional as well as modern agricultural and NRM practices through a process of joint experimentation. Several components run parallel to each other or were repeated during the process, of which the most important were: the identification of farmer innovators and their innovations, promoting networking between farmer innovators through exchange visits and study tours, participatory research, and dissemination of ideas and methods. The definition of "farmer innovator" included all farmers "who spontaneously try new things, without the direct support of formal research and extension" (Reij and Waters-Bayer, 2001).

meetings called by the area chiefs). Other organisations such as farmer cooperatives, stockists, traders and markets, were significant in some divisions but not in all. These results confirm the significance of social interactions, local practices and institutions to the "social organization of the innovation". In fact social capital – mainly in the form of groups, networks and other institutions, both formal and informal – plays an important role in the process of innovation generation and diffusion, especially by "influencing policy institutions, improving access to and flow of information, promote social cohesion (which influences transparency of knowledge, access to knowledge and limit power conflict) and co-operative action" (Röling, 2006).

In order to improve social practices aimed at innovation in agriculture, thus, action as well as research should include inquiries into networking by relevant social actors, as well as into convergences, resource coalitions and communication networks that emerge as a result (Engel, 1997). In other words, several dimensions of social capital have to be taken into account, analyzed and proactively employed in the creation and the promotion of innovation. Depending on the way coordination is achieved, in fact, many types of institutional configurations aimed at innovation may evolve. "For example, institutional arrangements may emerge among governmental institutions, industrial companies and/or farmers' organizations. Innovation networks of individuals and NGOs may prove to be the more flexible forms of social organization for innovation that are needed by modern agricultural development. The analysis of such configurations is proposed as an instrument to use in studying the effects of leadership and coordination on innovative performance" (Engel, 1997).

In comparison with the "Farmers First", the "Beyond Farmers First" approach addresses more deeply the relationship between social capital and agricultural innovation. In particular, a part from recognizing a concrete, active role of social interactions in innovation generation and diffusion, it also takes into account issues of power and equity stemming from the different degree of access to knowledge and information by different actors. The increasing use of "enhanced" participatory methods, as described above, and the diffusion of the AKIS reflect these theoretical changes.

2.3 The current approach: from innovation to the "Innovation System" concept

2.3.1 The need for an alternative approach to agricultural innovation

Since the Nineties and the diffusion of the AKIS, knowledge, information and social interactions have become central to the theory (even though, to a lesser extent, to the practice) of agricultural innovation. Henceforth, the "social organization of innovation" model has been tested in

less developed economies by several empirical studies (see, among the most recent, Van de Broek and Dercon, 2007; Mazur and Onzere 2006; and Davis et al., 2006). As it has been seen in the previous paragraph, social networks and information flow are directly interrelated and influence each other in innovation processes. Information flow originates from the existing social structures; at the same time, how information is spread to foster innovation is an important indicator of the way social networks are organized and how power relations among farmers and between farmers and other actors might change as a result of innovation dissemination.

In the last decade, the "social dimensions" of agricultural R&D (Waters-Bayer and Bayer, 2005) have gained more and more relevance and new factors have been explicitly included among the determinants of innovation generation and diffusion. Most of them are strictly related to the kind and the quality of social interactions. For instance, the transformation of social status – described by Ridgeway (2003) as the evaluative hierarchy that exists between social groups or individuals and usually expressed in terms of 'respect' and 'fame'– is one of the social mechanisms that have been recognized as capable to affect innovation processes (Mazur and Onzere, 2006). Also the status of property rights and collective action is likely to constrain or enable innovation options and it is also important in determining who benefits from productivity increases, both directly and indirectly (Knox and Meinzen-Dick, 1998). Other institutional factors, such as laws and community rules, norms and ideas, have been often included among the conditioning factors of innovation processes. Social networks, collective action, reputation, and institutions may all be considered as dimensions of social capital. In turn, these social capital elements affect other important determinants of innovation, that is – has it has been just said – information flow and knowledge sharing, but also the attitude towards different types of risk, access to credit, etc.

Indeed, along with the recognition of the role of social and institutional factors in the innovation process, it has also been acknowledged the need to consider implications for efficiency (in terms of risk and transaction cost, for example) and equity. Collective action can enable marginalized groups to challenge property rights institutions and facilitate technology adoption, thus fostering equity among community members and improving their social status (ibid.). For instance, during a study conducted in Uganda on the factors that farmers considered when adopted a set of innovations promoted by a local Ngo, female farmers reported that the access to new knowledge was especially important for them because they got to earn money 'as women' (Mazur and Onzere, 2006). At the same time, there may be cases in which some people (e.g. elderly or sick people) cannot sustain innovations adopted by the rest

of the community, thus exacerbating their marginalization, or cases whereby innovations benefit one group at the expense of other groups, with uncertain impacts on efficiency. In other cases, the persistence of old status distinctions may mean that the benefits stemmed from interventions which were supposed to target "weaker" categories, have actually reverted back to those who are privileged by structural conditions (ibid.). To sum up, while innovation is commonly perceived as "something good", in practice it may not be welcome to all people. Whenever it unsettles old patterns of thinking and working, it constitutes a challenge to the status quo and vested interests. This is the reason why, in most cases, existing institutions tend to influence technological and organizational change in order to perpetuate and reproduce inequalities in power, status and wealth, and they can even discourage innovation and risk-taking (Kelles-Viitanen, 2005).

The controversial aspects of innovation as a "social construct" (IFAD, 2006), may be particularly detrimental to poor or marginalized groups, who risk missing the opportunity to gain access – and participate – to the innovation process. Those who emphasize the importance of the "social dimensions" of R&D, recognizing that innovation might result from conflicting interests and power relationships, demand an alternative approach to agricultural innovation, more complex and all-encompassing than the past. This would be especially important in developing countries, where small-scale farmers have been largely excluded from the technological options developed under programmes that mostly continue to support traditional, linear models of agricultural innovation. Furthermore, the top-down approach pursued primarily by the public sector has hampered an effective technology transfer, while policy and donor pressures have strongly influenced research priorities and stakeholder dynamics.

Both the NARS and the AKIS frameworks turn even more inadequate as new challenges of political, economic, social, and environmental nature arise for the rural poor. Among the most relevant are economic globalisation, evolving international trade agreements, spread of new technologies, urbanization, climate change and health emergencies such as HIV/AIDS. Causation is complex, and the effects are not always negative, since out of some challenges there may also arise opportunities (Poole, 2006). For instance, while major food crops remains important, a number of niche sectors – such as export horticulture and agro-processing, which are knowledge-intensive sectors – are emerging and can take advantage of an increasingly globalised economy. Organisations beyond the State, particularly the private, but also cooperatives and civil society, are expanding their role. The progressive modernization of agriculture increases the importance of rural non-farm employment. At the same time, innovation

and upgrading are critical not only to new, emerging sectors, but also to traditional sectors including the management of natural resources. All these challenges and opportunities often require institutional changes and innovative organizational solutions, rather than new technology options (Hall, 2006).

Because of the diverse circumstances mentioned above, recently the theory of agricultural innovation has evolved further towards a more comprehensive concept, the Agricultural Innovation System (AIS). The idea draws largely on that of National Innovation System (NIS), developed by the industrial economics literature between the Eighties and the Nineties. Studies on NIS emphasize the role of learning processes and the socioeconomic contexts that are considered crucial for applying new knowledge and leading to actual innovation (Wennink and Heemskerk, 2006). The next section treats more extensively the origins and the definition of AIS, the relevance of different SC dimensions to AIS, and the possible impacts on agriculture innovation practices, with a special focus on poverty reduction.

2.3.2 The 'Agricultural Innovation System': Origins of the Concept and Main Features

During the Seventies and the Eighties, production became more knowledge-intensive as investments in intangibles assets such as research and development, software and design started to play a greater role. Within the context of more knowledge-intensive production, challenged by the dismantlement of traditional barriers to trade and investment, firms began to compete on the basis of their ability to innovate. Local producers everywhere engaged in a process of continuous innovation, while governments had to develop policies to stimulate and support such processes. This created the space for the emergence of alternative conceptualisations of innovation generation and diffusion (Hall et al., 2005). The innovation systems approach emerged in the mid-1980s as a neo-Schumpeterian30 perspective that drew significantly from the literature on evolutionary economics and systems theory. According to this approach, technological and institutional changes are endogenously determined by

[30] According to Schumpeter (1939), innovation is endogenously determined by the behaviour of the entrepreneur and his or her financiers, and by the institutions of private property, business traditions, and capitalist competition. Over the long run, technological change results from the continuous market entry of entrepreneurial agents and innovation processes that force older firms and production methods into obsolescence, thereby reallocating resources to support a new production regime (the "creative destruction"). Schumpeter thus suggested that innovation results from the character of social and economic institutions, and that institutions change in response to innovation, that is, that the relationship between society and innovation is endogenously determined (Spielman, 2005).

continuous and nonlinear processes, in contrast to the more conventional theories of relative factor prices, exogenous technological shocks, and static equilibria (Spielman, 2005). The first written contribution that used the concept is an unpublished paper by Christofer Freeman dated 1982 that he wrote for the Science, Technology and Competitiveness OECD Expert Group, in which he referred to "national system of innovation". A comprehensive description of the innovation systems approach was then provided by Lundvall (1985) and applied by Freeman (1987) to compare national innovation systems. The concept was further developed during the Nineties (Dosi et al., 1988; Lundvall, 1988, 1992; Freeman, 1988, 1995; Edquist, 1997), with empirical applications focusing primarily on national industrial policy in Europe, Japan, and East Asian countries (Johnson and Lundvall, 2003; Spielman, 2005; Hall et al., 2005, 2006).

An innovation system can be defined as "a set of interrelated agents, their interactions, and the institutions that condition their behaviour with respect to the common objective of generating, diffusing, and utilizing knowledge and/or technology" (Spielman, 2005). Under this framework, the focus is on the process rather than the product: knowledge is accumulated and applied by heterogeneous agents through complex interactions that are conditioned by social and economic institutions. An innovation system thus founds on four elements: knowledge, agents, interactions, and institutions. The importance of knowledge, its sources and the ways it is transmitted has been already emphasized.

Agents — individuals, firms as well as public institutions and non-state actors — constitute the principle operating components of the system. With regard to the agricultural sector, relevant agents may comprise all the components of the public research system (both national and international), all types of private firms, civil society organizations, including producer/farmer associations, non-governmental organizations, consumer groups, and other types of community or solidarity groups, and, last but not least, agrarian agents: farmers, agricultural workers, farm households, and rural communities.

The interaction among agents is the dynamic component of the innovation process. The kind and the quality of interactions are strongly conditioned by the institutions – both formal and informal. Institutions and policies, by influencing habits and practices, are thus the factors that determine the efficiency and stability of cooperation and competition, and whether agents in an innovation system are able to interact so as to generate, diffuse, and utilize knowledge (Spielman, 2005; Hall et al., 2005, 2006). In other words, institutions, incentives, policies and power shape the innovation processes (Berdeguè, 2005).

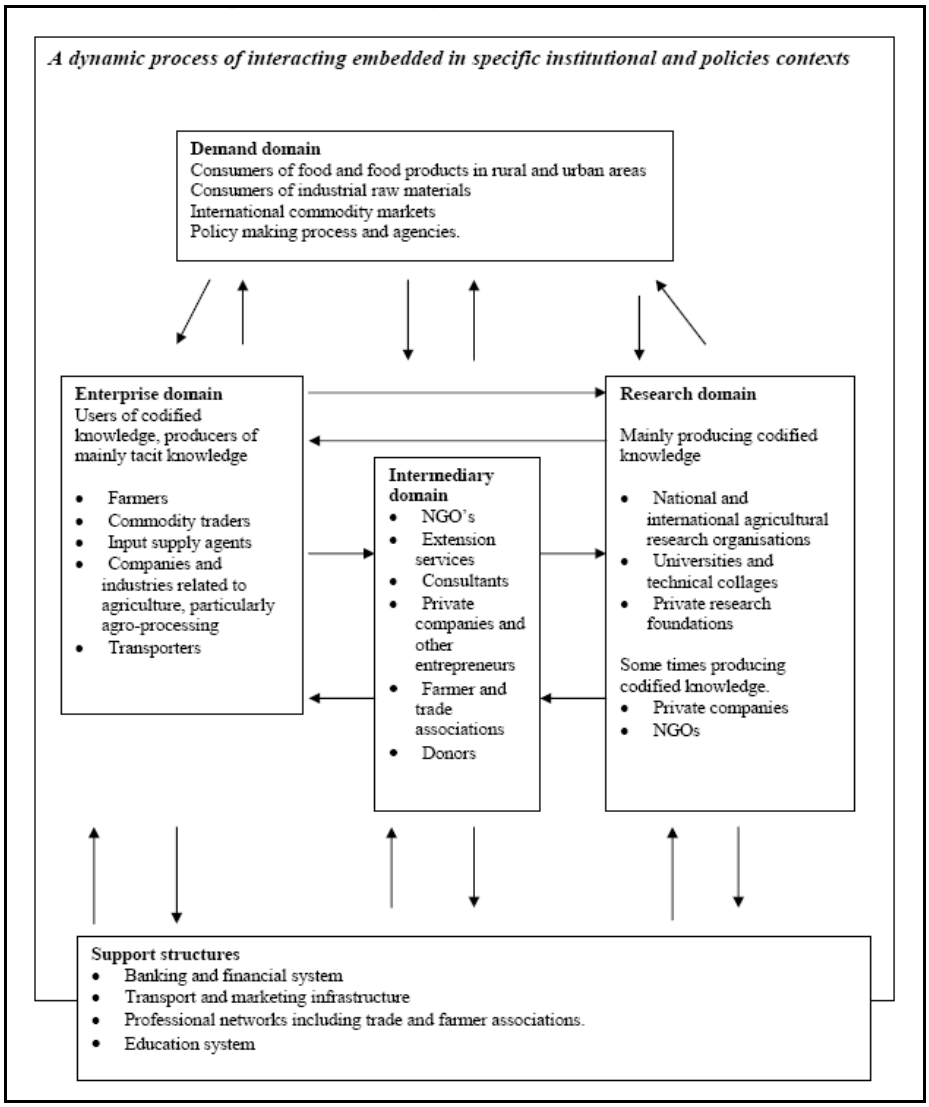
Recently, a number of scholars have attempted to apply the National Innovation System concept to study innovation generation and diffusion in developing countries. Biggs and Clay (1981) and Biggs (1990) have introduced several key concepts — institutional learning and change, and the relationship between innovation and the institutional setting — that have become central to later studies on developing country agriculture and agricultural research systems, such as those by Hall and Clark (1995), Hall et al. (1998), Johnson and Segura-Bonilla (2001), Clark (2002), Arocena and Sutz (2002), Hall et al. (2002, 2003), among the others. This literature has lead to the emergence of the concept of Agricultural Innovation System (AIS), which basically applies the definition of "innovation system" to the agricultural sector (see Figure 2.1).

The AIS approach does not necessarily replace prior agricultural innovation theories, but looks at them from a different perspective. Compared to the NARS and AKIS models, in fact, the innovation systems approach broadens the scope of the analysis in order to include not just the nature and character of agents' interactions, but also agents' motives and behaviours, the institutions that shape these motives and behaviours, and the dynamics of institutional learning and change. In particular, since the innovation systems framework highlights the notion of individual and collective capabilities to translate available information and knowledge into useful social or economic activities, an AIS analysis should attempt to understand how these capabilities are strengthened, and how they are applied to agriculture (Spielman, 2005, 2006).

To this aim, planners and researchers need to pay much greater attention to policies, institutional settings, and their dynamic interactions. This involves thinking more broadly about the range of polices that can influence the innovation process not just through the provision of new knowledge, but also through incentives, triggers and structures capable to stimulate and sustain creativity. Secondly, it must be taken into account the importance of relationships. All stakeholders in the innovation system should have sufficient skills and incentives to create and pursue new relationships through linking, networking and building consortia. Consequently, policies and institutions should promote a partnership-based approach by encouraging relationships of trust and cooperation among individuals and organizations (Hall et al., 2005). In fact, one important way of developing innovation capacity is through public private sector partnerships (PPPs). While research-based PPP are important, partnerships that promote innovation are not only concerned with research and technology, but more generally they are concerned with problem solving of institutional, managerial and policy nature. Yet despite the apparent promise, so far PPP for agricultural research in

developing countries have been difficult to promote (Hall, 2006). One reason may be the fact that most of these partnerships have involved large life science companies with a limited interest in the crops and the constraints characterizing developing country agriculture (Scoones, 2001).

Figure 2.1 An example of Agricultural Innovation System



Source: Hall, 2006, drawing on Arnold and Bell, 2001

Further practical implication of the AIS approach is a (even) narrower focus on participation. In this new perspective, participation is more than involvement; it is the recognition that farmers as such are constantly innovating. As Chambers et al (1989) described already in the 1980s, experimentation is part of the performance of farming. Therefore a first step towards actual participatory research is to recognise this local experimentation and to value the knowledge and rationale behind it. Furthermore,

usually farmers are not innovating as individuals, but they build on the knowledge of their communities, as well as knowledge gained from elsewhere. Useful innovation is the result of social interaction between several concerned actors, of which formal scientists are only one group among many (Waters-Bayer and Bayer, 2005).

Box 2.1 Prolinnova: Supporting Local AIS

Prolinnova (Promoting Local Innovation in ecologically-oriented agriculture and NRM) is an NGO-initiated programme which is built up from country level and aims at creating a global learning network to promote local agricultural and NRM innovation. It was conceived in 1999 by a group of Southern and Northern NGOs supported by the Consultative Group on International Agricultural Research (CGIAR) and the French Ministry of Foreign Affairs and, since then, diverse organizations and networks have joined the initiative in several countries in Africa, Asia, Latin America and the Pacific. Nowadays, the interest in Prolinnova is still growing, as reflected in more and more requests for information and collaboration, and in increasing donor support which includes the International Fund for Agricultural Development (IFAD), the Netherlands Directorate General for International Cooperation (DGIS), the Rockefeller Foundation, and ActionAid, amongst the others.

Although each Country Programme is unique, some common elements emerge: developing inventories and databases of local innovations, innovators and organizations working with them; bringing farmers, development agents and formal researchers together to plan and implement participatory experiments; creating national and sub-national multi-stakeholder platforms; creating awareness and engaging in policy dialogue about agricultural research, extension and education, in order to promote PID. The focus is on recognising the dynamics of indigenous knowledge (IK) and enhancing capacities of farmers to adjust to develop their own site-appropriate systems and institutions so as to gain food security, sustain their livelihoods and safeguard the environment. The programme builds on and scales up farmer-led approaches to development that start with finding out how farmers do informal experiments to develop and test new ideas. Local ideas are then developed in a participatory process that integrates IK and scientific knowledge. The programme also seeks to create or strengthen platforms and partnerships among farmers, NGOs, extension, research and other stakeholders in agricultural R&D, in order to increase their capacity to work all together.

It is important to stress that both the identification of locally-developed innovations and the effort towards knowledge sharing through building partnerships are equally important to the effective use of PID modalities. In fact, results from farmer-led research and innovation in one locality can seldom be replicated exactly somewhere else, especially under the diverse conditions under which most smallholder farming is done in developing countries. Nonetheless, sharing of innovations that are discovered and developed in the course of promoting local innovation processes can serve to stimulate experimentation and innovation elsewhere. Therefore the exercise of identifying and giving recognition to local innovations is, above all, an entry point to joint experimentation to serve as a learning ground for institutional and policy change (Waters-Bayer, 2006).

The networks supported by Prolinnova exemplify several aspects of an AIS. First of all, they are conceived as a system integrating different stakeholders of the innovation process, from farmers to R&D agencies to development organizations. Second, Prolinnova actually promotes the creation of an AIS as a means to diffuse sustainable innovation especially targeting resource poor farmers. Finally, it puts into practices a number of theoretical assumptions of the AIS approach, such as the recognition that farmers' knowledge often represents the foundations of the system, the deliberate promotion of

social capital through networks and partnerships, and the involvement of institutions in building policies.

According to the most recent perspectives on innovation generation and diffusion, an innovation process, when translated into practice, basically has to overcome conflicts among different interests and power relationships. The AIS framework explicitly recognizes that informal, spontaneous sources of innovation (such as on field experimentation) and local institutions (e.g., traditional rules) have to co-exist with formal, external institutions (the state, the non-profit sector, farmers organizations and so on) in order to allow all participants in the innovation process to share information, skills and techniques (Kelles-Viitanen, 2005; Mazur and Onzere, 2006). The interaction between the formal and the informal systems do not regard anymore only the mere creation of knowledge, that is, the research of new technological and organizational solutions (e.g. scientists collaborating with innovating farmers), but also the institutional aspects that influence equity and efficiency issues stemming from innovation adoption.

2.3.3 The AIS approach applied to agricultural development and poverty reduction

According to Hall (2006), an AIS should be understood essentially as a policy tool, i.e. "as a way of organizing thinking on the analysis and understanding of how innovation can be nurtured, how appropriate capacities can be built and how social and economic change can be accelerated". Indeed, some of the studies from the recent AIS literature are distinguished from the previous works on agricultural research and development because they embed analysis of innovation within the wider context of institutional change. However, for what it is concerned to the application to less developed countries, there is still limited evidence that the framework is being successfully exploited in order to understand and promote the generation and transmission of agricultural innovation (Spielman, 2006). The narrow extent to which it has been applied reflects certain realities in developing-country agriculture. For instance, the public agricultural research sector has still a prominent role and absorbs most of the investment in research and innovation. Moreover, the focus on the public system overlooks the importance of understanding the wider, dynamic process of social and technological change, the institutional factors that underlie these processes, and the possible impacts on research and innovation.

Other reasons deal with methodological limitations. With few exceptions, the studies on agricultural research in developing countries consist of *ex post* descriptions of the dynamics of some technological or institutional innovation, with limited or no relationship between empirical analysis and policy recommendations, nor application to system building (Johnson and Lundvall, 2003; Hall et al., 2004; Spielman, 2005). This is due to that the application of the innovation system framework to

agricultural development still lacks the diversity of rigorous qualitative and quantitative methods on which the conventional NIS literature relies. These include, among the others, in-depth social and economic analysis; policy benchmarking, cross-country comparisons and best practices; statistical and econometric analysis; systems and network analysis; and empirical applications of game theory (Spielman, 2005).

An effective use of the AIS concept as analytical tool as well as a practical model would allow also to better examine the poverty-related effects of innovation processes. As it has been said, a more comprehensive perspective on the innovation process recognizes that different interacting actors may have conflicting interests and objectives, and certainly they have different degrees of economic, social and political power. As a result, innovations and innovation processes of greater interest to the poor are often neglected, or even undermined and repressed, if they are perceived as a threat to the status quo of power relationships at the local, national or global levels (Ifad, 2006).

On the other hand, the process of innovation generation and diffusion, as perceived by the AIS approach, may generate and put to use new knowledge for the poor, thus expanding their capabilities and opportunities (Berdeguè, 2005). More generally, according to Johnson and Lundvall (2003), the innovation system theory seems to be consistent with some recent trends in development thinking: (i) an increasing emphasis on capabilities rather than resource endowments; (ii) a new focus on knowledge; (iii) the primary importance of institutions as root causes of development. The broad definition of innovation system may in fact be well integrated with both Sen's focus on capabilities and the focus on institutions since a broad spectrum of socially based inter-linked capabilities are necessary for efficient innovation processes or for well performing innovation systems. Ultimately, the AIS framework highlights the notion of individual and collective absorptive capabilities to access information and knowledge and translate them into a useful social or economic activity (Spielman, 2006).

It has been argued (paragraph 2.1) that, under certain conditions, the net impact of agricultural innovation on poverty depends, on one hand, on the livelihood strategies of the households, on the other hand, on the effects of the innovation on farmers income, food prices, and agricultural and non-agricultural employment. Differential strategies are required to build situation-specific AIS that are relevant to particular combinations of these factors. According to Berdegué and Escobar (2002), three broad situations can be conceptualized:

- Market-driven: innovation is driven by favourable contexts and asset positions, and impacts poverty primarily through lower costs of food, through more and better employment opportunities, and through production, consumption and investment that stimulate the non-farm rural economy.
- Market-oriented: small farmers and small rural entrepreneurs are predominant; they may have the incentives to embark in market-oriented innovation processes, but lack the capacity to fully respond to that favourable context. Innovation may impact on poverty through both direct and indirect effects.
- Context- and asset-constrained: rural households lack most types of assets and operate in unfavourable environments. Innovation is driven by social capital and is aimed at stabilizing survival strategies, managing risk and reducing vulnerability. Thus the potential for agricultural innovations that can result in substantial reduction of poverty levels, is limited.

In the first situation, agricultural innovation can be effectively pursued by formal scientific research activities, with a prominent role of the private sector and research-based PPP. Research priorities are established by the market and they have an impact on the rest of the society almost exclusively through indirect effects. In the latter two cases, research is still an important component, but not the central one. Instead, several social capital dimensions and the institutional setting are among the most important determinants of the innovation patterns. In the market-oriented situation, structural bonding and bridging social capital – such as farmers' organizations, social networks and formal and informal links among different interest groups – coexist and may drive the innovation process for agricultural development. However, also formal and informal institutions (such as trust norms) play a critical role since they can create the appropriate conditions to start and/or sustain the process.

In the third, less favourable situation, innovation patterns are driven mainly by forms of bonding social capital (such as kinship or village networks) aimed at guaranteeing survival conditions. While supporting these risk- and vulnerability-reducing innovations, it is also important to exploit endogenous opportunities for growth. The existence of complementary cognitive social capital (trust and reciprocity norms) and local and meso-institutions capable to transform forms of bonding social

capital into bridging social capital31 (see Chapter One, paragraph 1.3.1), are very important in order to set the development process off (Berdeguè 2001, 2005). In fact the nature of innovation and the related opportunities faced by the poor (in particular, the extent to which they are able to participate in the innovation process and to share its potential benefits) are critically influenced by the interactions of formal and informal political, social and cultural institutions with economic institutions. This implies that the institutional framework – both the formal and the informal – may require substantial changes for certain pro-poor innovations to take off (Berdeguè 2001, 2005). Some changes may happen more or less spontaneously through internal mechanisms, while others may need to be promoted, shaped or even imposed by an external agent. Whenever these institutional changes are feasible and socially sustainable, they place a challenge to governments, development agencies, agricultural research institutions, and whoever is involved in the process of poverty reduction.

Recently, several research centres and development agencies, including IFPRI, IFAD and WB, have shown a renewed interest in the role of innovation process in rural development and poverty reduction, and their focus on the AIS concept32 clearly indicate that they are willing to include it in their development strategies. Nonetheless, as it has been said, so far the innovation system approach has been used mainly as an ex-post rather than an ex-ante concept, with limited application to policy building and weak translation into practices. An effective application of the AIS framework would first of all require overcoming some of the structural limitations that usually characterize developing countries agriculture, such as inadequate funding for R&D, inefficient management, scarce

[31] For instance, Isham's work on fertilizer adoption in Tanzania (2000, 2002), supports the finding that group homogeneity, in the form of tribally-based social affiliation, acts as a form of social capital which positively affects adoption. Narayan and Pritchett (1999) counter argue that in rural Tanzania, households with a high social capital index – in which they include variables of group heterogeneity – make greater use of modern agricultural inputs. The example suggests that a social capital approach can not detail how distinct institutions and forms of social organization may affect innovation uptake and, in general, development outcomes. This will depend on the features of the local social and cultural background, as well as on the underlying pattern of local social and economic development.

[32] In 2005 IFAD launched the Initiative for Mainstreaming of Innovation (IMI), a complex programme made of small project, study cases, workshops and thematic publications, with the objective of contributing to an innovation strategy whereby IFAD should increasingly promote innovation in rural areas. In 2006, the theme of the IFAD Governing Council meeting was how innovation could help meet the challenges faced by rural poor people. Since 2004, the WB has started reviewing the role of agricultural research in development organizing a number of fora and workshops, and in 2006 published "Enhancing Agricultural Innovation: How to Go beyond the Strengthening of Research Systems". Most recently, in April 2008, the International Service for National Agricultural Research (ISNAR) division of the International Food Policy Research Institute (IFPRI) held a conference on "Advancing Agriculture in Developing Countries through Knowledge and Innovation" in which pro-poor innovation and innovation system have been major topics of discussion.

combination of public and private research activities, defining responsibilities and networks among different actors of R&D, and so on. Secondly, it should be enhanced the use of the AIS concept as an analytical tool, so that new applications would include more analysis of agents and agent behaviour, the institutions that condition their behaviour, and the diverse interactions. Furthermore, such applications should include more in-depth study of the policy options that may affect the innovative process and direct it toward more welfare-improving outcomes (Spielman, 2005).

2.3.4 The relevance of social capital to the AIS approach

Vis-à-vis the previous theories on agricultural innovation, the innovation system approach enquires more deeply the interaction between social capital and agricultural innovation. Moreover, several social capital dimensions are explicitly considered as part of the AIS framework. Social capital counts firstly because social interactions – at all levels and among different interest groups – are considered primary sources of innovation. Compared to the social organization of innovation, the focus on social interactions put by the AIS approach has a higher number of practical implications. For instance, the analysis of the existing social interactions relevant to innovation (which may be very different depending on the context) plays an important role since it serves to assess the possibility of promoting them appropriately. Secondly, it has been also narrowed the focus on participation, knowledge sharing (including scientists' expertise as well as farmers' indigenous knowledge) and information flow, that may all be facilitated by appropriate combinations of bonding and bridging social capital. In particular, 'participation' is not intended anymore as the involvement of local stakeholders in a process to which they contribute more or less directly. 'Participation' refers to the explicit recognition that farmers, as such, are "constant innovators", providing the basis of the innovation system. Moreover, modern participatory methods do not aim at finding consensus among the stakeholders about a particular matter. They instead serve to resolve disputes, mediate equity issues and balance distribution of power, which are all important aspects of an innovation system.

Further distinguishing feature of the AIS framework is the higher importance given to the analysis of the institutional setting, including both formal and informal institutions. Informal institutions, such as rules of trust and reciprocity, may ease the innovation process by enabling groups and individuals to manage conflicts and promoting cooperative behaviours. Formal institutions count since they may actively promote (or discourage) those social capital aspects that are relevant to the innovation process. For instance, the government could support associations, groups and networks, in

order to encourage knowledge sharing and information flow, as well as, depending on each context, to stimulate the passage from bonding to bridging forms of social capital. As for what concerns cognitive forms of social capital, the possibility to use them in order to indirectly affect innovation, will depend on the capacity to envisage the possible innovation patterns which are embedded in the social and cultural background. The relevance that institutions, meso-institutions and agency (see the case of Prolinnova, Box 2.1), play in the application of the AIS framework, is consistent with the theoretical framework on social capital and development built in the previous chapter.

Social networks and Farmers Organizations

As it has been already mentioned, the role that farmers play in the innovation system framework is extremely relevant. At the farmer level, social networks, and the changes that occur within them, have emerged as a crucial element in defining the nature of such role and its influence on the success or failure of innovations. Farmers' networks facilitate and incubate innovations by providing a space where knowledge sharing, experimentation and risk mitigation can be embedded (Hussein, 2000). In their study on smallholder innovation in Ethiopia, Davis et al. (2006) find that innovators are better connected in a number of ways: they are typically members of networks that are larger in size and characterized by higher degree centrality, and they also tend to have more ties to traditional institutions compared to non-innovators.

The higher relevance given to social capital and participation by the innovation system approach is exemplified by the shift from a "romanticized view of network" (Lyon, 2000), usually identified with "the community", to the analysis of the existing, functioning social networks to which community members feel actually to belong to in their daily lives. Several empirical studies have demonstrated that research agendas seeking to work exclusively with "communities" that demonstrate high levels of social capital may end up marginalizing the poorest and most vulnerable groups. In reality, village communities are not homogeneous entities and farmers rather participate in multiple and overlapping social networks that intersect within and across many communities. Such networks are usually characterized by high levels of social trust and commitment and offer different kinds of material and social support to members. Many factors such as ethnicity, gender, socio-economic status, and power relations determine networks membership and therefore one's access to information and resources. This, in turn, shapes patterns and processes of technology uptake (Adamo, 2001; GebreMichael, 2001).

The identification of these farmer-initiated, local forms of social organization would enable researchers to build more effective linkages with local knowledge systems, enhance the meaningfulness of local peoples' participation in research, and target the networks through which farmers actually disseminate technologies. Overall, exploring the different manifestations of social capital among rural people in order to identify the range of local networks relevant to innovation, would reveal a more socially and culturally sensitive, and a more sustainable, approach to research and development (Adamo, 2001). For instance, using a case study on Groundnut Production Technology in Maharashtra, India, Padmaja and Bantilan (2007) demonstrates that the explicit inclusion of women's groups in the participatory innovation process has led to both individual and collective women's empowerment in decision making. Women's networks facilitated communication, coordination, and the provision of information and knowledge regarding agricultural production, income generation, and skill enhancement, which it would not be achieved if only traditional, male-dominated village structures were involved in the innovation process. Moreover, women's inclusion amplified the positive outcomes from the spread of the new technology since gender relations played a significant role in mediating the translation of economic benefits into well being of the individual, the family and community.

As the pace of rural development increases, the need for new actors and greater diversification of roles and responsibilities may become necessary. Farmers groups and networks at community level may turn into more formal organizations, specialize in order to represent the needs of particular interest groups and expand geographically. Government-led network structures may be promoted, along with the formation of more independent, but still integrated, network actors from the private sector and civil society. Research and extension organizations move from working with individual farmers to collaboration with groups and, increasingly, with farmers' organizations.

Farmers' organisations (FOs) have emerged in many less developed countries as key providers of agricultural services to their members and they are now, more than ever, actively involved in agricultural development. While agricultural research is not usually a priority for farmers' organisations, these organisations are often effective in providing their members with better access to user-oriented research, extension and training services, which are all prerequisites for technological innovation. Wennink and Heemskerk (2006) identify several functions that FOs may have within the agricultural innovation system. Basic functions are related to the innovation process itself, and include identifying problems and needs for innovation; and creating knowledge (research) and supply information (research and extension) for solving problems and responding to needs. However, as it has

been said, FO contributions to the so-called basic functions (especially research) vary greatly according to the type of organization involved. Whereas almost all FOs contribute to the so-called support functions, which facilitate the effective use of new knowledge, and include facilitating the exchange and sharing of knowledge and information, supplying resources and incentives (e.g. funding of research and extension, but also input, credit and savings schemes, marketing of products, etc.), providing complementary services and a favourable environment (e.g. infrastructure for marketing, insurance schemes, etc.).

FOs are also increasingly valued for representing social capital that is a crucial component of agricultural innovation especially for less-developed rural markets and subsistence agriculture. On the other hand, Röling (2006) stresses that often FOs can be appropriated by farmers with additional assets or by those who hold positions of power within the organization. Drawing on a multi-country study covering a range of West and Central African contexts, Hussein (2000) also highlights that whenever FO's are not characterized by clear rules for group interaction, where there are no core cultural or economic activities that bind their members, where the organisations do not have access to capacity-building support or where they operate in an unfriendly institutional environment (lack of supportive legislation, no formal recognition, etc) they tend to be weak and unable to influence powerful actors with the needs of their members. In other words, not only structural but also cognitive aspects of the social capital held by farmers groups and networks count in order for them to effectively influence innovation patterns. Further important characteristics of a functioning FO are effective leadership, coupled with inclusive membership rules. Finally, a major challenge for formal FOs remains the capacity of effectively tapping into the existing social capital as a means to involve the most marginalized farmers in the innovation process. In many SSA countries, for example, national agricultural innovation programmes aim at empowering farmers' organizations by mobilizing social capital at village level into "Farmer Fora" (Heemskerk and Wennink, 2004).

2.4 Concluding remarks

This chapter has reviewed the theory of agricultural innovation in order to highlight how social capital may influence and may be influenced by agricultural innovation. From the historical review it emerges that social capital, as it has been defined in chapter one, has not been considered as a determinant or even a component of the innovation process until very recently.

The view of agricultural innovation as an assembly of modern technological improvements that can be transferred from one country to another through a linear and mechanistic process was very common in the Fifties and the Sixties. All these modernization related models on innovation and technological change did not take into account social and cultural factors. Neither did the subsequent theories on induced innovation: social capital was not considered either among the relevant variables or among the context variables in none of the phases of the innovation process. The scarce attention given to the role of the users of innovation and the context in which they lived was reflected by the top-down approaches to innovation generation and diffusion which characterised the agricultural development practice.

Subsequently, it has been recognized that even though innovation can well comprise radical breakthroughs, it usually consists of new combinations of existing elements, many small improvements and an iterative process of upgrading through incremental problem solving. Moreover, these improvements are not only technical, but may be also of a managerial, institutional, or policy nature (Hall, 2004). In the Seventies, agricultural development theories (and related policies) started to look at innovation as a multiple dimension phenomenon, having multiple sources as well as manifold objectives. For what concerns the sources, new approaches to agricultural innovations have started to include not only the laboratories and the research stations, but also research-minded farmers, innovative research practitioners at the local level, research-minded administrators, NGOs, private corporations, and extension agencies. Among the multiple objectives which guide farmers' decision about adopting a given innovation, it has been recognized that there are not only technical and economic feasibility, but also considerations regarding food security, adequate cash income, a secure resource base and social security. Moreover, within the household, actual decisions can depend on a complex bargaining process among household members, each one having different choice abilities depending on age, gender and other categories (Cramb, 2003).

The acknowledgement that farmers operate in context specific, complex systems, led to the emergence of the 'Appropriate Technology' and the 'Farming System' approaches. By the mid-Eighties, new theories that gave a major emphasis to the role of farmers were put into practice . NARIs were re-oriented towards a wider client participation and a more efficient management, while development agencies, researchers and NGOs started to employ a wide range of participatory methods, often summarized under "Farmers First". These new approaches included social capital – mainly in the form of 'indigenous social systems' and 'local culture' – among the variables that have to be taken into

account in order to assess the feasibility of promoting technical innovation as well as to forecast the possible effects of adoption. However, in spite of the focus on participation and the local socio-cultural context, innovation was still promoted and introduced by external agents, and social capital did not have an active role in its generation and diffusion. Moreover, at least in the early years, Farmers First approaches often overlooked fundamental issues of power and knowledge among community members, thereby disregarding important dimensions of social capital, including some of its "dark sides", such as exclusion of outsiders and marginalization of poorest community members.

Along with the diffusion of participatory methods, an idea emerged that a particular innovation depends not only on "formal research", but also on "coalition building" of actors who combine their resources to push for a particular path of technical change (ibid.). According to this perspective, since the Nineties agricultural innovation has started to be considered as the result of a social process involving interactions among multiple actors. In order to improve social practices aimed at innovation in agriculture, action as well as research should include inquiries into networking by relevant actors, as well as into convergences, resource coalitions and communication networks that emerge as a result (Engel, 1997). Compared to "Farmers First", the "Social Organization of Innovation" approach has addressed more deeply the relationships between social capital and agricultural innovation. In particular, a part from recognizing a concrete, active role of social interactions in innovation generation and diffusion, it has also taken into account issues of power and equity stemming from the different degree of access to knowledge and information by different actors. The increasing use of "enhanced" participatory methods, as described above, and the diffusion of the AKIS, reflected these theoretical changes.

The attention to social interactions has further widened to include a number of "social dimensions", most of which represent different aspects of social capital. The recognition of these social aspects has gone together with the acknowledgement that innovation might be a conflict process, so that different actors are needed in order to get the opportunities right. At the same time, both the NARIs and AKIS frameworks have been increasingly challenged by the changing and increasingly globalized context in which technological change and agricultural development are evolving. Following these transformations, in the last decade, agricultural development theories have looked for new insights and sources of inspiration. Since the end of the Nineties, some scholars have borrowed the concept of "national system of innovation" from the Industrial Economics to apply it to agricultural innovation,

recognizing a higher importance to social and institutional factors both as determinants and products of the social learning process that leads to innovation.

An innovation system is comprised of the networks of agents involved in the innovation process (organizations, enterprises, and individuals), their actions and interactions, and the formal and informal institutions that regulate this system (Ekboir and Parellada, 2002). In many senses, the basis of the innovation systems paradigm lay in the Farming System approach and the related participatory research models. In fact, these models legitimised the role of farmers in the innovation process, championing the idea of participation and acknowledging special relevance to social interactions; they also recognised that innovation draws knowledge and information from multiple sources. Therefore, it is possible to state that the AIS approach does not necessarily supplant prior approaches, but looks at them from a different perspective. Innovation systems ideas, nevertheless, have brought new impulsion to the discussion on the role of agricultural innovation in development. Moreover, they actually shifted the focus from technology delivery to capacity strengthening and, specifically, the capacity to innovate (Spielman, 2006; Bell 2006; Hall, 2007).

In the AIS approach, the focus is on the process rather than the product. Social capital, due to its potentially positive role in managing conflicts and promoting cooperative behaviours, is an important determinant of the process. Moreover, higher relevance is attributed to the interactions among different agents which pool resources and abilities. Further critical determinant of the innovation process is thus the presence of bridging social capital, or of institutions that can support the shift from bonding to bridging forms of social capital. This is particularly important in order to allow the poorest to participate in all the phases of generation, diffusion and adaptation of innovation. Especially in unfavourable environments, in fact, successful innovation for poverty reduction depends on building local institutions, networks and organizations that help communities mobilize their scarce resources, and link them to external networks.

Many NGOs, research centres and development agencies have stressed the potential of the AIS framework to promote pro-poor innovation. Nonetheless, a part from few exceptions, so far the application of the innovation system concept to developing countries agriculture – either as an analysis tool or as a practical model – has been quite limited. This is in part due to methodological limitations as well as to some structural features of the developing countries agricultural sector. However, there may be also more complex, political reasons. The innovation system approach deserves attention just because it promises to be an effective approach to promote innovation through institutional change at

local as well as national level. Of course this implies to accept a new, somehow revolutionary perspective on agricultural development. As it has been effectively highlighted by Röling (2006), "it is not farmers, but NAROs, IAROs, local and national governments and especially international agencies that need to innovate." According to the analysis of Hall (2007), even though the approach of international organizations (such as the CGIAR), donors and national governments has changed, unfortunately there is still a large gap between what is known about enabling innovation for development and what is evident in mainstream policies and practices.

Chapter 3 The Role of Social Capital in the Spread of Conservation Agriculture in Sub-Saharan Africa

In the previous chapter it has been argued that social capital (SC) plays an active role in the generation, the adoption and the diffusion of agricultural innovation. Drawing on these conclusions, this chapter seeks to highlight the role of social capital in the adoption of conservation agriculture (CA) as an innovative approach to combat land degradation and sustain rural livelihoods in Sub-Saharan Africa (SSA).

In the past, African traditional farming practices included different conservation principles in order to ensure the environmental sustainability of the agricultural activities. Under the colonial regimes, most of these practices were partially or totally abandoned following the diffusion of Western agricultural models and the increasing population forced to move into marginal lands. Therefore, the relatively recent spread of small-scale CA in SSA may be considered as an innovative process because it stems either from the introduction of newly developed technologies or from the adaptation of traditional indigenous soil and water conservation (SWC) practices.

Since conservation practices are part of a broader set of measures under the concept of SWC, paragraph 3.1 introduces the issue of land degradation in Africa and reviews briefly the history of SWC starting from the colonial period. The concept of conservation agriculture and the associated costs and benefits are described in paragraph 3.2 and paragraph 3.3 outline This short insight aims at clarifying some technical concepts in order to better understand which are the potential costs and opportunities associated to the adoption of CA by African farmers, discussed in paragraph 3.4. Subsequently, paragraph 3.5 reviews the recent empirical literature with the objective of identifying the technical, socio-economic and institutional factors which are potentially relevant to the effective adoption and diffusion of CA. Among these, a particular focus has been given to social capital and its multiple roles in the identification, the adoption and the diffusion of conservation practices.

3.1 Land Degradation and SWC in Africa

At small scale level, a farming system is deemed sustainable when it allows the farmer (and its family) to meet the present needs for food and other requirements without damaging the resource base (Beets, 1990). Maintaining long term soil productivity through a correct nutrient cycling within the agro-ecosystem is one of the most frequently mentioned issue in relation to the problem of sustainable

resource use in agriculture (Altieri, 1987; Singh et al., 1990). Irrigation, improved seeds and fertilizer may compensate the productivity loss. Also natural replenishment through the supply of crop residues, manure, or other natural sources of fertilization may keep with productivity losses. However, in presence of diminishing soil depth and natural fertility, such practices will just postpone the decline for some time. Especially in SSA, where nutrient extraction usually exceed the input, sooner or later farming systems are destined to turn unsustainable (Adenew, 2001). Subsequently, land degradation[33] – and in particular soil erosion[34] – is usually considered the primary cause of decline in soil productivity, although the relationship between erosion and fertility is difficult to study due to the multiple interactive factors which contribute to crop yields.

According to IFAD (1992), land degradation can be defined as the loss of the productive capacity of the land to sustain life. Its two main components are:

- Soil degradation: a reduction in soil fertility caused by soil erosion and exploitative cropping[35]
- Impoverishment of the vegetative cover: a reduction in the available biomass caused by climatic factors, over-utilisation of vegetation and reduced soil fertility.

Soil degradation is often caused by water or wind erosion[36] (or both), as well as other bio-physical factors such as salinity and waterlogging. Further important determinant of land degradation is fertility depletion due to exploitative cropping. According to FAO (1998, 2001b), current conventional farming practices are a major cause of severe soil loss and desertification in many developing as well as developed countries. Conventional tillage with tractors and ploughs provokes soil compaction and biological degradation. Even animal traction systems, though to a lesser extent, can lead to erosion.

[33] "Land" is a broader concept than "soil", as it encompasses vegetation as well as the growth medium itself (IFAD, 1992).

[34] FAO (2001) estimates that soil erosion, accelerated by wind and water, is responsible for around 40 percent of land degradation world-wide.

[35] The term "exploitative cropping" describes the reduction in soil fertility which occurs through the removal of nutrients in the harvested crop, where these are not replaced by adequate quantities of manure and fertilizer (IFAD, 1992).

[36] Water erosion is predominant in SSA, except in arid zones where wind erosion is more important. The stages distinguished in the process of erosion by water are: splash, sheet, rill and gully erosion. The most important process in water erosion is the effect of rainfalls on the soil. The vulnerability of the soil to rainsplash depends on soil quality (clays and soils richer in organic matter are more resistant than sands), topography (steep slopes are more vulnerable), vegetation cover – usually the most important factor, in turn affected by crop management and conservation practices. Erosion by wind is most severe in arid zones and where the cover is poor.

Also mono-cropping and continuous cultivation of the same crop in the long run may damage the soil life and the soil structure by increasing the mineralisation of soil organic matter.

Impoverishment of the vegetative cover may result directly from the degradation of the soil, but its primary causes may also be of external nature, such as climatic factors associated with overuse by people and livestock. Soil degradation and vegetation impoverishment exacerbate each other causing the progressive reduction of land productivity. In extreme cases, this process turns almost irreversible and ends up in desertification37.

Erosion affects productivity primarily because it changes the intrinsic physical and chemical characteristics of the soil. The presence of nutrients and organic matter, as well as the soil structural stability, are reduced, the infiltration and moisture retention capacity decrease, and the rooting zone gets progressively lost. This suppresses plant growth and the potential for biomass production. Erosion and soil depletion, thus, exacerbate each other, even though it is extremely difficult to predict which is the reduction in fertility (measured through crop yields) resultant from the quantity of soil lost. Furthermore, a simple or commonly agreed measure of land degradation does not exist. This is the reason why, despite many alarmist statements, many scientists and researchers find difficult to give an indication of the extent of land degradation worldwide and especially in Sub-Saharan Africa. Nonetheless, it is commonly agreed that the processes of land degradation and desertification affect large areas in Africa[38], seriously threatening the ecosystems as well as the livelihoods of millions of people. The causes are manifold.

Especially due to the changing climate, in Africa droughts, cyclones, sporadic but violent rainfalls are more and more frequent. At the same time, the human activities which most accelerate

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[37] According to the United Nations Convention to Combat Desertification (UNCCD), "desertification" is the process of continued land degradation in arid, semi-arid and dry sub-humid areas, caused primarily by human activities and climatic variations. Therefore, it does not refer to the expansion of existing deserts, but it occurs because dryland ecosystems, which cover over one third of the world's land area, are extremely vulnerable to over-exploitation and inappropriate land use. Poverty, political instability, deforestation, overgrazing and bad irrigation practices can all undermine the productivity of the land. Under desertification processes, the productive capacity of land is greatly reduced and the process is only reversed slowly and with considerable input (IFAD, 1992). The UNCCD (2008) estimates that over 250 million people are directly affected by desertification, and about one billion people in over one hundred countries are at risk. These people include many of the world's poorest, most marginalized and politically weak citizens.

[38] The UNCCD estimates that over 1 billion hectares in Africa (73% of the continent's drylands) are moderately or severely affected by land degradation

land degradation – namely collection of firewood, clearing for cultivation, livestock herding, and exploitative cropping with shorter fallow periods – are commonly practiced in wide parts of the continent and especially in drylands. Overexploitation by people and livestock is exacerbated by poverty and the progressive inclusion of marginal lands under intensified agricultural production systems. Population pressure on the limited carrying capacity of land, a stagnant pace of agricultural technology progress, low agricultural productivity and the poor development of the non-farm rural sector, implying the absence of alternative employment means, are the major socio-economic causes of land degradation39 (Adenew, 2001). Various social, demographic, economic, and political reasons lie behind the need to remain in – or move towards – overpopulated areas. In other cases, degradation may stem from the progressive abandonment of the land – due to migration or the AIDS pandemic – and the stop of traditional soil and water conservation (SWC) practices.

Conservation can be defined as the optimal timing of the use of resources – primarily soil and water – given the existing and expected technology and preferences (Penson e al., 1986), with the aim to slow degradation processes and increase soil productivity. Since ancient times, land users in Africa have used a wide range of indigenous SWC techniques in order to conserve the land and to maintain fertility. These techniques can be divided in "ethno-engineering" (Reij, 1991), agroforestry and agronomic practices, which are usually combined: the rationale of soil management in fact is to limit soil erosion (maintain physical soil), improve fertility and conserve water retention capacity at the same time. Under colonial administrations most of these practices were abandoned (especially in those countries where peasants were dispossessed of their land and pushed in unproductive, overpopulated areas), or substituted, often through coercion, for expensive construction conservation works (such as terraces and contour banks borrowed from the North American and the European expertise). Most of these projects failed to solve the problems identified and in some cases they even exacerbated them (see the following chapter on the case of Lesotho). The most important reasons are the use of a dominant top-down approach, the promotion of expensive and complicate techniques, not suitable to

[39] The vicious cycle determined by increasing population pressure and overexploitation of land can be described as follow: in order to meet the increasing demand for food, grazing land, fuelwood and construction wood, farming activities are expanded to marginal and fragile lands on sloping areas. As such areas are prone to erosion, the soil productive capacity declines fast. Fertility depletion is accelerated by a decline in fallow practices, insufficient crop rotation and the removal of crop by-products which are used as livestock feed and fuel. At the same time, deforestation and burning practices reduce the vegetation cover and augment soil vulnerability to run-off erosion and wastage of water resources (Adenew, 2001).

local conditions (they often made use of heavy machinery) and difficult to replicate, and a neglect of farmer training (ibid.). Subsequently, after independence, SWC received low attention by Governments, also because in many countries SWC practices were associated with colonialism and oppression.

Between the Sixties and the Seventies, the emerging environmental concerns in Europe and North America shifted the public attention back to the land degradation problem. The term "desertification" entered the international development lexicon (Scoones et al., 1996) and conservation programmes were re-introduced in Africa, usually with the support of external donors40. However, also the programmes carried out during this period and until the Eighties, have had mixed, often disappointing results. The engineering approach continued to receive too much emphasis, implying the use of heavy machinery for conservation works and the effective exclusion of land users from both the phases of construction and maintenance. As a result, inappropriate techniques were promoted, while indigenous practices were ignored and often discouraged. For what concerns the methodology, most programmes still were of a top-down nature. Along with the frequent uncritical use of food-for-work and other incentives, this approach limited severely the sustainability of the projects implemented. Overall, "the history of soil conservation in SADCC countries suggests that governments and aid donors projects have usually not understood rural resource users, and the decisions they take over land use and management" (Blaikie, 1987). The few exemplar cases of successful SWC conservation strategies, such as the Yatenga region in Burkina Faso and the Machakos district in Kenya, demonstrate that whenever external, often imposed, programmes have been properly combined with indigenous farming practices and with improved land management, sustainable results could be achieved even in marginal and overpopulated areas (Kaborè and Reij, 2003; Barbier, 2000).

3.1.1 Participation and Indigenous Knowledge: a New Approach to SWC

In the Nineties, the diffusion of participatory approaches to development raised the attention towards land users participation in SWC, as well as towards indigenous technical knowledge41, as

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[40] In 1977, the United Nations Conference on Desertification – held in Nairobi – adopted a Plan of Action to Combat Desertification. Consistently, other international agencies started to promote similar initiatives, such as the Special Programme for SSA Countries Affected by Drought and Desertification, launched by IFAD in 1985.

[41] For instance, the first resolution of the 6th International Soil Conservation Conference (1989) explicitly recognizes the importance of learning from traditional techniques from small-scale farmers.

means to ensure the sustainability of the conservation projects. However, as many have noticed, it is not uncommon to observe some distance between the rhetoric and reality of participation aims (Scoones et al., 1996), since many projects have ceased just after incentives have been removed. Furthermore (as it has been widely discussed in chapter two), participatory methods which target "the community" or "the village" may reveal exclusive or underrate hidden interest conflicts among individuals or groups. On the other hand, the review and the analysis of indigenous SWC in Africa – well documented by the extensive work of Reij (1991, 1996), Scoones and Toulmin (1999), Barbier (2000), and Adenew (2001), among the others – have proved the efficiency and the socio-economic feasibility of the existing traditional conservation practices. The evidence from the case studies has also helped to better determine the nature of the soil fertility problem in Africa, and also to identify a number of issues which explain patterns of soil management, assess the range of strategies available and discuss the possible role of policies and public intervention.

The major finding of the studies analyzing indigenous SWC is that problems related to soil fertility are complex and diverse. The characteristics of soils are remarkably different across Africa, in part due to parent rock and rainfall patterns, but also due to differences in location within the landscape, exposure to erosion or sedimentation. Further important determinant of the soil characteristics is the history of use and land husbandry practices, which may vary from village to village within the same area. As it has been already said, the extent of land degradation depends not only on bio-physical factors but also on a wide range of local social, demographic and economic features. Once the problem of soil degradation is conceived as a system problem, several interactive features of the farming systems, and their effects on resource utilization, must be taken into consideration (e.g. changes in soil management practices should be accompanied by improvement in fodder production and supply of household fuel energy). Furthermore, in order to provide a broader understanding of the likely factors affecting farmers decisions, not only the biophysical, but also the socio-economic and the institutional characteristics of the micro-setting have to be assessed. The macro level policies have to be analysed too, since many field studies also verified the influence of public policies (such as structural adjustment programs) on soil management practices (see, for instance, Barbier, 2000).

Therefore, the technological options for managing the soil and their impacts will vary greatly depending on the site-specific interaction of all the factors mentioned above. Moreover, farmers are faced with many important choices relating to their farm enterprise and the decision to invest in improving the soil will depend, on one hand, on the perception that changes are necessary and, on the

other hand, the perception that return to investment will be worth it. Since farmers in LDC use to attach more value to current benefits than future benefits, conventional evaluations involving formal discount rates may not provide the right judgment of investment profitability. This implies that the benefits of conservation activities should be clearly perceivable from farmers. Otherwise, the promotion of SWC practices must provide some kind of incentive in order to compensate the lower profitability stemming from farmers' higher discount rates.

Since the Nineties, a number of global initiatives to assess and combat land degradation in Africa have been launched[42]. Soil depletion and soil erosion have been widely documented in all parts of the continent. Even though different research approaches and quantification methods have leaded to different results, there is a near-universal consensus that soil degradation is a significant and growing problems in SSA, and issues of soil management remain at the top of the international development policy agenda. However, in striking contrast with the evidence of high level of diversity collected at local level, the international debate often founds on generalizations (aggregate statistics and undifferentiated analysis). Indeed, generalizations serve to simplify a complex problem for an international audience, and raise awareness also among those who are less familiar with these topics. On the other hand, generalized and sometimes inaccurate statements may raise excessive alarmism. This results in "emergency" interventions promoting uniform (usually simplistic), technology-centered solutions, which are inadequate to solve such a complex problem (Scoones and Toulmin, 1999; Scoones, 2001).

A review of the data gathered for the World Overview of Conservation Approaches and Technologies (WOCAT) program[43] has identified a number of key elements which limit the effectiveness of most SWC initiatives, and which confirm the trends described above: widespread

[42] Some of these initiatives are: the Africa-wide Soil-fertility Initiative (World Bank and FAO, 1996); the Global Assessment of Human Induced Soil Degradation (GLASOD) (conducted by the International Soil Reference and Information Centre (ISRIC), as commissioned by the United Nations Environment Programme (UNEP, 1987-1990); the World Overview of Conservation Approaches and Technologies (WOCAT) program, initiated during the 1992 International Soil Conservation Organization (ISCO) conference, held in Sydney, Australia.

[43] The World Overview of Conservation Approaches and Technologies (WOCAT) programme was initiated at the 1992 ISCO conference with the aim to facilitate local and international exchange of experience and lessons learnt on SWC. To this aim, the WOCAT programme has created and maintained a global database system for storage, retrieval and dissemination of documented information based on an internationally recognised standardised methodology. Books, reports and papers are accessible in 3 languages (English, French and Spanish) on the Internet and on CD-ROMs.

overemphasis on structural measures; lack of a holistic assessment of the processes and causes of land degradation and failure to understand the context; insufficient use of indigenous knowledge and land users' own experiences; lack of flexibility in implementation and rigid adherence to centrally determined conservation "standards" (Liniger et al., 2004). On the other hand, the WOCAT database also includes a growing number of farmers' own, as opposed to research-based or extension- and project-promoted, soil conservation technologies. As Liniger et al. (2004) notice, this dichotomy should be overcome and both SWC specialists and local land users should open to each other knowledge and expertise. This exchange would help to promote more sustainable and easily adaptable technologies in order to face the challenges posed by a changing (socio-economic and natural) environment.

In sum, the review and the analysis of the existing local knowledge have raised awareness on a number of theoretical issues and promoted a new approach to the management of soil fertility:

- (Concrete) participatory planning and analysis in SWC is extremely important, not just to find sustainable technological solutions, but also to understand which is farmers' perception of the costs and the benefits associated to investing in land management.
- Standardized technological solutions for SWC are not suitable for managing highly diverse contexts, even in the same country or agro-ecological region. At the opposite, SWC interventions must be local specific and integrate several physical, technical, socio-economic and institutional aspects.
- Not only technological and biological features, but also socio-economic factors have to be taken into account in order to understand which are the local needs and the relative feasible answers. A number of social capital related issues, such as the community or the village customary use of land (including land tenure systems), the role of local institutions, formal and informal laws, existing farmer groups and organizations, and the interaction among research, extension and farmers, have also gained increasing importance in the assessment analysis.
- While much of the current international debate supports direct interventions which pay particular attention to the improvement of natural and physical capital (e.g., the massive supply of inorganic fertilizer, or the construction of dams, banks, etc.), the evidence from the local contexts would suggest that the debate on soil fertility management in SSA and the options for intervention need to be set within the broader context of how to support rural livelihoods. From this perspective, all five capital assets (natural, physical, financial, human, social) should be considered, since all of them play a role in the effective implementation of SWC measures.

As a consequence, the engineering approach has been progressively substituted for a multidisciplinary, more flexible one. The value and the significance of indigenous knowledge has been widely recognised and often traditional SWC practices have been employed in combination with modern research-based solutions. At the technical level, physical works are closely integrated with agro-forestry and agronomic practices, so that a wide range of techniques can be adapted to the diverse agro-ecological zones. Conservation agriculture (as defined in the next paragraph) well fits this new, comprehensive approach to combat land degradation and manage soil fertility. In the last decade, CA has been increasingly promoted in Africa complementarily to other SWC measures. In some cases, it proved to significantly improve the soil conditions even though it was not employed as part of a broader SWC strategy. Furthermore, CA may increase the yield in a short or medium term, thus providing an attractive solution to land degradation also for those farmers who seek rapid, visible advantages from investments in SWC.

3.2 The Concept of Conservation Agriculture

Conservation tillage is a general term which has been defined as "whatever sequence of tillage operations that reduces the losses of soil and water, when compared to conventional tillage" (Lal, 1995). Normally this refers to a tillage systems which do not invert the soil and which retain crop residues on the surface. Over the time, these production systems have demonstrated to be more sustainable than conventional farming and also that they can stop and reverse soil degradation. The terminology being adopted for such systems by FAO and other organisations is "Conservation Agriculture" (CA) and it is used to refer to all the practices which follow three basic principles:

- Disturb the soil as little as possible. As it has been said, in the long term, the use of the plough and the hoe destroys the soil structure and contributes to declining soil fertility. In conservation agriculture, tillage is reduced to ripping planting lines or making holes for planting with a hoe. The ideal is to plant direct into the soil, without ploughing. If ploughing or hoeing in previous years has produced a hardpan, this hard layer must be broken by digging deeply with a hoe or an animal- or a tractor-drawn subsoiler. After the first season, once crop roots have penetrated deep into the soil and have helped water to seep into the soil, it is not necessary to dig through the hardpan again.
- Keep the soil covered as much as possible. In conventional farming, farmers usually remove or burn the crop residues or mix them into the soil with a plough or hoe. Once it is left bare, the soil is vulnerable to water and wind erosion. In conservation agriculture, stubble left on the field, mulch

and special cover crops protect the soil from erosion and, in the medium and long run, limit weed growth throughout the year.

- Mix and rotate crops. Planting the same crop each season allows certain pests, diseases and weeds to survive and multiply, resulting in lower yields. Mixing and rotating the crops helps to improve the fertility of the soil, while crop rotation can also break some pest and disease cycles.

The aims of CA practices are to increase yields while improving soil and water conservation and reducing production costs (FAO, 2001b). In order to gain the full benefits, all three principles have to be applied at the same time. However, this is not always the case, especially in Africa where the adoption and the diffusion of conservation farming is largely at an early stage.

Conservation agriculture can be applied to different farming systems, with different combinations of crops, sources of power and inputs. Farmers who do not own livestock or can not afford draught or mechanized power, can practice conservation agriculture by digging planting basins with a hoe. They can then put chemical or natural fertilizers in the basins in order to raise the soil fertility and the water-holding capacity, and sow by hand. Alternatively, they can use a manual jab-planter to put fertilizer and seeds into the soil. Smallholders who own (or can hire) oxen or donkeys can use several implements: animal-drawn rippers, some of which allow also to sow and apply fertilizer at the same time, subsoilers and knife-rollers. Mechanized, large-scale farms can practice minimum and zero tillage by replacing tractor traditional implements with rippers, subsoilers and direct-drill planters. In any case, minimum tillage techniques should be combined with crop rotation, intercropping and mulching. The extent of the use of agro-chemicals instead of natural fertilizers and integrated weed and pest management will depend on the access to markets and credit, as it happens in conventional agriculture. The efficacy and the sustainability of the adoption of CA principles by different farmer categories is critically determined by the choice of the proper combination of tillage techniques, equipment and inputs.

3.3 Costs and Benefits of CA

The advantages associated to conservation agriculture can be divided into agronomic, environmental and socio-economic. Especially for what concerns the agronomic and the environmental benefits, the impact of CA practices depends critically on whether (and the extent to which) the most important conservation principles are applied. Generally speaking, the most important agro-environmental benefits which accrue to land and farm management are:

- Reduced tillage improves soil structure and stability and leads to the progressive suppression of weed growth.
- Crop residues left on the soil surface protect the soil from wind erosion and break the impact of raindrop splash, slowing down the velocity of surface runoff and impeding water erosion. Reduced runoff results in a reduced loss of water, soil, fertilizer and pesticides, so avoiding wastes and contamination of soil and downstream waters.
- The soil cover also makes the organic matter content to augment over time, increasing soil fertility and improving the structure. Soil organic matter binds the soil particles together into structural units called aggregates and thus helps to maintain a loose, open, granular soil structure. Such a friable soil structure improves water infiltration, retention and availability, impedes water runoff and thereby soil erosion. In turn, improved water infiltration and the reduction of moisture loss by evaporation, improve the capacity of the soil to retain nutrients and moisture.
- Crop residues are also a habitat and a source of food for the organisms in the soil, which in turn help the formation of stable aggregates. Stimulation of the biological activity in the soil (micro-organisms and insects) and in the field (predators), creates conditions for effective biological pest and disease control and, in general, has a positive impact on agro-biodiversity.
- Better soil structure and increased fertility improve the rooting conditions for plant development and growth, and reduce the probability that the crops will suffer from drought and other natural disasters.
- Crop rotation and intercropping maintain and enhance soil fertility, while crop rotation contributes to break pest and disease cycles. The inclusion of leguminous green-manure or cover crops in small-farm systems not only provides dense cover and large quantities of organic matter to the soil, but also significant quantities of microbially fixed nitrogen (FAO, 2001a).

Conservation agriculture also contributes to wider environmental benefits such as:

- Less erosion impedes land degradation and desertification.
- Reduced runoff limits the loss of water and soil, but also of fertilizer and pesticides, and so avoids the contamination of soil as well as pollution and siltation of downstream waters.
- No-tillage and mulching reduce the release of carbon into the atmosphere. Higher carbon sequestration mitigates climate changes and the impact of greenhouse gases.

- Biodiversity is enhanced through diversification, improved field conditions and stimulation of biological activity (soil micro-organisms but also pest predators). Living cover crops and crop residues provide the habitats for a variety of animals (insects, birds, small mammals, reptiles, and so on), plants and micro-organisms, which are necessary to sustain key functions of the agro-ecosystem.

The major socio-economic advantages relate to saving costs and labour, increased food security, profitability and suitability of CA practices. One of the major benefits is that many CA techniques are labour saving (IFAD and FAO, 2004), while others become less labour-intensive over time. For example, the planting basin system used in Zambia increases labour requirements for weeding, at least in the first seasons, due to the fact that farmers only till 15% of the soil surface during field preparation. However, when using planting basins the land can be prepared (that is, holes can be dug) in the dry season and thereby relocate the heavy labour out of the peak planting period. This also enables farmers to sow earlier and benefit from timely planting (Haggblade and Tembo, 2003).

Several agronomic factors increase fertility and thus yields. Conservation farmers avail not only of higher productivity but also of output stability, in turn due to crop diversification, improved soil and fields conditions, increased resistance to drought and other climatic shocks such as storms and floods. Increased and stable production may have a dramatic impact on food security but also on income, if the surplus can be marketed. Higher yields and reduced production costs (of labour – depending on the adoption stage –, rent and/or operation and maintenance of machineries, energy required for land preparation and sowing, etc.) increase net profitability.

Finally, the suitability of many conservation practices to resource poor farmers and to marginal environments makes them far more sustainable than conventional agriculture.

In spite of many advantages, the adoption of CA is sometimes limited by institutional, social and technical factors. The most important limitations in all areas where conservation agriculture is practiced, are:

- The initial lack of knowledge. There is no blueprint available for conservation agriculture techniques, that must be adapted to the different agro-ecosystems. The success or failure of conservation agriculture highly depends on the flexibility and creativity of the practitioners and extension and research services of a region. This implies, on one hand, the need for technical and institutional support, on the other, farmers' openness to innovation. In many countries already exist

organizations and networks that exchange information and experiences on cover crops, tools and techniques. However, in most parts of Asia and Africa access to knowledge and information remains a problematic issue.

- Soil tillage is sometimes associated to the local culture. Farmers' willingness to adopt CA may be hampered by the fear of making a change that may generate opposition or biases within the community. For instance, in some African societies, farmers who plant cover crops and leave crop residues in the field are regarded as lazy.
- Farmers may be reluctant to adopt CA also because the shift to a completely new farming approach may require a great investment in resources (to buy or rent new equipment) and time (for training and acquiring new skills). In most cases, at the early adoption, additional work is required for application of lime, weeding, breaking hand pans and constructing planting basins. Although labour diminishes starting from the first or the second crop season, the risks associated with the adoption of a new technology may be considered too high compared to the effort required.
- Finally, the inappropriate application of the CA principles and scarce management skills may result in lower yields and other problems. For instance, if not managed properly, soil cover and mulching make the field vulnerable to plant diseases and pest infestations.

Most of the problems mentioned above stem from the lack of adequate technical and institutional support. In countries where CA has been adopted since a long time, such as North and South America, farmers who want to shift to conservation practices can rely on the strong support of research institutions and farmers organizations (see paragraph 3.5.2). At the opposite, in Asia and Africa, where CA experiences are still limited, problems are more difficult to solve. Extension officers and pioneer innovating farmers, if properly supported by formal as well as informal institutions, may play a critical role in overcoming cultural prejudices and spreading technical knowledge.

Due to the high risks associated with farming – that become even higher when a new technology is adopted – farmers may consider unworthy to engage time and resources. As it has been said for the promotion of SWC techniques, in these cases it is critical that all community members (especially in case of cultural biases) participate in training and demonstrations. Even if suitable practices to be introduced and adapted are identified, there may still be the need to use some kind of incentive, either in terms of credit, inputs or provision of labour. However, the use of incentives should be always limited to well defined situations, for example if farmers have to face short-term costs in

order to achieve long-term (social) benefits. These issues are discussed more in detail in the rest of the chapter, with particular reference to the opportunities and the constraints associated to the diffusion of CA in SSA.

Table 3.1 Potential benefits associated with conservation agriculture

Agro-ecological benefits	Resulting from…	Due to…
Progressive suppression of weed growth	Improved soil structure and stability	Reduced tillage
Long-term yield increase	Reduced water and wind erosion	Reduced tillage and soil cover
	Increase in soil fertility and stability and improved soil structure	Reduced tillage, soil cover, mulching, intercropping and crop rotation
	Improved retention of water, nutrients and soil moisture	Reduced tillage, soil cover, mulching
Reduced runoff	Decreased erosion, improved soil structure and water retention capacity	Reduced tillage and soil cover
Improved rooting conditions	Increase in soil fertility and stability and improved soil structure	Reduced tillage, soil cover, mulching, intercropping and crop rotation
Improved agro-biodiversity	Higher biological activity in the soil and in the field	Soil cover and mulching
	Crop diversification	Crop rotation and intercropping
Output stability	Reduced vulnerability to climatic shocks	Improved rooting conditions
	Enhanced biological pest and disease control	Crop rotation
		Higher biological activity in the soil and in the field
Reduced waste of water and inputs	Reduced runoff	Decreased erosion, improved soil structure and water retention capacity
Environmental benefits	**Resulting from…**	**Due to…**
Decrease of land degradation	Reduced erosion, higher soil fertility, improved soil structure	Reduced tillage, soil cover, mulching, intercropping and crop rotation
	Improved agro-biodiversity	Higher biological activity in the soil and in the field
Reduced downstream sedimentation and siltation	Reduced runoff	Decreased erosion, improved soil structure and water retention capacity
Reduced contamination of soil and surface and ground water	Reduced runoff	Decreased erosion, improved soil structure and water retention capacity
Reduction of CO2 emissions to the atmosphere	Higher carbon sequestration	Reduced tillage, soil cover, mulching
Conservation and enhancement of terrestrial and soil based biodiversity	Crop diversification	Crop rotation and intercropping
	Higher biological activity in the soil and in the field	Soil cover and mulching

Socio-economic benefits	Resulting from…	Due to…
Increased food security	Long-term yield increase and output stability	Reduced erosion, higher soil fertility, improved soil structure, improved retention of water, nutrients and soil moisture Enhanced biological pest and disease control
	Crop diversification	Reduced vulnerability to climatic shocks Crop rotation and intercropping
Increased net profitability	Long-term yield increase and output stability	Reduced erosion, higher soil fertility, improved soil structure, improved retention of water, nutrients and soil moisture Enhanced biological pest and disease control Reduced vulnerability to climatic shocks
	Reduction of on-farm costs	Savings in labour, machinery and (in the medium-term) chemical inputs (herbicides, fertilizer and pesticides, depending on the technology adopted)
Technology sustainability	Suitability to different farming systems and agro-ecological environments	Appropriate combination of tillage techniques, equipment and inputs

Source: author's elaboration

Table 3.2 Potential constraints to the adoption of conservation agriculture

Technical/Management Constraints	Resulting from…	To be addressed through…
Short term pest and disease problems	Change in crop management Increased use of soil cover and mulching	Development of appropriate technology packages and training Training on IPM and biological pest and disease control Application of additional chemicals
Short term weed infestation	Change in crop management Change in tillage techniques	Development of appropriate technology packages and training Application of additional chemicals Additional labour
Insufficient management skills	Need to careful plan crop rotations and intercropping, choice of cover crops, new approaches to weed control and pest management, proper application of all basic CA principles, …	Technical support and extension Farmers' time commitment to learning and experimentation Development of appropriate technology packages and training Creation and operation of farming groups and research and extension networks

High perceived risk (country specific)	Technology shift Insufficient management skills Lack of knowledge and information (country specific) Cultural barriers and community biases	Appropriate use of incentives (credit, inputs, labour, …) Development of appropriate technology packages and training Farmers' time commitment to learning and experimentation Creation and operation of farmers groups and research and extension networks Technical and institutional support Commitment of extension officers and pioneer innovating farmers Community participation in, training, demonstrations and technology adaptation
Economic costs	**Resulting from…**	**To be addressed through…**
Additional starting costs	Purchase of specialized planting equipment Farmers' time commitment to learning and experimentation (At initial stages) additional labour requirements	Enhanced access to markets Appropriate use of incentives (credit, inputs, labour, …) Development of appropriate technology packages and training
(At initial stages) lower yields	Initial immobilization of nutrients	Intercropping with nitrogen-fixing crops Application of additional fertilizer
	Short term pest and disease problems and weed infestations Insufficient management skills	Training on IPM and biological pest and disease control Application of additional chemicals Additional labour Development of appropriate technology packages and training Technical support and extension Farmers' time commitment to learning and experimentation Creation and operation of farming groups and research and extension networks

Source: author's elaboration

3.4 The Spread of Ca in Sub-Saharan Africa

No tillage and minimum tillage techniques started to spread in the United States in the Thirties, when soil erosion transformed the Midwest in what was then called the "Great Dust Bowl". Supported by the government, many farmers abandoned the plough and started to plant directly into the stubble they left on the soil surface. Faced with similar problems, farmers in South America also took up conservation agriculture. In the early nineties, the Zero-Tillage (ZT) movement has spread in the whole Latin America. At the beginning, ZT was practiced almost exclusively by large-scale farmers; over the

time, the combination of minimum and no-tillage with cover crops and crop rotation, and the development of improved herbicides and special equipment adapted to tropical conditions, made the technology progressively available also to many small farmers (Benites et al., 2002).

Recent studies estimate that no tillage is practiced on more than 95 million hectares of farmland (Table 3.3), mainly in North and South America (39% and 47% of no-till farmland, respectively). Worldwide, the area under this technology increased by 66% between 2000 and 2005. Despite the fact that the United States has the biggest area under no-tillage, it accounts for only 23% of all cropland hectares, while in Brazil and Argentina no-tillage accounts for about 60% and in Paraguay for 65% of all cropland hectares. In Africa and Asia, the size of farmland converted to CA is still negligible, though increasing (Reijntjes, 2002; Derpsch, 2005; Theodor, 2006).

Table 3.3 Total area – in hectares – under no-tillage in different countries, 1973/74- 2004/2005

Country	1973/74	1983/84	1999/2000	2004/2005
USA	2.200.000	4.800.000	19.750.000	25.304.000
Brazil	1.000	400.000	13.470.000	23.600.000
Argentina	-	-	9.250.000	18.269.000
Canada	-	-	4.080.000	12.522.000
Australia	100.000	400.000	8.640.000	9.000.000
Paraguay	-	-	800.000	1.700.000
India, Pakistan, Bangladesh and Nepal	-	-	-	1.900.000
Bolivia+Uruguay+Chile	-	-	350.000	933.000
South Africa	-	-	-	300.000
Spain	-	-	-	300.000
Venezuela	-	-	-	300.000
France	-	50.000	50.000	150.000
Colombia	-	-	-	102.000
China	-	-	-	100.000
Others (Estimate)	477.000	605.000	650.000	1.000.000
Total	**2.778.000**	**6.255.000**	**57.040.000**	**95.480.000**

Sources: Benites et al., 2002; Derpsch, 1999, 2005

Conservation agriculture has great potential in Africa because it can control erosion, produce stable yields, thus improving food security, and reduce labour needs (IIRR, 2005; FAO, 2001a). The Declaration of the Second World Congress on Conservation Agriculture (Brazil, 2003), states that "CA is the principal road to sustainable agriculture and capable of helping solve the world's hunger and environmental crises while improving the quality of life". However, the story of conservation agriculture in Africa is not completely new. Before European settlers and colonial regimes introduced

ploughs, conservation principles used to be normal practice: farmers would cultivate by hand, often with hoes, mulching, rotating crops and fallowing fields for several years. Nowadays, the farmers who still rely on these traditional practices may easily integrate some of the CA principles in their farming systems in order to increase efficiency and facing the growing constraints represented by population pressure, land scarcity and soil degradation. Nonetheless, so far practitioners of no-tillage and minimum tillage techniques have been relatively few.

CA has started to spread in Zimbabwe and South Africa in the Seventies and the Eighties, when large South African and Zimbabwean commercial farmers, after visiting the USA, decided to launch local research programs44 and set up no-till farmers' clubs similar to those in South America. These experiences proved particularly influential among Zambian commercial farmers, who sent farm delegations to the USA for study and commercial contacts during the mid Eighties (Fowler and Rockstrom, 2001). Subsequently, also large-scale farmers in Kenya and Namibia came to use conservation agriculture practices. The conservation practices introduced by commercial agricultural exploitations in Eastern and Southern Africa have been mainly minimum and no-tillage, combined with the application of chemical herbicides.

Since the Nineties, national and international development organisations (including World Bank, FAO, GTZ, RELMA, among the others), as well as private enterprises, such as Monsanto in collaboration with Sasakawa 200045, have started supporting initiatives to introduce CA among small-scale farmers in several countries. Some of the most successful initiatives have been implemented in Zambia, due to the variety of technologies introduced and the high adoption rates (10% of smallholders throughout Zambia in 2003, according to Baudron et al., 2005). Other important programmes have supported the diffusion of indigenous minimum tillage methods such as planting pits (known as *tassa* in Mali, *zai* in Burkina Faso, *demi-lune* in Niger, *potholing* in Zambia, and *matengo* pit system in

[44] During the mid-Seventies the South African Grain Crop Research Institute established tillage trials to compare the effects of different tillage systems on grain yields. This was followed by the work of the Agricultural Research Trust in Zimbabwe and the Golden Valley Agricultural Research Trust in Zambia.

[45] Many civil society organizations accuse Monsanto and other agro-chemical companies of hiding commercial interests behind the commitment to the promotion of CA in Africa and other developing countries. The technology they promote founds on high-external-input ZT based on direct seeding, and to a much lesser extent on crop rotation, mulching and soil cover. Such an approach may actually reveal unsustainable for many small farmers and makes them dependent on buying seeds and agrochemicals, with the well-known risks related to farmers' health and wealth as well as to the environment and the lost of local cultures.

Tanzania), and the slash and burn systems in Ghana and Tanzania (IFAD, 1992). In 1998, national and international organizations set up the African Conservation Tillage Network (ACT) with the support of FAO. The objective of the ACT is promoting CA and exchanging experiences amongst African practitioners46. Although CA has been rarely applied in a manner that encompasses all its aspects and the impacts on smallholder agriculture have been limited, these early African experiences have been positive (Ashburner et al., 2002; Fowler and Rockstrom, 2001). The interest for CA in SSA has continued to grow and recently, a new wave of initiatives have started in Cameroon, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zimbabwe, and other countries. In addition, the Third World Congress on Conservation Agriculture was held in Nairobi in October 2005[47]. The congress theme was "Linking Production, Livelihoods and Conservation" and its objective was to expose and share experiences and lessons on the role of conservation agriculture in enhancing rural livelihoods in diverse environments, with a focus on smallholder farming systems. The contribution of conservation agriculture to the attainment of the millennium development goals has been analyzed especially with regard to: poverty reduction and food security, sustainable natural resource management, and mitigation of impacts of HIV/AIDS.

3.5 The Adoption of CA in SSA: Constraints And Opportunities

This section discusses the major constraints and opportunities the diffusion of CA in Africa, as they have been identified by the most recent empirical literature,. These include the advantages and the disadvantages that generally stem from the use of CA practices, and that have been described in paragraph 3.3. However, there are also a number of issues which are peculiar of African agriculture, because of its special features and above all because of the challenges that farmers and in general rural people are facing in most LDC.

Higher and more stable yields represent the most important benefit for African farmers who adopt conservation agriculture. Associated with decreasing variable costs, larger outputs increase net

[46] www.fao.org/act-network

[47] The 4th World Congress on Conservation Agriculture – "Innovations for improving efficiency, equity and environment" – was held from 4-7 January 2009 in New Delhi (India) and was jointly organized by the Indian council of Agriculture Research (ICAR) and the National Academy of Agriculture Sciences (NAAS) under the sponsorship of ICARDA, RWC, FAO and IFAD. The conference materials were not yet available when the present work was finalized.

profitability and contribute to strengthen and diversify rural livelihoods. CA farmers rely on more produce to be marketed or consumed, but they also avail of extra time to undertake off-farm work, hire out services (for example, draught animals), or move into higher value-added agricultural production. Food security is enhanced due to higher outputs as well as to nutritional improvements. Enhanced diet diversification results from the availability of diverse crops planted in rotation or along with cereals in CA fields, the extension of cultivated spaces thanks to additional resources (including time), and purchased food. The cases confirming the potential of CA are many: Zambia (Haggblade and Tembo, 2003), Burkina Faso (Kaborè and Reij, 2003), Mozambique (Taimo et al., 2005), Lesotho (Mapeshoane et al., 2005; Silici et al., 2007), among the others.

Beyond increasing net profitability and food security, CA ensure long-term socio-economic and environmental sustainability, even in densely populated areas, such as it occurred in Burkina Faso (Kaboré and Reij, 2003). As it has been said (paragraph 3.1), African soils are increasingly affected by land degradation and desertification, but these phenomena have to be contextualized in order to understand the diverse causes, features and consequences which are highly local specific. CA may benefit African agriculture just because the wide range of practices and techniques can be adapted to different socio-economic contexts (paragraph 3.3) as well as to different agro-ecological conditions. In semi-arid lands, conservation agriculture retains water and moisture in the soil, keeps the soil temperature even, and protects the land from erosion during heavy downpours. In sub-humid and humid areas, crops planted at closer spaces and cover crops help suppress weeds and protect the soil. On slopes, conservation agriculture reduces runoff and soil erosion, and can be effectively used in association with terraces, contour grass strips and other erosion-control methods (IIRR, 2005).

Further advantages for African farmers stem from lower labour requirements. In many countries, the rural population is steadily being reduced by rural-urban migration and by the HIV/AIDS pandemic. These phenomena concern particularly the younger male population, meaning that those with the best potential for heavy physical work are no longer working on the land, while a growing number of households are headed by women. At small scale level, once the conservation farming system is well established, the shorter time required for land preparation and weeding, along with the more even distribution of labour throughout the season, allow to reduce the amount of labour. Also draught animal power (DAP) systems permit to save labour by shifting from the mouldboard plough to shallow ripping. Time saving and reduced drudgery of field activities benefit all farmers, but a major opportunity arises for women due to the increasing “feminisation of agriculture” (Ashburner et al., 2002). Moreover,

while in conventional agriculture seedbeds are often prepared too late, due to that most farmers have no direct access to animal or motorized traction, CA farmers can prepare the land throughout the whole dry season and avail of higher yields just because of timely planting (Fowler and Rockstrom, 2001; Haggblade and Tembo, 2003).

Evidence of CA techniques as labour saving practices has been assessed in field works in Northern Tanzania (FAO, IFAD, 2004) and Zambia (Haggblade and Tembo, 2003). Further empirical studies have highlighted that the impact of CA on labour saving may affect men and women differently, depending on the responsibilities they perform by tradition and local customs. For instance, eliminating ploughing (traditionally a men's work) may make it easier for women to adopt conservation agriculture, especially if they are heading the household without male or youth support. In other cases, CA practices increase the amount of work that women and children use to do, namely planting, weeding and harvesting. Also land preparation by digging planting pits may result extremely hard and time consuming if done by women. However, these distinctions are not always clear-cut and they differ from place to place and from family to family (IIRR, 2005).

Depending on the technology employed, the adoption of CA may also have a negative impact on labour. Many small-scale conservation practices, in fact, require temporary additional work, for instance for initial land preparation and weed and pest control in the transition phase. Even though labour requirements diminish after the first or the second season (leading to important – already mentioned – advantages), such initial effort may prevent resource poor farmers, and especially women and the elderly, from adopting the technology. The shift from conventional to conservation practices may require also additional financial resources to buy inputs and purchase (or hire) and maintain new equipment. As it has been said, the choice of appropriate combination of CA practices and inputs should limit the expenses. However, if additional costs can not be avoided (especially those from initial labour demand), poorer, more risk-adverse farmers can be supported with some kind of incentives (discussed in the next paragraph).

The adoption of CA technologies which require higher labour demand and the use of more or diverse inputs and equipment may result difficult also to better-off and commercial farmers. Highly imperfect (when existing) markets for inputs and credit and lack of a local infrastructure to support the manufacture and repair of CA equipment, may hamper the adoption and the diffusion of conservation technologies also among farmers who could afford them. Of course, these problems affect the development of the whole agricultural sector in Africa and not just the diffusion of CA. A discussion

on the complex range of institutional and political measures needed to face these challenges is beyond the scope of this work. However, since CA has a potential to turn subsistence farmers into small- and medium-scale commercial farmers, the initial diffusion of simpler and cheaper techniques may over time stimulate a demand for a concrete improvement of local markets as well as of the linkages with international markets. In addition, it can also stimulate the development of private and public research on locally adapted inputs and equipment that are more easily available to farmers.

Additional technical constraints to the adoption of conservation farming in Africa stem from the difficulty to keep a permanent soil cover due to insufficient biomass production. This may be due to agro-ecological and weather conditions, such as high humidity or poor rainfalls. But the most important reason for scarce soil cover is that available crop residues serve many other scopes such as animal feed, fencing, and fuel. For CA to be successfully adopted, alternative sources of fuel and fodder should be found. Otherwise, crop rotations and cover crops cultivation should allow the production of enough residues to meet the several needs. Proper crop selection, right choice of crop rotation, and improved crop residues management, may help achieve these objectives. For instance, many Burkinabe farmers who have started CA, have then invested in livestock, since they could increase the production of fodder crops (Kaboré and Reij, 2003). However, especially in drier areas, sufficient biomass production still requires a lot of time and resources, and in most African countries, such as in Zambia – where the benefits of CA have been extensively described – most fields remain uncovered. A part from technical answers, the even allocation of crop residues among multiple purposes may be achieved also through the right use of institutions, community participation and cooperation.

Further particular aspect that must be addressed jointly by community members is the integration of crop and livestock production, especially wherever livestock constitutes a major component of the local economy. The integration of livestock into CA may contribute significantly to the overall efficiency of the local agricultural system. Farmers can introduce forage crops into crop rotation, and these can be used for both fodder and soil cover, as well as to reduce pest problems. On the other hand, animals manure can be exploited to recycle nutrients in the fields, thereby reducing the environmental problems caused by intensive livestock production (Theodor, 2006). However, conflicts between the use of organic matter to feed the animals or to cover the soil may still be difficult to solve. In many societies traditional rules allow animals to graze on stubble. A part from reducing the biomass available for soil cover, free communal grazing on harvested fields causes soil compaction, with the risk to wane the advantages of reduced tillage. Livestock keepers and CA farmers should find

alternative solutions such as fencing animals out, planting not edible cover crops, clarifying land tenure arrangements, changing traditional grazing rights, or growing special plots of fodder crops (Calegari and Ashburner, 2005). Integration of crop and animal production systems is therefore essential for sustainable rural livelihoods, not just for technical reasons but also – and in some cases especially – because of the intrinsic cultural value that agricultural practices and livestock have in African societies.

Indeed, in Africa, cultural and institutional issues affect the adoption of innovative practices, including CA, more than elsewhere. As it has been explained in the previous paragraphs, the shift to conservation practices involves a profound mindset change. But conceiving a completely different agricultural system may be extremely difficult in places where practices such as ploughing, clearing the land and free animal grazing are embedded in the local institutions. Many African societies are also influenced by the idea that the current situation can not be changed and those who are born in poverty will die in poverty. In such cases people – and especially vulnerable categories, like women – have subsistence aspirations and purposely avoid transformations which are likely to improve their situation (see for instance, Bolliger et al. (2005) on the failure of CA experiences in Republic of South Africa). In some cases, such behaviour have more reasons. For instance, where women do not have rights to the land, any improvement they achieve in crop production may expose them to the risk of loosing the fields which become more attractive to their male relatives. In order to overcome constraints which depend on institutional and cultural issues, it is extremely important the role of human and social capital (see next paragraphs). Therefore, the adoption and the diffusion of CA in SSA may be held back by lacking human and social capital, especially among most marginalized groups and less resource endowed farmers.

This brief discussion highlighted many significant opportunities arising from the adoption of CA in SSA. At the same time, there are also some downsides mostly related to factors that may delay or corrupt the effective adoption of the practices. Some of these constraints may in turn transform into opportunities, but an appropriate set of initial conditions and/or adequate policies and interventions are needed. Based on a recent literature review, the next section discusses the factors that revealed to be determinant to the right adoption of CA in Africa.

3.5.1 Factors Affecting the Effective Adoption of CA in SSA

Many recent case studies on the spread of CA in SSA have highlighted the factors which most determine the effectiveness and the sustainability of the techniques adopted. The following section discusses the most recurrent issues, with a special focus on the role of human and social capital.

In several cases, the promotion of CA techniques in SSA has been accompanied by the use of **incentives** such as subsidized input packages or provision of labour. Incentives are usually employed to compensate initial additional costs for technology adoption. According to Lutz et al. (1994), the rationale for intervention is justified only when significant off-farm effects are present, because the farmers' estimation of returns to conservation will pay inadequate attention to its social benefits (see also 2.3.4). But even in these cases, the authors argue, the use of subsidies may encounter several difficulties, due to the complexity of establishing the actual divergence between social and private returns to technology adoption, the difficulty of designing appropriate incentive structures in order to meet social objectives, and the risk of creating perverse dependence schemes for farmers. In a review of case studies in Latin America and Africa, also FAO (2001b), albeit recognizing a possible role for governments and other organisms, regards the suitability of incentives as questionable, and stresses the importance of deeply analysing the possible repercussions, as well as of integrating subsides with complementary policies at farm, community and national level.

Due to the relatively short time since when CA practices have been introduced among small-scale farmers in Africa, the evidence of the impacts of subsides on the efficacy and the sustainability of the technologies is not straightforward. In Zambia (Haggblade and Tembo, 2003), Ghana (Boahen et al., 2005), and Lesotho (Mapeshoane et al., 2005; Silici et al., 2007), for instance, incentives schemes have brought immediate good results in terms of adoption rates, but the long-term sustainability of these strategies has to be confirmed yet. In other cases, such as in Burkina Faso, the wide and effective adoption of conservation practices has occurred over a long period of time without external incentives (Kaborè and Reij, 2003).

Among the technical factors relevant to the promotion of CA (just as to the promotion of any agricultural innovation), there are adequate **training**, effective support from **extension** services, and organization of **field activities** (exchange visits, farmer field schools, workshops, etc.). These serve to provide farmers with the necessary technical knowledge and "precision" management skills, as it has

been demonstrated for example in Zambia (Kabwe and Donovan, 2005; Haggblade and Tembo, 2003), South Africa (Bolliger et al., 2005) and Ghana (Boahen et al., 2005).

Another recurrent topic is the need to foster **participation** and **interaction between formal research and indigenous knowledge**. Many socio-economic and cultural constraints in fact can be overcome by encouraging farmer participation in the identification of the system components best suited to their specific needs (Nyagumbo, 1999). Participation and knowledge sharing among farmers and researchers have also technical implications, since usually lead to higher adoption rates and quicker adaptation of the technology (Fowler and Rockstrom, 2001). Furthermore, by avoiding mere technology transfer and top-down approaches, stakeholder interaction fosters dynamic, flexible innovation diffusion strategies which ensure higher technology sustainability (Bolliger et al., 2005).

Several field studies have also demonstrated the importance of **education** both to overcome institutional constraints and cultural biases, and to improve farmers' management skills (Bolliger et al., 2005). For instance, Haggblade and Tembo (2003) and Chomba (2005) find that in Zambia retired school teachers, draftsmen and accountants have got better results from the employment of conservation practices. Higher educational levels enhance farmers' openness to innovation adoption and adaptation. Well educated farmers in fact use to be more aware of the problems which limit the sustainability of agricultural production and seek viable solutions, such as CA. In addition, they are more likely not only to implement correctly what they learnt, but also to further improve it through experimentation and adaptation. The latter aspect is extremely important, since conservation agriculture is a dynamic system and its successful application relies mainly upon the skill of the practitioner "to adapt the basic principles to his or her individual needs, blending into the local agro-ecological environment and fitting into the local socio-cultural practices" (Calegari and Ashburner, 2005).

The appraisal of the spread of CA in SSA has also stressed the relevance of two cross-cutting issues: **women inclusion** and policy support (though often lacking). Depending on the practice promoted, women may find more difficult than men to get the support needed to shift from conventional to conservation agriculture. Due to cultural biases or even to the legal system, in many African countries women have restricted access to resources (land, inputs and credit), education, training and extension services. Such limitations may seriously reduce the opportunities arising from the use of conservation practices. This is why, whenever it may be needed, incentive strategies, farmer participation activities, extension and research programmes should have a gender oriented focus.

Similarly, the significance of all the above mentioned issues depends critically on the political willingness to support the appropriate combination of the most effective promotion strategies. Furthermore, according to Benites et al. (2002), **policy support** (both national and international) is especially important for a number of specific achievements such as the involvement of the private sector (e.g., for the production of locally adapted equipment and inputs), multiple stakeholder partnerships, and the promotion of adaptive research.

3.5.2 Social Capital

Last but not least, albeit not frequently explicitly reported in the African study cases, further important determinant of the effective adoption of conservation agriculture is **social capital**. Two broad aspects have to be considered:

- the relevance of SC to CA as part of soil and water conservation measures
- the role of social capital in the adoption and the performance of CA as an innovation process in Sub-Saharan Africa

The potential role of social capital in pursuing development process, including the sustainable use of natural resources and the generation and diffusion of agricultural innovation, has been widely discussed in Chapter One and Two, respectively. At the beginning of this chapter, it has been also pointed out that the most recent approaches to SWC take into account social capital factors both in the in-depth assessment of the local socio-cultural and institutional context and in the planning and implementation of conservation measures. The positive impact of social capital on the effective use of SWC measures has been demonstrated by several recent empirical studies in Uganda (Sanginga, 2006), Kenya (Barbier, 2000; Mwakubo et al., 2006; Nyangena, 2007); Philippines (Cramb, 2004) and Peru (Swinton, 2000). These studies show that social capital helps individuals overcome resource barriers to conservation and internalize economic externalities stemming from SWC by:

- raising awareness on soil degradation and conservation,
- encouraging behaviours that support the implementation of byelaws (including the development or reinforcement of conservation norms, or the traditional land tenure systems),
- facilitating collective action (e.g., to form labour-exchange groups or to manage common pool resources),

- improving skills and knowledge through better information flow (but also encouraging farmer-led training, cross-farm visits, extension networks, etc.),
- fostering participation in planning and implementing soil conservation measures,
- and maintain links to government and non-government technical agencies (bridging social capital).

There are also some risks associated to strengthening social capital for SWC. These are the possible exclusion of already marginalized groups and the increase of conflicts (e.g. among livestock owners and cultivators) if institutional changes are controlled by powerful individuals or groups.

As it has been mentioned, the recent spread of CA has been motivated by the increasing concerns about the extent of land degradation in Africa, and it can be considered part of a new, more integrated approach to SWC. Therefore, what has been said in general terms about the relevance of SC to SWC, should be true for CA as well. Even if not explicitly mentioned, several structural and cognitive SC dimensions may affect the relevance of the factors (listed at the beginning of this paragraph) which most determine the effectiveness of the adoption of CA. Social capital in fact may facilitate extension and field activities (such as exchange visits and FFS); it fosters farmer participation and enables closer cooperation among researchers, extensionists and farmers. If an incentive scheme is in place, high social capital levels help guarantee fairness and transparency. As a means to ensure the right use of local institutions, avoid conflicts and foster community participation, SC may also help solve the problems related to tenure arrangements and grazing rights, which seriously affect the adoption of CA in SSA (Calegari and Ashburner, 2006).

The presence of social capital may also support a good attitude towards the mental and institutional changes that have to accompany the technical transformations in innovation adoption and diffusion. According to Coughenour and Chamala (2000), the change from traditional to conservation farming (CF) in America has been revolutionary "because the farmer shifted from conventional farm technologies to different tillage techniques—often no tillage at all—to usually a different cropping system, often a new farming system, a new vision of a desirable farm landscape, and a new identity as a farmer." Such revolution has founded on the adoption and the diffusion of innovations which are not directly transferable because they do not imply just technical or organizational improvements. Rather, CF practices are socially constructed system innovations and, as such, they are constructed through networking with innovation-minded farmers and knowledgeable advisers. In turn, the spread of system innovations is a result of innovative local networks established by farmers and institutional agents

using local knowledge and accessing broader networks of expertise (ibid.). Individual and collective features (non just technical, but also socio-cultural), adaptive research skills and networking are therefore the salient ingredients of the innovation system through which the shift from conventional to conservation agriculture has occurred.

Conservation agriculture is not one set of techniques, but a set of principles that can be adapted to suit local conditions. Especially in Africa, indigenous technologies are a powerful source of innovative ideas, so that often the technology has to be adapted rather than transferred (Fowler and Rockstrom, 2001). Farmers should be at the centre of this adaptive research process through continuous learning, experimentation and exchange with neighbours, extensionits, and researchers. It has been already stressed the ways through which social capital may help this process. But adaptive research does not require only stakeholder participation and interaction. It needs a whole innovation system at work, supported by all the relevant actors (the farmers, the government, extension services, development agencies, the private sector, etc.) and by appropriate policies. As highlighted in Chapter Two (see paragraphs 2.3.3 and 2.3.4), social capital is especially relevant to AIS in small-scale and subsistence agriculture because – among other reasons – (i) fosters coordination aimed at solving conflicts among interest groups, (ii) facilitates the access to and the exchange of knowledge and information, (iii) encourages cooperative behaviours among farmers and networking among different stakeholders.

A critical element of a functioning innovation system for the diffusion of conservation agriculture is networking. The role of innovative networks in no-tillage further confirms the utility of the AIS approach. Under this perspective, the focus shifts from the technological innovation to the innovative process, and from the efficacy of the farmer in learning a new technique to the efficacy of farmers, scientists, policy makers in collaborating to construct an enabling environment for innovation diffusion and adaptation. Successful collaborative networks depend on the initiatives of each member. Many studies explicitly stress the relevance of farmer groups and organizations and that of networking at national, regional and international level (Reijntjes, 2002; Ashburner et al., 2002, IIRR, 2005, FAO, 2001b). Coughenour (2003) states that in America, “the innovation of no-tillage cropping agriculture led to and was created and sustained by new networks and relationships involving farmland, farmers, farm advisors, farm supply agents, new techniques, and agricultural scientists”.

Indeed, in South, Central and North America conservation agriculturists are well organized in local and national farmers’ associations. Farmer groups and associations are crucial for the conversion

from conventional to conservation agriculture since they may facilitate the access to and the exchange of knowledge. Furthermore, especially for small farmers, groups and associations may provide the organizational and institutional support in order to access credit (and therefore inputs and equipment), but also training and technical support. Drawing on the Brazil case, Benites et al. (2002) demonstrate that neither extension activities nor individual skills and commitment determine the successful improvement of land husbandry. The formation of farmer groups and associations or, even better, building on existing and active groups, is critical for testing and adapting the techniques to the local contexts, learning from shared experiences and linking to wider networks and organizations (thus passing from bonding to bridging linkages; see also Cramb (2004) describing the case of Landcare groups in the Philippines). In Brazil farmer groups have also become important local pressure groups, managing to obtain improvements at institutional and political level. Many American farmer associations are supported by Governments and other institutions and have links with private enterprises as well as international agencies such as FAO, GTZ and the World Bank. By analysing the cases of the Confederation of American Associations for a Sustainable Agriculture (CAAPAS) and the Soil Conservation Council of Canada (SCCC), McKell and Peiretti (2004) have shown how the participation to national and international networks allow farmers to learn from each other and so improve significantly the productivity.

The need to promote networks to foster conservation agriculture, especially in developing countries, has been one of the main outcome of the 1st World Congress on Conservation Agriculture (Madrid, Spain, 1-5 October 2001), where an apposite special session was organized. However, unfortunately, in Africa there are still few experiences of well-functioning small-scale conservation farmers groups and networks. Important exceptions are the informal networks of neighbours in Zambia (Kabwe and Donovan, 2005) and Burkina Faso48 (Kaborè and Reij, 2003; Mazzuccato and Niemeijer, 2000), as well as the cases of communal work activities in some South African villages (Bolliger et al., 2005). The promotion of farmer groups, organizations and networks should become part of an active

[48] According to Kaborè and Reij (2003), in Burkina Faso, spontaneous networks for the promotion of conservation practices were promoted mainly thanks to the agency of few capable leaders. In a different research, Mazzuccato and Niemeijer (2000) find that in Burkina Faso, over the last thirty years, agronomic and biological measures have been effective components of an agricultural system that conserves the soil, and such outcome can be partly explained by the relevance of exchanges based on social networks.

policy to spread conservation practices. The feasibility of pursuing such a strategy will depend critically on the quality of the social capital existing at local level. At the same time, new groups and networks will reinforce or create new forms of social capital among farmers and community members.

3.6 Concluding Remarks

The recent spread of conservation agriculture practices in Sub-Saharan Africa has been part of a progressively changing approach to soil and water conservation. SWC technologies are not seen anymore as simply structures defined strictly by engineering parameters. Rather they are the sum of practices involving agro-forestry, agronomic and tillage related measures, and their implementation must be situated within the social and economic understanding of the causes of land degradation and water depletion. Furthermore, SWC strategies must be flexible and adaptable in order to be attuned to people's needs, local environment conditions and socio-economic factors (Reij, 1991). In order to achieve such suitability and flexibility, SWC strategies should be designed on the basis of the existing land users' experiences and of the combination of indigenous knowledge and formal research.

The wide range of CA practices which can be adapted to different farming systems and agro-ecological conditions, well fits this new approach to SWC. CA in fact is a dynamic system and its successful application relies mainly upon the skill of the practitioners to combine and adapt tillage practices, input and equipment according to three basic principles: disturb the soil as little as possible; keep the soil covered as much as possible; mix and rotate crops. In order to get the full benefits from conservation practices, these fundamental rules should be applied simultaneously, but this is not always the case. In most parts of Africa, for example, due to the difficulty of keeping an adequate quantity of crop residues for mulching and soil cover, the critical component of conservation tillage is the minimisation of soil disturbance (Fowler and Rockstrom, 2001).

The benefits of CA are of different nature: agro-ecological, environmental, and socio-economic. Among the most important are: long-term yield increase and output stability, reduced wind and water erosion and reduced land degradation, improvement of agro-biodiversity, reduced contamination of soil, water sources and the atmosphere. The increase in yields is accompanied by a decrease of the costs, leading to higher net profitability, greater technology sustainability and (especially important in Sub-Saharan countries) higher food security. Furthermore, techniques which demand lower labour requirements, or which allow to spread the workload over the whole dry season (rather than concentrating all the operation at the beginning of the raining season, which often results in late

planting), are particularly helpful in those rural areas where migration and health emergencies have reduced the labour supply and leaded to an increasing "feminization" of the agricultural sector.

Especially if the soil is degraded and with poor fertility, dramatic increases in yields can occur after only the first or second season. However, the full benefits of CA may take a number of years to achieve (Calegari and Ashburner, 2006). Where conservation agriculture has been adopted on a massive scale, with good rotations and for a long time, it can be proven that weed and disease problems, and thus the use of agrochemicals, tend to decline and eventually reach levels below that of conventional agriculture (Theodor, 2000). But in a previous phase, just during the transition from conventional to conservation practices, farmers may face temporary problems with weed, pests and diseases. In the great majority of cases, troubles can be easily avoided through careful planning of crop rotations, new approaches to weed control and pest management, and a range of other necessary "precision farming" skills.

Conservation practices in fact can be suited and adapted to all kinds of farming systems, including small-scale subsistence agriculture. However, the initial efforts needed not only for temporary higher requirements of labour and inputs, but also to acquire new skills and knowledge, may discourage many farmers from the adoption, especially those who are worse off, more risk adverse and less willing to experiment. Other factors which may constrain adoption of CA in SSA include socio-cultural and institutional issues such as subsistence aspirations, lack of tenure security for certain categories (especially women), communal grazing systems and traditional land tenure arrangements (which often impede to retain crop residues in the fields as soil cover), cultural believes related to conventional tillage practices, low education and literacy standards, few or poorly organized farmers' organizations, and weak marketing systems and infrastructure (FAO, 2004; IFAD, 2004).

The constraints to the realization of the potential opportunities stemming from the adoption of CA in SSA, have often justified the use of incentives in the form of subsidized inputs or labour supply. Nevertheless, incentive schemes are often introduced without enough consideration of the possible repercussions on technology efficiency and sustainability, leading to controversial outcomes. In addition, many interventions foresee the provision of subsides as main or unique promotion strategy. Instead, as stated also by FAO (2001b), incentives should always be just one of different complementary measures aiming at enabling the adoption of conservation practices. Further important determinants of the effective adoption of CA in SSA, as identified through the review of the most recent empirical literature, are:

- Adequate training, effective support from extension services, and organization of field activities provide farmers with the necessary technical knowledge and "precision" management skills
- Farmers participation and interaction of formal research and indigenous knowledge make the technology more suitable to the local conditions and thus more sustainable. Farmers participation is critical to overcome cultural and institutional biases which hinder the full, correct application of conservation principles (such as traditional land tenure arrangements which allow animals to graze into the field causing soil compaction and impeding to retain crop residues)
- Literacy and education also help overcome institutional constraints and cultural biases. In addition, more educated farmers learn more rapidly, show better management skills and a positive attitude towards innovation and experimentation. The correct application of conservation principles, and their adaptation to the local conditions, allow better farmers to get higher outputs
- Multiple stakeholder partnerships (including also the private sector) and adaptive research are critical elements of a dynamic system as that implied by the shift to CA. The successful application of conservation practices requires constant searching and flexible promotion strategies, which can be obtained only with the close, equal interaction among promoters, users and a number of other actors such as equipment producers, input dealers, and so on.

Finally, a number of cross-cutting issues have also been identified. These are the need for an effective policy support, the relevance of gender oriented activities, and (albeit not frequently explicitly reported by the African empirical literature) the multiple roles of social capital.

The relevance of each factor, as well as their appropriate combination, will depend time by time on the features of the socio-economic context, the prevalent farming system and the agro-ecological conditions. With regard to social capital, two broad aspects have to be considered: (i) the relevance of SC to CA as part of soil and water conservation measures; (ii) the role of social capital in the adoption and the performance of CA as an innovation process in Africa.

Recent approaches to SWC take into account social capital factors in the in-depth assessment of the local socio-cultural and institutional context as well as to plan and implement more sustainable conservation measures. In fact, it has been demonstrated that social capital improves the effectiveness of SWC practices, including CA, in several ways: raising awareness on soil degradation and conservation, encouraging institutional agreements and cooperative behaviours (such as participation and collective action in learning, planning and implementing soil conservation measures), improving

skills and knowledge through better information flow, and fostering bridging social capital by linking local groups to wider networks and other institutions.

Several structural and cognitive SC dimensions thus affect the relevance of the factors determining the adoption of conservation practices. If an incentive scheme is in place, strong civicness, trust and cooperation improve fairness and transparency. However, higher levels of trust and reciprocity, as well as an easier access to labour and credit (for example through labour exchanges, social networks and associations), help farmers to internalize social costs and benefits associated with the shift to CA, thus reducing the need for external incentives. By fostering cooperation and collective action, social capital also facilitate extension and field activities, and encourages adaptive research by enabling the formation of farmer groups and networks among researchers, extensionists and farmers at different levels. As a means to support institutional agreements, avoid conflicts and foster community participation, SC may also help to solve the problems related to the use of common pool resources, such as land tenure and grazing rights, which seriously affect the adoption of CA in SSA (Calegari and Ashburner, 2006).

The presence of social capital may also support a good attitude towards the mental and institutional changes that have to accompany the technical transformations in innovation adoption and diffusion. Drawing on the North American experience, Coughenour and Chamala (2000) has defined the shift from conventional to conservation practices as "revolutionary" and the process of adoption as a socially constructed system innovation. This innovation system has been built on individual and collective features (non just technical, but also socio-cultural), adaptive research skills and networking among different actors and at different levels. Conceiving the spread of CA as an agricultural innovation system (AIS) at work, implies that particular emphasis has to be given to social capital, especially in rural farmer communities in Africa. As highlighted in chapter Two, in fact, social capital is especially relevant to AIS in small-scale and subsistence agriculture because – among other reasons – (i) fosters coordination aimed at solving conflicts among interest groups, (ii) facilitates the access to and the exchange of knowledge and information, (iii) encourages cooperative behaviours among farmers and networking among different stakeholders.

Drawing on the above considerations, it becomes clear that several social capital dimensions play a potentially positive role in the adoption and the diffusion of CA practices in SSA, and that these dimensions can not be excluded from CA promotion strategies. On one hand, the assessment of the socio-cultural and institutional features contributes to identify suitable technologies thanks to a deeper

understanding of the farmers' perception of land degradation problems and possible related solutions. On the other hand, the social capital belonging to a given community may significantly contribute to the adoption and the diffusion process, above all by creating the enabling conditions for the creation of new knowledge through participative, adaptive research. In North, Central and South America the contribution of social capital – mainly in the form of social networks – to the spread of conservation tillage has been widely acknowledged. Nonetheless, in Africa, CA promotion strategies have rarely taken into account other factors beyond technical ones. In addition, a part from some exceptions (such as in Burkina Faso or Zambia), experiences of small-scale conservation farmers groups and CA networks have been few and largely unsuccessful. The next chapter analyses the case of the spread of a particular CA technique – locally called *likoti* – in Lesotho, with the aim of verifying the relevance of social capital to the adoption and the diffusion of this practice as an innovative process.

Chapter 4 Conservation Agriculture and Sustainable Livelihoods: the Case of *Likoti* in Lesotho

This chapter analyses the costs and the benefits associated with the adoption of a particular conservation agriculture practice – locally called *likoti* – in Lesotho. The choice of the study case is motivated by different reasons. First of all, the impressive extent of land degradation, from which the country suffers, and the impacts that this has on agricultural output and, in turn, on food security, make the introduction of CA in Lesotho a particularly interesting case. Secondly, Basotho have experienced rapid economic and social transformations which are affecting their ability to cope with shocks and vulnerability. In particular, these trends have narrowed the range of livelihood strategies, including relying on social assets and, subsequently, farming. Therefore, understanding the potential role of social capital in the adoption of conservation practices in such a context of growing vulnerability, may be extremely useful also to contribute to appropriate recommendations and policy prescriptions.

Although with some differences, the social and economic trends which characterize Lesotho, affect many other Sub-Saharan countries: environmental emergencies (such as increasing land degradation), frequent food crisis, deteriorating social capital and increasing vulnerability interrelate and exacerbate each other (Misselhorn, 2004). Further reason for the choice of the case study is thus the possibility to generalize the results and extend them to more countries.

Last but not least, the author directly participated in the design and the implementation of the baseline survey from which the data have been taken and analysed. This allowed for conceiving part of the research as a component of the present PhD dissertation since the collection of primary data. The choice of the case study is thus motivated also by the great familiarity the candidate acquired with both the questionnaire and the database under the implementation of the field survey.

The next paragraphs introduce the case study and assess the potential role of conservation agriculture as a means to combat the growing vulnerability which affect Basotho. Social capital and cultural aspects are discussed in detail in the next chapter, which focuses on the role of SC in the adoption of CA as an innovative process in Lesotho.

4.1 Lesotho: a Context of Growing Vulnerability

Lesotho is a small, landlocked, mountainous country of about two million people (*de jure* population amounts to 1,880,661, according to the 2006 Lesotho Census of Population and Housing), of which 76% are rural (ibid.). Most of the population (58%, ibid.) lives in the lower lands of the North-West, along the Caledon River, where the capital, Maseru, and most of the arable land are situated. With a GDP per capita estimated at US$396 in 2002[49] and half of the population living below the poverty line (EIU, 2005), Lesotho is one of the world's poorest countries. Its economy is based on limited agricultural and pastoral production and light manufacturing (textile, clothing, and leather). Recently there have also been royalties from exporting water to South Africa through the Lesotho Highlands Water Project (LHWP). Being completely surrounded by South Africa, Lesotho is politically and economically dependent on that country. Ninety percent of Lesotho's imports come from South Africa and 65% of its exports go there. Since the end of the 19th century, and especially since the Thirties, South African mines have been a major source of employment for Lesotho's labour force (absorbing about 80% of Basotho migrants) and thus a major source of remittances. In recent years, however, the number of workers engaged in this activity has fallen dramatically (from a high of 127,000 in 1989 to only 62,000 in mid-2004 (Hassan and Ojo, 2002; EIU, 2005).

On the other hand, the growth of export-oriented manufacturing, led by the garment sub-sector, has created new employment opportunities. Mostly due to the export concessions obtained under the African Growth and Opportunity Act (AGOA) – which allows duty free access to the US market for African textile exports – employment in manufacturing grew by 60% from 2001 to 2004, when employees in the sector were more than 53,000 (Central Bank of Lesotho). However, new employment opportunities have been predominantly in low-wage, low-skill jobs, and labourers who move into the urban and peri-urban have to bear poor working and living conditions. Even though the AGOA concessions have been extended until 2015, the strength of the Rand and, above all, the expiry of textile export quotas under the Multi-Fibre Agreement (MFA) at the end of 2004, have raised concerns about the long-term viability of the sector (EIU, 2005). Early in 2005, some of the clothing factories (mainly owned by East Asian investors) had already closed, as production started to shift to cheaper locations

[49] According to the EIU (2005), a large rise in GDP per head occurred in 2003 e 2004, but it was the result of the appreciation of the rand against the US dollar, rather than a decrease in poverty levels.

previously restricted by the MFA. In March 2008, according to Central Bank of Lesotho, the number of people employed in the garment factories lowered to 45,650.

In spite of low income rates, Lesotho's social indicators are generally better than the Sub-Saharan Africa (SSA) average. Notwithstanding, in 2008 the United Nations Development Programme (UNDP) ranked Lesotho as 155th out of 179 countries based on its Human Development Index, and as 103rd out of 135 countries based on its Human Poverty Index. Lesotho's social service delivery is extremely weak: health personnel are in short supply, health centres are not adequately equipped, and schools lack teaching materials. As a consequence, while the literacy rate is relatively high at 83%, the provision of education is barely able to keep up with demand and only a small percentage of students reach higher levels (Hassan and Ojo, 2002; EIU, 2005). Similarly, even though the status of health (leaving aside the ravages of HIV/AIDS) is generally good, poor sanitation and malnutrition continue to be widespread, especially in remote areas. Over the last ten years, a major health problem has been the increasing spread of HIV/AIDS. According to UNAIDS, at the end of 2003, 29% of the population aged 15-49 was infected. Such infection rates have dramatically lowered Basotho life expectancy, estimated at 42 years in 2006 (UNDP, 2008).

Further social and economic emergencies which expose Basotho to poverty and vulnerability are represented by high inequality, increasing unemployment rates, a fragile natural environment, and declining agricultural outputs. All these problems interrelate each other and are exacerbated by the spread of HIV/AIDS.

Inequality refers to income as well as to the access to social services and other assets. The most recent figure, from 1995, estimates the Gini index at 63.2 (UNDP, 2008), which is pretty high also in comparison with other African countries. More recently, a longitudinal study on chronic poverty undertaken by Sechaba Consultant, has showed that income inequality has further augmented between 1993 and 2001 (Wason and Hall, 2002). The most evident disparities exist among urban and rural population, and especially those who live in remote mountain areas (Gay and Hall, 2000). Due to poor infrastructure and lacking health and education facilities, the latter have difficult access to all basic social services, including formal financial services. Further cause of poverty in the mountains – in particular in the villages which border the Eastern Cape Province of RSA – is the rampant stock theft, which has dramatic negative impacts not only on the household wealth but also on the community cohesion. A vulnerability assessment conducted by CARE in 2000 emphasises that a new kind of poverty is emerging also in the expanding urban and peri-urban areas. According to Turner (2001),

those at the bottom of the livelihoods profile in urban areas are somehow worse than the rural poor. In fact, while the latter still rely on many livelihood strategies (such as social capital and traditional networks), which preserve them from complete destitution, urban poor avail of very few livelihood strategies.

Lesotho is characterized also by dramatic gender disparities. Although girls receive more education than boys (due to the fact that boys used to be employed in South African mines or herding livestock), and in spite of the high number of *de facto* and *de iure* female-headed households[50], Basotho women have a legal status of perpetual minors which limits their access to economic assets, including land and credit, and their role in social life. "Basotho women depend on their links with men – as daughters, sisters, wives, mothers and widows – for much of their status, rights and resources. If these links deviate from the social norm, women are typically impoverished. It is very hard, at least in conventional village society, for a woman to build and sustain an adequate livelihood without being married" (Turner, 2005). As a consequence, households headed *de jure* by women form the poorest class of livelihoods in Lesotho. On the contrary, those headed *de facto* by women often show a higher cash income per member than male headed households, thanks to the remittances they receive from their absent husbands (Turner, 2001). In spite of the increasing female employment in garment factories, women continue to be disadvantaged by prevailing gender relations. Their wages are so low that they can do little to redress their own or their families' poverty (Turner, 2005), and often they are forced to accept degrading living conditions that make them afraid or ashamed to go back to their natal villages.

High unemployment, mainly due to the retrenchment of many Basotho miners, represents a serious social issue not only because of its effects on the household as well as the national economy, but also because it is leading to other problems such as diffusion of crime and other illegal activities, abuse of alcohol, and so on. Along with the migration towards urban and peri-urban areas (all located in the lowlands), and the absorption of many young female workers by the textile industries, such trends are changing the traditional social structures which used to exist within the household and at village level. As a result, traditional social protection mechanisms, which have helped Basotho cope

[50] The high presence of de facto and de iure female-headed households depends on, respectively, the large number of Basotho men working in RSA and the increasing mortality rates because of HIV/AIDS, which affect men more than women.

with livelihood shocks and stresses, are in decline, while social protection and welfare policies by the modern state have mostly failed to take over these tasks (Turner, 2005).

These social and economic transformations occur in a risk prone environment, where the scarcity of natural resources, especially fertile land, is at the same time a cause and a consequence of poverty. Lesotho's ecology is fragile because of its mountainous topography (it lays on a high plateau that rises from 1,500 metres in the West to 3,350 metres in the East), the thin soil layer and limited vegetative cover. Because of the high pressure of human and livestock activities on the land, the country faces major environmental problems: loss of topsoil, which is eroding agricultural productivity and has increased river siltation; increased gully erosion, which reduces the land available for cultivation; loss of tree cover[51], owing to excessive cutting for firewood and damage to saplings from animals; and loss of pasture because of overgrazing (EIU, 2005).

Over the time, land degradation along with unpredictable weather conditions — including both drought and extreme cold — have steadily reduced potential agricultural output[52]. The sector's share of GDP has fallen from 50% in 1973 to about 15% in recent years and yields have fallen by about two-thirds since the mid-1970s (EIU, 2005). Turner (2005) reports that during a survey aiming at the determining underlying and intermediate causes of poverty in Lesotho, Basotho themselves mention "agricultural problems" (including climatic hazards like drought and frost) among the most important reasons for poverty. Nonetheless, agriculture remains a source of livelihood for the vast majority of the population, most of which is engaged in subsistence farming. Direct government interventions have limited private-sector involvement in the commercial development of agriculture. In spite of recent attempts to strengthen the sector and encourage diversification into high-value export products – including an Agricultural Sector Adjustment Programme assisted by the African Development Bank in 2000 – progresses have been slow. The livestock sector provides a significant proportion of rural income (usually for better-off households) and is well integrated in the national and the regional economy through the export of meat, wool and mohair. However, recently also the importance of the

[51] FAO (2003) estimates that in Lesotho the land area covered with forests is of 14,000 ha, or the 0,5% of the total land area (3,035,000 ha). On average, in Africa forests cover 22% of the land area.

[52] A severe drought in 2001/02 led to the government declaring a state of famine and the introduction of an emergency food relief programme requiring substantial donor support. A further state of emergency was declared in February 2004 (when FAO and WFP estimated that 950,000 people (about half of the population) would need food assistance).

livestock sector has declined due to the recurrent droughts, poor and declining animal quality and disease control.

Finally, all these problems are exacerbated by poor governance and inefficient governing institutions. Even though corruption remains low in comparison with other African countries (EIU, 2005), scarce law efficacy and order, insecure property rights, inadequate delivery of public services, and inadequate local government (including difficult integration of traditional and modern institutions), slow down economic growth and development, and discourage people participation to civic and political life (Hassan and Ojo, 2002; Turner, 2005). As a result, Basotho live in a context of growing vulnerability, reflected in poverty trends, increasing inequality, deteriorating health conditions, including low standard of food and nutrition security, and increasing exposure to external shocks and changing climatic conditions.

An assessment on the food security situation after the 2002 and 2003 food crisis, undertaken by the Forum for Food Security in Southern Africa[53] (FFSSA, 2004), has found that the crisis were the result of a latent situation of food insecurity rather than the consequence of temporary adverse weather conditions. As such, they also had the effect of expanding food insecurity, instead of provoking a situation of temporary hunger to be addressed though a humanitarian response. These findings are supported by the analysis of the nutrition indicators of the children, who suffer from specific conditions of malnutrition that are different to those of their elders. Young children are increasingly exposed to poor sanitation, contaminated water and a poorly diversified diet, most likely due to a chronic status of vulnerability. Similar results have been found by the FFSSA for other countries, leading to the conclusion that in Lesotho, just as in most of the southern Africa region, food crisis stem only partially from unpredictable shocks; rather they reflect long-term food insecurity, in turn caused by poverty (lack of physical assets), deteriorating social capital, and negative social and economic trends due to migrations, retrenchments, and HIV/AIDS pandemic (FFSSA, 2004).

[53] The Forum for Food Security in Southern Africa is a consortium of NGOs and research organizations, leaded by the Overseas Development Institute, which has operated since 2003 with the purpose of providing a platform for improved linkages between food security analysis, policy making and implementation in the Southern Africa region.

4.1.1 Social Capital and Farming: Do Coping Strategies Still Work?

Traditionally, Basotho people rely on several livelihood strategies to cope with situations of vulnerability (Gay and Hall, 2000; Turner, 2001, 2003; Boehm, 2004). Indeed, especially in rural and peri-urban areas, households do not depend only on money. Rather, they rely on a complex "livelihood web" made of family owned assets (fields, animals, tools), social assets such as strong kinship and networks, and participation into the informal economic sector (Gay and Hall, 2000). Furthermore, whereas at national, macro-economic level agriculture has a minor role, farming is still a way of life – and a critical survival strategy – for the rural poor. "In the micro-economic perspective, agriculture can mean the difference between maintenance of life and collapse" (ibid.).

Social assets – or social capital – support rural livelihoods and help the very poor to survive. The support mechanisms which characterize rural communities in Lesotho, include charity, gifts (usually food), and employment of kin in the household fields. These employment arrangements have mainly a redistribution aim, since usually the productivity of the additional work they provide is very low. Similarly, *matsema* are traditional work parties open to community members, through which the household which calls the party gains access to additional labour during seasonal labour peaks, while the participants get food and, more recently, money. Other traditional sharing mechanism is the *mafisa* system – loaning cattle and other stock from richer to poorer households in return for the use of by-products like milk, cow dung and draught power. The provision of labour in fields owned by the chief, whose harvest is used to feed destitute households, is another traditional practice, nowadays almost in disuse.

Further important part of Basotho social capital is membership in various community based organizations (CBOs), which often allows also to access loans otherwise unavailable due to the poor coverage of the formal banking sector and the inexistence of rural credit schemes. Burial societies are a very common type of CBOs. By paying monthly subscriptions (which vary depending on the internal rules), households receive assistance to meet the cost of burying a family member, which can be very high. *Stokvels* (as informal savings and credit groups are called in South Africa) and *grocery associations* are other forms of saving associations. Members contribute an agreed sum of money throughout the year and at the end of the year they share the profits made by lending money to both members and non-members. In other cases the association buys groceries for the members. As reported by Turner (2001), "membership has a significant impact on the livelihoods of participating households", which rely on this money to buy food for celebrations as well as to pay school fees.

As highlighted by Boehm (2003), also "farming in Lesotho is essentially an activity characterised by a high level of sociality". Since very few farmers own all the necessary assets and production means, Basotho depend on various forms of co-operation, the most important being sharecropping agreements (*seahlolo* or *lihalefote*), by which two (sometimes more) partners pool together the resources needed to farm, such as land, labour, draught power and inputs (ibid.). Sharecropping agreements depend not only on matching the needs of two or more households. In order to successfully conclude an accord, farmers have to be part of a social network which keep them linked to other farmers and land owners. Furthermore, farmers need to use a number of "social skills" in order to conclude the agreements at the right time of the year, maintain the agreement over time, accomplish their commitments, and so on. Last but not least, sharecropping founds on trust.

The variety of sharing mechanisms briefly described above, has allowed Basotho to redistribute their little wealth and avoid complete destitution of the poorest. As it is occurring in other African countries, however, Lesotho society is fragmenting and its culture – including aspects of social capital – is increasingly affected by rapid social and economic transformations. High unemployment forces young people to migrate, leaving elderly people alone or caring of the children, and breaking up traditional kinship and community linkages. As observed by Turner (2005) and Boehm (2004), mechanisms of social reproduction are changing, modifying the structure of the household and the society as a whole. Young men struggle to take on the role of "providers", which is seen as a precondition for entering a marital relationship. As a consequence, the number of marriages is declining, while those who start a family often live with minimal resources, sustained by their parents (who instead used to rely on youth support) or other relatives. Furthermore, existing kinship relations are weakening and broken marriages are much more common than in the past.

Deteriorating social capital, along with the increasing number of vulnerable households due to unemployment, the associated increase in income poverty, and the spread of HIV/AIDS, have made the effectiveness of the community as provider of social protection weaker and weaker over time. The number of households able to assist poorer relatives and neighbours is in sharp decline, while traditional support mechanisms are not be compensated by official safety net projects or social welfare efforts (Gay and Hall, 2000). The current AIDS crisis is one of the most important threats to the balance between givers and receivers (Turner, 2001). According to LVAC (2004), there is an increasing pressure on communities to absorb orphans and support members whose capacity to work is limited or absent. Not only the number of affected households is growing, but also their size and

composition make them particularly vulnerable and in need of help. For instance, the number of child-headed households and orphans is steadily increasing (in 2002, the total population of orphans was of 137,000 according to FAO/WFP). Beyond economic reasons, households affected by HIV/AIDS are often exposed to isolation and exclusion from safety nets also due to ignorance and stigmatization of the illness.

Stock theft is at the same time a consequence and a cause of the increasing poverty. In an accurate assessment of the socio-economic impacts of the phenomenon, Kynoch and Ulicki (1999) highlights how theft, and related violence, impact the living standards of rural Basotho, not only in economic terms. It also causes social divisions within and among villages, which in some cases ended up in the displacement of community members. Increased suspicion and mistrust hampers village cooperation and social protection mechanisms. At the same time, the scarce effectiveness of the police and the court reduce people trust in institutions and politics.

All these factors are limiting the effectiveness of social assets and sharing mechanisms as coping strategies against vulnerability and destitution. Declining social capital (and especially trust), widespread poverty and labour constraints posed by HIV/AIDS and related illnesses, also affect the capability to sharecrop and ultimately to farm, which is another critical livelihood strategy. Finally, while it seems unlikely that sharing and support arrangements will persist (especially in the expanding urban and peri-urban settings), traditional moral structures are decaying, and a host of social pathologies are taking their place both in rural and urban areas. Alcohol abuse, crime and prostitution are rampant especially among young people who – excluded from conventional livelihood strategies – migrate in an often unsuccessful attempt to find an employment through which they can sustain their families (Turner, 2001).

4.2 Any development prospect for Lesotho?

Since the seventies, when the economic and political dependency from the RSA was already well consolidated, there has been a lively debate on the prospects of a sustainable, internal-driven development of Lesotho. In 1972, Walmann defined Lesotho as a country suffering of a *non-development syndrome*. The absence of an indigenous industry or entrepreneurship, the population pressure combined with an increasing land degradation, made the country "lacking of any marketable resource other than unskilled labour" (Walmann, 1972). Furthermore, over the time, the complex of poverty, migration and economic dependency leaded to an *ideological dependence*, which made

Basotho extremely pessimist about the possibility of any successful independent initiative (Walmann, 1976). Consequently, according to the author, external actions capable to take into account all these factors – economical, political and "psychological" – would have been the only way to properly "treat" the syndrome. At the opposite, Murray (1981) and Spiegel (1980) – quoted by Johnoston (1997) – criticize the "development assumptions" which guided most colonial and post-colonial development interventions (as well as Walmann's perspective), and attribute the "less developed" nature of Lesotho to the numerous contacts which took place with the market (and in particular the South African one) rather than to the absence of contacts and interventions.

Indeed, unemployment – which today is one of the most important causes of poverty – is a problem because Basotho were pushed into a labour reserve and made dependent on earning wages. From this angle, unemployment is an intermediate cause of poverty, while the underlying issue is the international economic injustice that has leaded to the current situation (Turner, 2005). Similarly, the underlying cause of the vulnerability to climatic shocks, is the fact that large numbers of Basotho have been forced to farm in a relatively inhospitable environment. At the same time, the almost complete absorption of Basotho workforce by the region's cash economy, has discouraged people's commitment to introduce and experiment suitable production techniques (ibid.). Rather, development interventions and official government policies have more often encouraged the adoption of intensive, unsustainable agricultural practices. Even the impressive gully erosion which characterizes the country has been attributed to the conservation policies – mainly founded on an engineering approach – imposed by the colonial administration and then supported by early international development assistance, as Showers (1994, 2005) argues by reconstructing the environmental history of Lesotho landscape (see Box 4.1).

Today, the negative consequences of economic trends and erroneous – often discriminatory – policies, are exacerbated by modern development challenges, as described above. Simultaneously, traditional coping mechanisms are less and less effective in supporting livelihoods in both rural and urban areas. As a result, social indicators, including some fundamental ones such as children nutritional status, have worsened, and poverty and vulnerability are widespread. Creating the conditions to enable a sustainable, locally-driven development process is not an easy task. According to Turner (2001), "the overarching paradigm for development strategy in Lesotho should be the dual one of directly strengthening safety nets in poorest regions while focusing on the indirect enhancement of enabling frameworks for Basotho enterprise in the more promising areas". These may include tourism, mining, manufacturing and niche agricultural exports, such as high value vegetables and livestock products. A

comprehensive discussion of the objectives as well as the contents of an integrated development strategy is beyond the scope of this work. The rest of the paragraph focuses on the potential role that agriculture, and in particular farming, may have in reducing vulnerability and support sustainable development in Lesotho.

4.2.1 The Potential Role of Agriculture

During the Nineteenth century, following the contact with the first Missionaries and other European settlers, Basotho people introduced several changes in their farming system. The most significant were the introduction of wheat and the further diffusion of maize, the adoption of the plough, and the progressive establishment of an agricultural market (Turner, 1978). At the end of the 19th century, subsequent the development of the diamond and gold mining industry in the (then) Union of South Africa, and thanks to the intensification of their agricultural practices, Basotho started to export their produce. Despite the loss of most of their best farm land to Boer settlers, Lesotho (then Basutoland) was a net exporter of food (mainly wheat) until the 1920s. Subsequently, tariffs against Basutoland produce, discriminatory land legislation to dispossess black farmers, and the completion of railways that permitted bulk import from other countries, stopped the country from producing and exporting grain, and farming gradually dwindled to subsistence levels. At the same time, many dispossessed black farmers from South Africa sought refuge in the small country. Settlement began in the previously uninhabited highlands, increasing population pressure on natural resources and further threatening the already fragile environment (Turner, 2005). By the Thirties, Lesotho was importing maize, while agriculture was becoming progressively marginal to remittances (Fergusson, 1990). In the Sixties, the transition from "granary to labour reserve" (Murray, 1981) was completed.

While young males were working in RSA, fields were left to be worked by the elderly, the youth as well as the so called "gold widows". Farming started to be considered as a domestic and 'female' chore rather than a real profession. Nevertheless, in the absence of a pension scheme, own food production continued to be an essential retirement strategy and – in most cases – a complementary source of income. Nowadays, agriculture consists primarily of dry-land mono-cropping (maize and – to a much lesser extent – wheat). In spite of abundant and irregular rains, rainwater harvesting methods are rarely practiced (Gay and Hall, 2000). The potential role of agriculture in poverty reduction and economic growth is very contested. This is in part due to contradictory figures on agricultural production (in the latest seasons, estimates of the cereal gap varied by over 300% depending on the source). No matter the

precise data, it is hardly contestable that agricultural production is highly variable (especially due to the particular climatic conditions, including erratic precipitations), and that the maize yields have fallen from 1,400 Kg per hectare in the mid 1970s to a current 450-500 Kg per hectare in most of the districts (LVAC, 2004).

The causes and consequences of this situation are hotly debated (FFSSA, 2004). The most frequently mentioned factors include shortage of arable land, overgrazing, land degradation, erratic climate. Others argue that these factors have always characterized the country, and the most important causes of the decline of agriculture are rather of social and economic nature. The increasing population pressure due to forced displacements, the abandonment of the fields by migrant workers, and the consequent scarce investments made both by the state and the privates, have limited the interest towards policies and technologies suitable to the local conditions and ultimately the development of the sector. Many authors, in fact, attribute the current extent of soil infertility mainly to the use of intensive agricultural practices, and especially the use of the plough, introduced by the Europeans. More recently, the declining agricultural production has been also linked to the increasing poverty and vulnerability (discussed above), which affect the economic as well as the "social" capabilities needed to farm. In addition, the policies implemented to encourage the production of food – such as subsidies and emergency interventions – often had inconsistent and even negative impacts, resulting in late plantings or disincentives to plant.

Of course, none of these factors, alone, is the unique or main cause of the dramatic decline of yields and output. A complex combination of interrelated factors has contributed to the current situation. With regard to the future, some see the agricultural sector as a disaster, others recognise potential for increasing agricultural productivity (FFSSA, 2004) and stress the role of agriculture in combating poverty and enhancing food security (Gay and Hall, 2000). Those who support the potential role of agriculture in development recognise the need to face – and overcome – several challenges. Among the most important: improve access to inputs and services; improve the efficiency of technical and extension services for crop and livestock production; promote water harvesting and irrigation; exploit the opportunities stemming from high value products such as fruit, vegetable and (for livestock) mohair; improve integration of farming and livestock, also with regard to land tenure; promote and enable well-managed sharecropping; design appropriate policies for people living with HIV/AIDS; foster sustainable agricultural development through the promotion of more sustainable, ecologically friendly practices, such as soil and water conservation, reclamation of limited areas of degraded land

for intensive food production, mixed and low external input farming (Gay and Hall, 2000; Turner, 2001).

Even if, at least in the medium run, it seems unlikely that agriculture will be the driver of growth and provide significant numbers of jobs, "proper policy options and interventions aiming at enhancing the availability of food, could improve access to food by keeping prices low, and might contribute to creating employment and increasing wage rates through increased productivity" (FFSSA, 2004).

4.3 The Diffusion of Conservation Agriculture as an Innovative Process to Cope with Vulnerability and Food Insecurity in Lesotho

As mentioned in the previous paragraph, farming is a highly risky activity in Lesotho. In a risk prone natural environment, practices which rely on expensive inputs and mechanical implements, expose farmers to high vulnerability. Furthermore, conventional tillage methods stress the soil, decrease crop productivity and exacerbate the exposure to external shocks. The margin between buying and growing food is highly dependent on the season conditions and sometimes is very small (especially considering the competitive prices of South African products). Nonetheless, due to the spreading income poverty, the percentage of poor households which depend on purchases and face food shortages is growing. Therefore, there is an urgent need to promote appropriate, more sustainable farming practices in order to augment and stabilize the yields. It has been widely acknowledged that conservation agriculture (CA) may provide an effective solution to decreasing productivity due to land degradation and extreme environmental conditions, and that certain conservation practices may result more suitable to the characteristics of poor subsistence farmers (see Chapter 3, paragraph 3.3).

In Lesotho, the history of soil conservation is similar to that of many Southern African countries, where the engineering approach imposed by colonial administrations was abandoned after independence and then substituted by development interventions with mixed results (see chapter 3, paragraph 3.4). Nonetheless, due to the extent of land degradation and the strong – even though useless – commitment of the British Protectorate to solve the problem, the history of soil conservation in Lesotho presents also peculiar characteristics which are described in Box 4.1. For what concerns agriculture, traditional farming and land management practices used to include important conservation aspects (see Box 4.1). However, after the diffusion of the plough, the intensification of cultivation on restricted areas, and the promotion of soil conservation works, indigenous conservation practices

progressively got lost. In the Fifties, James Machobane developed the so-called Machobane Farming System (MFS), an intensive cropping system which follows most of the principles of CA. In spite of the good yields obtained by those who adopted the MFS, including resource poor farmers, the diffusion of the practice never received adequate support, and in some cases the Government even discouraged its adoption because of political reasons (Berold and Machobane, 2004). Subsequently, the Soil and Water Conservation and Agroforestry Program (SWaCAP), implemented with the support of IFAD between 1989 and 1994, was one of the earliest occasions in which the term "conservation farming" was used to the design the promotion of a sustainable agriculture technology. However, also the practices promoted through the SWaCAP (basically a rip-line system) did not diffuse extensively (Mosenene, 1998).

Box 4.1 Brief History of Soil Conservation in Lesotho

Landscape vulnerability in Lesotho began in the late nineteenth century, when international agreements ceded the Basotho richest agricultural and grazing lands to European settlers. These treaties transferred most of the rich farmland of the Basotho to the Afrikaner farmers of the Orange Free State. The subsequent increased population pressure on land, exacerbated by the migratory flows of dispossessed black farmers from the RSA, along with agricultural intensification, resulted in the acceleration of the land degradation process and the disruption of indigenous land use system. These included soil conservation practices such as the dispersed herding of cattle, maintenance of grass field boundaries and soil cover, inspection and maintenance of furrows used to divert storm water from the fields, intercropping and crop rotation with legumes, and regular fallows (Chakela, 1981; Showers, 1994, 2005).

Progressively, indigenous conservation measures were substituted with government conservation programmes. In 1936, the British Colonial Development Fund provided a loan to the Protectorate of Basutoland to implement a national soil conservation programme, the first in Southern Africa. The officers responsible for the programme basically tried to adapt to the Lesotho landscape the structural land treatments developed in the US for commercial farmers. These included almost exclusively engineering structures, like diversion ditches and terraces (referred to as contour banks, ridges or bunds). By the following year, the original projects were modified to save money; instead of strong banks, smaller and weaker structures were built. These structures broke down very frequently, and needed a constant maintenance activity which local farmers were reluctant to provide. Despite obvious technical failures, Lesotho's conservation program was considered a model of the (then) modern approach to soil conservation, and it was extended year after year until independence. "By 1964, a total of 519,681 acres had been terraced with 26,717 miles of terraces; 1,579 miles of diversion furrows had been excavated, and 737,346 acres of buffer strips and 1,049 miles of meadow strips had been planted" (Showers, 1994).

It is now widely recognized, and supported by local testimonies, that contours banks caused erosion in previously uneroded land. In many fields, gullies were initiated by water collected and concentrated behind conservation structures. Farmers tried to mitigate the negative impacts by reducing

the size of the banks, changing their location, or removing them from the sites where they were not visible from the roads. In other African countries resistance to soil conservation took an open political form. Basotho, instead, did not rebel against conservation programmes because they feared to lose their alliance with Britain and (after 1966) the international community against the threat of being incorporated into South Africa (Showers, 1994, 2005).

In spite of the technical problems and the reluctance of the population, until very recently the technology was neither investigated for local suitability nor evaluated for technical effectiveness (Showers, 2005). Therefore, soil conservation engineering was promoted also after independence by development organizations. The soil conservation programmes which started in the Seventies and continued until the Nineties, included area-based projects with some elements of biological conservation measures and the involvement of extension agents. However, most of the projects continued to emphasize mechanical methods, with very scarce involvement of local people in designing and implementing conservation policies (Chakela, 1981). Furthermore, very scarce attention has been given to the combination of physical conservation methods and improved farming and land management practices, which has been the key component of the few exemplar cases of SWC strategies in Africa, such as in the Yatenga region in Burkina Faso and Machakos district in Kenya.

The history of soil conservation in Lesotho is similar to that of other Southern African countries, and suggests that governments and donors have usually not understood local resource users, and the decisions they take over land use and management (Blaikie, 1987). The greatest limit of the strong conservation efforts made in Lesotho, has been the failure, over a long period of time, to understand local people needs and perceptions, as well as the inability to learn from the mistakes and successes of the past (Chakela, 1981).

In recent years, conservation practices have attracted the interest of several actors, including farmer organizations, NGOs, international organizations and the Government. The *Lesotho Food Security Policy and Strategic Guidelines* (MAFS, 2005) explicitly mentions the promotion of conservation farming as a strategic means to increase and stabilise agricultural production for both commercial and subsistence farmers, while preventing and reversing soil erosion. In 2006, the Food and Agriculture Organization (FAO) launched a Conservation Farming Network Group (CFNG) to encourage the adoption of water and soil conservation technologies and facilitate the exchange of experiences, knowledge and ideas among different actors. On the research side, the Agricultural Research Division of the MAFS started some trials, while the National University of Lesotho (NUL) undertook an evaluation assessment (Mapeshoane and Marake, 2005. *Evaluation of Conservation Agriculture Strategies Employed in Lesotho: a Farmers' Perspective*) which demonstrates that CA practices have meaningful potentials in increasing crop yields, especially in marginal and dry areas, stopping and reversing land degradation and enhancing soil fertility.

CA in the form of *likoti* (a Sesotho name for "basins") was introduced in Lesotho in 2000 by church organisations in Qacha's Nek and Botha-Bothe (described later in this chapter) and is currently the most common technique practiced in the country. Planting basins – about 15 x 30cm large and 15-20cm deep (or smaller) – are dug in a 75 x 75cm grid, that gives about 17,700 basins per hectare. Some fertilizer (either inorganic or organic) and seeds (the quantity depends on the desired crop density) are placed in each basin and covered with soil. Farmers who adopt the planting basin system are encouraged to leave crop residues on the field as mulch and to practice crop rotation and intercropping. Further conservation practices that have been promoted in Lesotho foresee the use of jab-planter (a simple device operated by hand that places a controlled number of seeds and amount of fertilizer directly into the soil) and animal- and tractor-drawn no-till planters (more suitable for better-off and commercial farmers). Furthermore, some NGOs are committed to re-introduce the Machobane Farming System.

4.4 Introduction to the Study Case: the Practice of *Likoti*[54]

Likoti has been introduced in Lesotho mostly due to the commitment of two Christian organisations: Africa Inland Mission (AIM) and Rehobothe Christian Church (Table 4.1). According to the data collected by the Lesotho Conservation Farming Network Group, in the agricultural season 2005/2006, about 500 households were practicing *likoti* in the Southern districts of Qacha's Nek, Quthing and Mohale's Hoek. The number of conservation farmers in Botha-Bothe and Berea districts, in the North West, was about 350, including 100 farmers who introduced CA in 2005/2006 with the support of German Red Cross. However, these figures do not take into account all the farmers who adopted the conservation technology without the direct support of an NGO or an International Organization.

Rev. August Basson is an Africa Inland Mission (AIM) missionary working as a pastor for the Lesotho Evangelical Church (LEC) in Tebellong, Qacha's Nek district. In 2000 he went to RSA to learn from Dominee Piet Deryer how to make planting basins (later called *likoti* in Sesotho). He then

[54] The information included in this paragraph is derived mostly from open interviews to key local informants and from the workshops held with the CA trainers in the surveyed areas. For a complete list of the people met, see Annex IV.

planted a 20x20m demonstration plot using this method but, in spite of the good yield obtained, people continued to be reluctant to introduce the technique.

Table 4.1 Conservation Agriculture Initiatives by Growing Nations and Rehobothe Christian Church

Promoting organizations	AIM – Growing Nations	Rehobothe Christian Church (in co-operation with Dihlabeng Church
Based at	Tebellong	Makhoakhoeng
Working in	**Qacha's Nek, Mohale's Hoek and Quthing:** Tebellong, Tsoelike, Qabane, Linakeng, Qanya, Seforong, Leosbeng (Thaba Tseka)	**Botha-Bothe:** Ha Chaka, Caledon, Ha Maloi, Ha Lefera, Koung, Thabong, Ha Paramente, Thaba Kholo, Mokotjela, Qholaqhoe **Berea:** Cana, Ntebele, Ha Lenea, Ha Mamathe/Ha Seuka
CA techniques practiced	From 2000: Likoti From 2005: Ripping to break plough pan with tractor before digging likoti From 2005: Trails with ox-drawn no-till planter From 2006: Trails with tractor-drawn no-till planter	From 2001: Likoti
Current training activities	Trainers travel around the whole country, each being responsible for some villages in specific areas.	Each CA leader is responsible for an area in the local community.
Incentives	From 2003: Vulnerable targeted farmers receive seeds, fertilizer, pesticides (and few herbicides) from FAO. **Tebellong:** WFP provided FFW to farmers who got trained by working in CA trainers' fields. **Tsoelike:** WFP provided FFW as an incentive to start CA.	From 2002: Vulnerable targeted farmers receive seeds and fertilizer with support of FAO.

Source: Adapted from Silici, Pedersen and Mapeshoane (2007)

In the growing season 2001/02 he hired some fields and at the same time paid farmers to do *likoti* on their own fields, for a total of 15ha planted with CA. The same year, Brian Oldrieve – an expert in planting basin systems from Zimbabwe – came to Lesotho to train farmers in Tebellong and Makhoakhoeng. From then onwards, a growing number of farmers started to introduce the new technique in these areas. The spread of the practice also captured the interest of development organizations. Since 2003, FAO has given seeds and fertilizer as incentives for farmers who wanted to

start CA. In 2005, also WFP started to support the diffusion of conservation farming, by providing Food for Work (FFW) to farmers who attended training while working in the fields of the 11 local trainers who in the meanwhile had taken over Rev. Basson's duties[55].

Pastor Rantimo learned how to practice *likoti* from Rev. Basson and started promoting CA in Tsoelike (Qacha's Nek) in 2003. The same year 12 farmers were trained and 5 started CA. Pastor Rantimo also planted a demonstration plot in his garden in order to show the use of the jab-planter and the no-till planter (pulled by horse) that he built on his own. As occurred in Tebellong with Rev. Basson, Pastor Rantimo started to train farmers elsewhere in the country (in collaboration with Dorcas Aid, a Dutch NGO), while a local responsible, Mr. Isaac Sehahle, took over his duties. WFP started a FFW programme also in Tsoelike, where farmers receive food for starting *likoti* in their fields, but, according to the perception of the local CA trainer, the system is not providing the right incentives to adopt CA in a long term perspective.

CA trainers working in Tebellong and Tsoelike use to follow up the training sessions by visiting the farmers on average three times per month and organizing open gatherings if they feel that there is any issue or problem to be discussed. By visiting farmers at their fields, and organizing there the meetings, they often capture the interest of conventional farmers who are nearby. A part from teaching the principles of CA, trainers encourage the household members to work together, as well as to organize work parties with other farmers.

Pastor John Mokoena and Rev. Pete West, from Rehobothe Christian Church, have started CA in Makhoakhoeng (Botha-Bothe district) in the cropping season 2001/02, when Mr. Brian Oldrieve from Zimbabwe came to teach them. They decided to supply the farmers who joined their training programme with seeds and fertilizers, because most of them lacked production assets and money to buy inputs. In 2006, in Makhoakoheng there were 14 "CA leaders", each being responsible for a village or an area, where they teach new farmers and follow up the training.

[55] By working with the trainers, farmers could learn all the aspects of the likoti system throughout the season. At the same time, working in a group and seeing good results has encouraged them to work harder. These farmers, who are expected to start CA in their own fields, can not join the FFW program for more than one season. The program has also helped the trainers to get time to travel around in Lesotho to teach other farmers the likoti system.

CA leaders in Makhoakoheng go to visit trained farmers on average once a month and they do not organize regular meetings with the groups, although they define individual interaction as quite constant. Even though they encourage CA farmers to work collectively, work parties are very rare. According to their view, farmers are not cooperative and they do not trust others' commitment.

The rationale to apply planting basins in Lesotho is threefold: to stop (and reverse) land degradation, especially soil erosion, to improve food security, and to obtain higher yields (due to improved water holding capacity and soil fertility) employing fewer inputs. However, often the potential benefits are not fully achieved. One of the major constraints faced by the organizations that aim to promote *likoti* is the difficulty of keeping the soil covered, due to the traditional practice of allowing community members to get access to the fields and the crop residues (mostly used as fuel) after the harvest. Even though today this practice is less common than in the past, villagers continue to collect the crop residues and to herd the cattle into the fields, even when the field owners disagree. Apart from eating the crop residues (that could be instead used as mulch), animals cause soil compaction.

The diffusion of *likoti* is hampered also by social and cultural bias. After the ox-plough was introduced by the first European missionaries, it spread very fast among Basotho, and soon people started to identify the plough with a particular social status. According to Ferguson (1990), "some women would refuse to marry a man who did not own a plough". Even if agricultural outputs are in decline, farming – and conventional methods introduced under the British Protectorate – continue to have a significant social role. Therefore, people – including the poorest – can be very reticent about farming without ploughing or without livestock, which also has a great, intrinsic value in Basotho culture. Similarly, people who adopt the new technology may be seen with suspicion, and even marginalized, by the rest of the community.

In spite of the constraints to the correct adoption of the practice, *likoti* has showed meaningful potential in increasing agricultural yields with a lower use of resources (Mapeshoane and Marake, 2005). Consequently, FAO decided to undertake an in-depth assessment of the costs and the benefits associated with the technique. The rest of the chapter discusses the benefits of CA and constraints to its adoption on the basis of the data collected under a field survey which was carried out by the candidate during an assignment as Intern at FAO Representation in Lesotho. The next paragraphs describe in detail the survey and discuss the results in terms of socio-economic and environmental impacts.

4.4.1 Source of the Data: Field Survey and Methodology

The author collected the data analysed in the following paragraphs under the initiative "Monitoring and evaluating the impacts of Conservation Agriculture (CA) in Lesotho: implementation of a comprehensive baseline study comparing conservation and conventional practices at small-scale farming level". The baseline survey was implemented under the FAO project OSRO/LES/503/UK – *Support to vulnerable rural household in Lesotho* – through a working arrangement between FAO Representation in Lesotho, the Department of Economics of the University of Roma Tre (Rome, Italy), the Department of Soil Science & Resource Conservation of the National University of Lesotho (NUL, Roma, Lesotho), and the Department of Agricultural Sciences - Section of Plant and Soil Science - of the Royal Veterinary and Agricultural University (KVL)[56], Frederiksberg, Denmark)[57]. The specific objective of the baseline study was to assess the socio-economic impacts of CA on small-scale farmers, with a special focus on agricultural outputs, food security status, and economic and environmental sustainability. In addition, part of the study was designed in order to describe the forms and the dimensions of social capital at the surveyed sites, and evaluate if and how social capital may influence the adoption of CA as an innovative practice, with the explicit purpose of integrating the present Ph.D. research[58].

The baseline study was implemented from January to October 2006 (see Table 4.2). Two sub-sample populations of farmers (innovator farmers who introduced CA[59] and conventional farmers)

[56] Since January, 1 2007, KVL has changed its name to "Copenhagen University, Faculty of Lifescience"

[57] The Emergency Programme of FAO Lesotho – headed by Ms. Farayi Zimudzi – has been responsible for managing and disbursing the funds and for the overall supervision of the activities implemented under the baseline study. The NUL - Department of Soil Science & Resource Conservation, in the persons of Dr. M.V. Marake and Ms. Botle Mapeshoane, has supervised and conducted the soil analysis. The Department of Agricultural Sciences of KVL has organized and participated in the field missions by assigning a Master student in Agricultural Development, Ms. Stine H. Pedersen. Assoc. Prof. Andreas de Neergaard and Dr. Adrian Bolliger supervised the research on the impacts of CA on agricultural production and soil fertility. The Department of Economics of the University of Roma Tre, under the supervision of Prof. Pasquale De Muro, focused on food security issues and the assessment of socio-economic sustainability. In particular, during the survey implementation, the author has coordinated the research and the field activities, planned the baseline survey (including designing the questionnaires and training the enumerators), supervised the creation of the database and the elaboration of primary data. Subsequently, she also edited and written, as main author, the survey report.

[58] Part of the results of the baseline survey have been included in a report, prepared by the author for FAO and funded by DFID: Silici, Pedersen and Mapeshoane, 2007. The impact of CA on small-scale and subsistence farmers. The case of likoti in Lesotho. The report does not include the information on social capital, which was elaborated by the author in separate instances.

[59] CA farmers include farmers who have been practicing likoti on at least one of their fields or in a garden

were monitored through a household survey and compared in relation to socio-economic and selected agronomic aspects. The concerned areas were: Makhoakhoeng in Botha Bothe district, Ha Mamathe in Berea district (lowlands) and Tebellong and Tsoelike in Qacha's Nek district (mountains). The sites were selected from those where CA had been practiced for a longer time (at least two agricultural seasons). As a whole, a sample of 240 and 229 farmers was interviewed in phase one and two, respectively[60]. The sub-samples represent a cross section of households in the selected sites. CA farmers were selected randomly amongst those who participated in training or other CA related initiatives (the complete lists were provided by local organizations promoting CA). The size of the sample was decided primarily in relation to the total number of CA farmers present in each area, and also considering other practical issues such as the accessibility of the sites and the work conditions (see Table 4.3). Conventional farmers were selected partly randomly partly purposively, in order to have control fields to compare to CA fields in relation to soil features and crop yields. The results presented below have been achieved by analysing the "restricted" sample of 229 farmers (117 CA and 112 conventional).

The first phase of the baseline study was conducted from January to April 2006. Fourteen (14) local enumerators were trained to administer a semi-structured questionnaire (Annex I) divided in five sections: background household information (household composition and wealth status); food availability and food security; farmers associations and community organization; agricultural production activities; knowledge and perception of CA practices. During this phase, the co-ordinates of 165 fields (109 CA fields and 56 ploughed control fields[61]) were identified and their area measured with a GPS. A composite soil sample[62] was taken from each field. A random selection of 122 soil samples was sent to the Department of Agriculture in Cedara, KwaZulu-Natal, and analyzed for soil fertility[63] and soil texture (Table 4.4).

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[60] The sample from the second phase is made of 229 questionnaires only: two questionnaires were not submitted because nobody was found in the household (one respondent died and the other one was away); three questionnaires were not returned on time; six questionnaires were excluded because by mistake they had been submitted to households that were not part of the original sample.

[61] Nearby fields with similar soil type and preferable same crops grown were chosen as control fields.

[62] Stratified random soil samples were taken on each field to make one composite sample for each field. The soil samples were taken randomly from the field with an auger to a depth of 30 cm, and mixed.

[63] Soil samples were tested for P, K, Ca, Mg, Zn, Cu, Mn, pH, acid saturation, organic carbon and clay.

Table 4.2 Timeframe of the activities

Month	Activity/activities undertaken
January	Definition of monitoring needs and appropriate tools
	Preparation of a semi-structured questionnaire for the household survey - phase I
	Selection of the sites and respective samples' size
	Fields tracking
February	Training of 14 enumerators - Soil sampling and mapping of fields – Interviews to local stakeholders
	Submission of questionnaires – phase I
March–April	Data entry – phase I
	Soil analysis
May – June	Data analysis – phase I
July	Preparation of a semi-structured questionnaire for the household survey - phase II
August	Training of enumerators - Interviews to local stakeholders
	Submission of questionnaires – phase II
	Data entry – phase II
	Yield records
September – October	Data analysis – phase I and II
	Report drafting

Source: Adapted from Silici, Pedersen and Mapeshoane (2007)

Table 4.3 Population sample, by site (village area), farmer type and gender of the HH, second phase

Village	CV FHH	CV MHH	Total CV	CA FHH	CA MHH	Total CA	Total by village	Approx total no of CA farmers
Makhoakhoeng	24	29	53	23	29	52	105	274
Ha Mamathe	3	3	6	3	4	7	13	52
Tebellong	5	20	25	9	18	27	52	100
Tsoelike	8	18	26	8	20	28	54	289
Linakeng		2	2	1	2	3	5	22
Total by farmer type and gender	40	72	112	44	73	117	229	737

Legend: CV= conventional farmers; CA=conservation farmers; FHH=female head of the household; MHH=male head of the household

Source: Adapted from Silici, Pedersen and Mapeshoane (2007)

Table 4.4 Number of farmers interviewed, fields tracked and soil samples tested, by district

District	Phase I		Phase II		CA fields		Control fields	
	CA	CV	CA	CV	Tracked	Soil tested	Tracked	Soil tested
Botha Bothe	56	54	52	53	54	31	29	24
Berea	8	6	7	6	51	3	24	3
Qacha's Nek	63	53	58	53	4	38	3	24
Total	**127**	**113**	**117**	**112**	**109**	**72**	**56**	**51**

Source: Adapted from Silici, Pedersen and Mapeshoane (2007)

The second phase was carried out from July to September 2006 and focused on the results of the agricultural season 2005/2006. A new questionnaire (shorter than the first one and translated into Sesotho, Annex II) was submitted to the same sample of farmers to collect information on agricultural yields and profitability, and on food security status. Also a section on household vulnerability and community cohesion was included. During this phase, the information on the yields collected through the questionnaires has been complemented with the data recorded from a sub-sample of farmers. As for the yields obtained by the conventional farmers, direct measurements were conducted on a sample of 15 fields in Makhoakhoeng (Botha Bothe). For the CA group, yields have been collected from 38 CA farmers with the support of local organizations promoting CA.

The information collected through the questionnaires has been entered in two datasets in Excel. As a whole, about 300 variables have been acquired on demographic and social features, household composition, wealth, assets, food security, community organization, social capital, agricultural production activities, knowledge and perception of CA, and agricultural yields. The discussion presented below relies mostly on the analysis of the information included in the two datasets.

4.4.2 Characteristics of the Surveyed Sites: Land Area and Topography

The household survey was conducted in 5 different areas where farmers started to adopt *likoti* between 2000 and 2001: Makhoakhoeng and Ha Mamathe, situated in the lowlands, respectively in the districs of Botha Bothe and Berea; Tebellong, Tsoelike and Linakeng in Qacha's Nek (mountains).

The land area of Botha Bothe district is 1,767 km^2 of which 7,763 ha (less than 5% of the total land area) is used for crop production, especially cereals (MAFS, LASR, 2005) The population accounts for 5.9% of the total Lesotho population (FAO, 2001c) with a population density of approximately 72 people per km^2. Qholaqhoe is the principal village in Makhoakhoeng area. It lies on the borderline between the lowlands and the foothills of the northern part of the district at elevations between 1,500 and 2,000m a.s.l. and occupies the upper slope positions of the sandstone escarpment above the Caledon river flood plains. The average annual rainfall is 800 mm with 60% falling during summer months – December to January. However, winter precipitation in good years allows for the winter cropping season with wheat and peas as the main crops. Summer temperatures range from 25^oC to 34^oC while the winters are cold (-2 to 14^oC) with occasional snowfall around June and July.

The land area of Berea district is 2,222 km^2 of which 27,158 ha (about 8% of the total land area) is used for crop production (MAFS, LASR, 2005). The population accounts for 13.9% of the total

Lesotho population and the population density is of 135 people per km^2 (FAO, 2001c). The village of Ha Mamathe is located in the northern part of the district at an elevation ranging from 1,500 to 1,800 m a.s.l.

The land area of Qacha's Nek is 2, 349 km^2 of which only 2,000 ha (less than 1% of total land area) are used for crop production (MAFS, LASR, 2005). The population accounts approximately for 3.7% of the national population with a density of 34 people per km^2 (FAO, 2001c). The chieftainship of Tebellong lies at an elevation of 1,700 to 1,900m a.s.l. while Tseolike lies in 1,800 to 2,000m a.s.l. Both areas are situated on top of the Senqu River Valley escarpment. The average annual rainfall is 800 mm. Summer temperatures range from 18^o to 25^oC while the winters are cold (0^o to 15^oC) with frequent snowfall in July and early September.

As it has been mentioned in the previous paragraphs, there are significant differences between different geographical zones in Lesotho. The Lowlands, where Botha Bothe and Berea are located, support more than half of the national population, constitute 70% of the limited arable land, and provide most of the available non agricultural employment. In contrast, the Highlands districts, such as Qacha's Nek, are sparsely settled, arable land is scarce and communities are much more isolated from urban services and markets.

4.4.3 Sample Social and Economic Features

Demographics and Education

Looking at the gender of the head of the household (HH), the percentage of female-headed households varies greatly in the mountains and the lowlands (29% and 44%, respectively), while there is no significant difference between the sub-samples – the CA and the conventional. The existence of more opportunities for migration, along with the higher incidence of HIV/AIDS, may explain the higher percentage of *de facto* and *de jure* female-headed household in the lowlands (Botha Bothe and Berea). Household headed by widowed women constitute more than 64% of the whole sample of female HH. However, while in the conventional sub-sample 25% of the 36-59 aged women and 42.5% of the women older than 60 are widows, the ratio is inverted in the CA sample, where more than 42% of the 36-59 aged female HH are widows compared to 21% of the women more than 60 years old. This indicates that relatively young women are left in charge of a family.

Table 4.5 shows the average number of household members and the average dependency ratio (DR, calculated as the ratio of household members more than 60 years old and less than 18 to the 19-59 years old members) for each farmer type (CV or CA) and household gender category (MHH or FHH). Female headed households, and especially those from the CA sample, have a higher average number of members and a higher DR. Households held by elderly women show even higher figures. Moreover, a higher percentage of widowed women is in charge of big households (7 to 9 and 10 to 13 members) compared to widowed men (10% versus 1%). These results suggest a greater vulnerability for the FHH in both categories and, in general, a higher vulnerability of the CA sample compared to the conventional sample. Indeed, most of the projects promoting CA in Lesotho targeted disadvantaged households with the aim to cope with scarcity of resources, thus the presence of vulnerable categories amongst CA farmers is not surprising. Due to the relatively short time these households have been practicing CA, it was not possible to include a dynamic assessment of the impact of the technology on their socio-economic status. However, the fact that they have continued to practice CA means that it revealed to be suitable to their conditions.

Table 4.5 Average DR and relative frequencies, by farmer category, gender and age of the HH

Gender HH	Age HH	CV farmers			CA farmers		
		Rel Freq	Av DR	Av H size	Rel Freq	Av DR	Av H size
FHH	19 – 35	3%	1.67	4	2%	1.33	2
	36 – 59	14%	1.18	6	20%	1.61	7
	> 60	20%	2.10	6	14%	2.54	5
Total FHH		**37%**	**1.71**	**5**	**36%**	**1.96**	**6**
MHH	19 – 35	9%	1.38	4	9%	1.59	4
	36 – 59	32%	1.26	6	30%	1.51	5
	> 60	22%	1.95	5	25%	1.66	5
Total MHH		**63%**	**1.51**	**5**	**63%**	**1.58**	**5**
Total		**100%**	**1.59**	**5**	**100%**	**1.72**	**5**

Source: Author's elaboration

The educational level of the sample is generally very low (Table 4.6). The majority of the respondents (44%) reported that the HH does not have any formal education and 9.2% that he/she is illiterate. However, CA farmers appear to be more educated compared to the conventional group in relation to all levels of education. It is interesting to notice also that, while in the conventional sub-sample women have lower degrees of education at all levels, the CA FHH reported the lowest percentage of illiteracy and the highest percentage of accomplishment of primary school compared to all categories. Thus, farmers who adopted CA have higher degree of education and, within the CA sub-sample, more women than men are educated, even though at lower levels.

Table 4.6 Education of the HH by gender and farmer category, relative frequencies

Education HH	CA FHH	CV FHH	CA MHH	CV MHH	CA Total	CV Total
None	2%	17%	8%	11%	6%	13%
None, read and write	40%	49%	49%	41%	46%	44%
Primary School	44%	20%	22%	27%	30%	24%
Secondary School	13%	15%	17%	18%	16%	17%
High School	0%	0%	3%	1%	2%	1%
University Education	0%	0%	1%	1%	1%	1%
Total	100%	100%	100%	100%	100%	100%

Source: Author's elaboration

In all groups, the share of the HH who accomplished the primary school plus those who can read and write are the majority in the respective population sub-samples. The proportion of literate CA FHH (those who can read and write plus those who accomplished primary education) is significantly higher than the proportion of literate CV FHH (z=1.66; $z_{0,95}$=1.64) and literate CV MHH (z=1.98; $z_{0,95}$=1.64); while there is no statistically significant difference between the proportion of literate CA FHH and the literate CA MHH (z=1.51; $z_{0,95}$=1.64), neither among the latter and the CV FHH nor the CV MHH[64]. The relationship between the educational levels of women and the choice to adopt CA is confirmed by the chi square test, performed on the distribution of CA FHH in comparison with the other farmers categories[65]. The findings (a larger share of CA farmers having basic education and a positive relationship between the women educational levels and the adoption of CA) is consistent with the higher openness towards innovation that usually characterizes better educated people. Moreover, the significant larger proportion of literate CA FHH compared to the other groups could suggest that basic education is an important variable in the choice of the practice, and especially amongst the groups that usually rely on fewer means. In other words, a better endowment with human capital, even when other resources are absent, can determine the adoption of CA. Indeed, this has a number of policy implications, e.g. for targeting potentially interested farmers, preparing and addressing the training, evaluating the sustainability of a project, and so on.

[64] The test performed aims to assess the significance of the difference between the share of CA FHH having basic education and the respective shares of CA MHH, CV FHH and CV MHH having basic education. The test gives a z variable distributed as a normal standard variable.

[65] The chi square test was performed in relation to the attributes: no education, literacy and primary education, on the distribution of CA FHH in comparison with the CV FHH ($\chi 2$=7.48; $\chi 20,975$=7.4), the CV MHH ($\chi 2$=4.6; $\chi 20,9$=4.6) and the CA MHH ($\chi 2$=5.18; $\chi 20,9$=4.6).

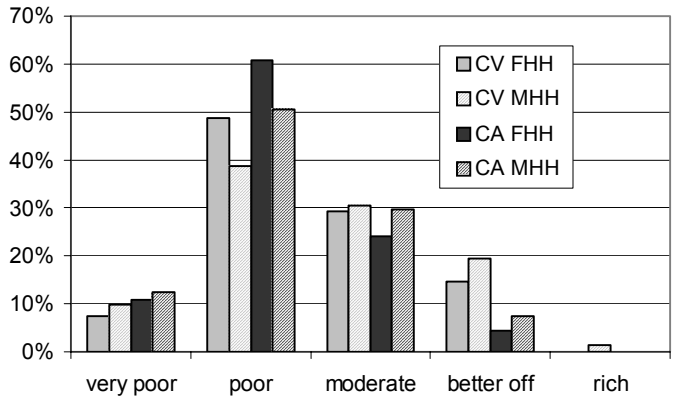
Wealth and wellbeing status

Three indexes have been built in order to compare the wellbeing status of the conventional and the CA farmers as well as to evaluate the distribution of welfare within the sample. The indexes range from 0 to 100 and the distributions were divided into quintiles in order to rank the households as *very poor*, *poor*, *moderate*, *better off* and *rich*. Annex III presents a methodological note on the construction of the indexes as well as the tables showing the average values of the indexes and the relative frequencies, disaggregated by farmer category.

The *Assets Index* (Figure 4.1) measures the endowment with productive assets, which includes animals, land, agricultural production means and other tools. The index can be considered as a proxy of the wealth of the households, even though it does not include other economic resources and monetary earnings.

On the basis of the Assets Index, most of the farmers can be classified as *poor* with a higher share of FHH included in this category compared to MHH in both categories. The percentage of CA farmers classified as *very poor* (the lowest quintile) is slightly higher compared to the conventional farmers. About 30% of farmers have been included in the *moderate* class (corresponding to the middle quintile), while in the fourth quintile, classified as *better off*, the percentage of conventional farmers, both FHH and MHH, is more than the double compared to the CA sample. Only one household, belonging to the CV MHH group, was ranked as *rich*. Consistently with the comments made on the distributions, the difference between the average Assets Index of the CV group (40) and the average Assets Index of the CA group (34.6) is statistically significant at 5% level (t=2.4; $t_{0,95}^{238}$=1,65).

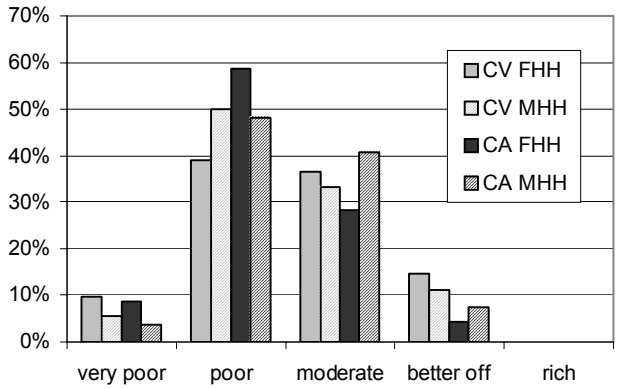
Figure 4.1 Endowment with productive assets (asset index), frequency distribution by farmer category and gender



The *Capabilities Index* (Figure 4.2) measures the household capability to generate welfare and includes variables such as the availability of a salary and other formal income sources, the ownership of a tractor, the capability to hire workers through *matsema* (collective wok), the presence of disabled members in the household and the household dependency ratio.

Looking at the quintiles based on the Capabilities Index, the percentage of farmers classified as *poor*, and especially the CA farmers, is still the largest. About 10% of the FHH and 5% of the MHH are included in the lowest quintile, meaning that they are exposed to high vulnerability. Compared to the Assets Index, a higher share of farmers is included in the *moderate* class, while there are less households classified as *better off* and none as *rich*. The T-test performed on the average Capabilities Index of the CV and the CA farmers (41.5 and 39, respectively) is significant only at a 10% level (t=1.35; $t_{0,9}^{238}$ =1,28)

Figure 4.2 Capabilities factors (capability index), frequency distribution by farmer category and gender



Finally, the *Outcome Index* (Figure 4.3) measures the household capabilities in terms of consumption, and takes in account the heating method, the dietary diversity (through the food consumption score, FCS)[66] and other consumption assets such as gas stove, radio and television.

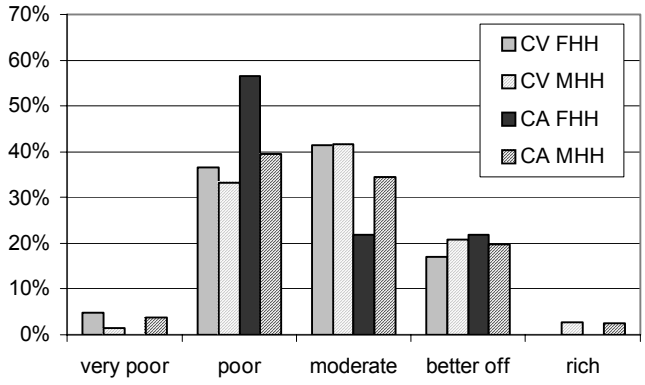
The conventional farmers are more normally distributed on the basis of the Outcome Index compared to the Assets and the Capabilities Indexes. Most of the conventional farmers are included in the middle quintile and the share included in the lower quintiles is smaller than in the previous cases.

[66] Refer to the following section on food security for a detailed description of the FCS

The classes seem to be more equilibrated also in comparison to the CA group. Most of the CA farmers, in fact, have been classified as *poor* in relation to their consumption capabilities and the differences between the FHH and the MHH are still very evident. However, the T-test performed on the Outcome Index (t=1.1; $t_{0,9}^{238}$ =1,28) does not indicate a statistically significant difference in the means of the two sample groups (CA average = 41.6; CV average = 44).

Generally speaking, all farmers categories show a poor welfare status, also reflected in the Outcome Index. The CA farmers show a higher degree of vulnerability especially in relation to the endowment of productive assets, while the differences with the conventional sample diminish in relation to other capability factors, although still present. In both sub-samples, the FHH as a whole show a lower welfare status, even though the differences are accentuated amongst the CA farmers.

Figure 4.3 Consumption (outcome index), frequency distribution by farmer category and gender



Access to food and availability

On average, CA farmers spend less money to buy food compared to the conventional ones and, in both groups, the average monthly expenditures of the FHH (285 Maloti) are lower than the MHH (358 Maloti). *Own production* and *Purchases* are the main sources of food in both sub-samples, having been reported, respectively, as the first most important and the second most important source of food by 78% and 70% of the farmers. *Purchases* have a relatively higher importance for the conventional farmers (reflected by the monthly expenditures) compared to the CA ones and, within the sub-samples, for the FHH compared to the MHH. Regarding the second most important source of food, *Private Gift* or *Food Aid* (primarily from WFP) have been reported by 9% of CV farmers and 13% of CA farmers, while *Food for Labour* (FFL, mainly from WFP) was mentioned by 5% of conventional farmers and 8% of CA farmers. The CA sub-sample seems to rely more on different forms of food aid than the CV

farmers, since 13% of CA FHH and 25% of CA MHH mentioned *Private Gift*, *Food Aid* or FFL as the second main source of food compared to 10% of CV FHH and 16% of CV MHH.

Even though own production resulted to be the most important source of food for all categories of sampled households, 76% of conventional respondents and 79% of the CA respondents reported that their own produce does not meet the needs of the household all year round. The average number of shortage months does not differ significantly amongst the farmers categories, however in both sub-samples the problem is more recurrent for female headed household. Instability of own food production is a result as well as a cause of vulnerability in rural contexts, thus female headed households could be badly affected by negative shocks that lead the household in a vicious circle of growing poverty. Looking at the overall availability of food (thus considering not just the own produce but also the food accessible through different sources), 46% of the CV sample and 66% of the CA sample reported to face shortages of food during the year.

Food and nutrition security

In both phases of the household survey, respondents were asked about diversity of food consumption, thus allowing to assess the food security status before and after the harvest. A food consumption score (FCS) was calculated to measure the diversity of food consumption[67]. Based on the FCS, the quality of the diet can be classified as *low* (FCS<10), *adequate* (10=<FCS<22) or *good* (22=<FCS<48). In both sub-samples, the majority of the households consume an *adequate* or a *good* diet; however, the average FCS obtained by those who fall in the *adequate* category is relatively small (average FCS=16) in relation to the top value of the category (FCS=22). In the case of Lesotho, a FCS equal to 16 means a basic diet made of *papa* (maize meal) and *moroho* (leaves vegetables) and a few alternatives.

[67] The food consumption score measures the diversity of household diet over three days, whereby to each food is allocated a score based on its nutrient density and its contribution to the diet. As an example, animal proteins and milk receive the highest score of 4, cereals receive 2, fruit 1 and so on (source: WFP Lesotho).

Table 4.7 Average food consumption score obtained in February and August, calculated with fruit (FCS) and without fruit (FCS*), and percentage variation

	CV FHH	CV MHH	CV Total	CA FHH	CA MHH	CA Total	Total
Average FCS, February	22,5	23,0	22,8	21,0	20,2	20,5	21,6
Average FCS, August	21,6	22,1	21,9	22,3	21,6	21,9	21,9
Average FCS*(without fruit), February	19,74	20,42	20,17	18,25	17,86	18,00	19,07
Average FCS* (without fruit), August	20,94	21,64	21,39	21,81	21,26	21,47	21,43
% Variation	-4%	-4%	-4%	6%	7%	7%	1%
% Variation* (without fruit)	6%	6%	6%	19%	19%	19%	12%

Source: Author's elaboration

As a whole, the CA farmers reported to consume a more diversified diet (i.e., they obtained a higher average FCS) in the second phase of the household survey (just after the harvest) than in the first one, while the conventional farmers' average FCS has slightly diminished. The differences between the first and the second phase of the survey for the two sub-samples are more evident if the FCS is calculated excluding the consumption of fruit, that in summer is widely available in rural areas, but it is not in winter after harvest. As shown in Table 4.7, without considering the consumption of fruit, all categories improve the diversity of the diet, but the increase is much more significant for the CA farmers (19%) than the conventional ones (6%). A T-test performed on the distribution of the differences between the FCS* (without considering fruit consumption) recorded in February and the FCS* recorded in August, showed that the increase of the average FCS* was significantly higher for the CA sample than the CV sample (t=1.59; $t^{227}_{0,925}$=1,44). The result would suggest that the availability of own production is more important for the CA sample and also that:

1. CA farmers rely more on their own production, even though on average they cultivate smaller fields and employ fewer resources (the CA sample also give a higher importance to *Own Production* as main source of food than the conventional one does).
2. Considering that initially most of the CA farmers were involved in a CA project just because they had been targeted as vulnerable and food insecure (that was confirmed by the socio-economic analysis), the improvement in the FCS after the harvest would indicate that currently they manage to achieve an adequate food security status through their own production (nevertheless, the amount of produce is still inadequate to cover the needs of the family all year round, and during the shortages time, CA farmers have less access to purchased food compared to conventional farmers)

Health status and access to public services

The health status of both children and adults is relatively poor, and there are no significant differences between the sub-samples. Though a higher percentage of CA farmers reported to have at least one member suffering from a chronic illness (39% compared to 32% in the conventional sample) that affects his/her ability to work in 26% of the cases. A part from Tebellong, in the other surveyed sites the access to health services is quite difficult, in fact the majority of the respondents reported to employ more than one hour to reach the nearest clinic or hospital. Safe water is generally available in all clusters with the exclusion of some households in Ha Mamathe and Linakeng, where the only source available for the majority of the household is an uncovered spring that is between 30 minutes and one hour away from the village.

In all sites but Linakeng, physical access to primary education is relatively easy (about 70% of the scholars live less than 30 minutes walk from the school). Still, 10% to 30% of the respondents take from 30 minutes to one hour to reach the nearest primary school and in Tsoelike 9% of scholars takes even longer. For what concerns the access to extension services, most of the farmers reported to live relatively close to a Resource Centre. In the areas of Ha Mamathe, 38% of the farmers is satisfied with the support received, even though they get it very seldom. In Qacha's Nek district, 56% of farmers is satisfied with the support received, but further 32% never receive a visit from the extension officers. The frequency of the visits of the extension officers, and the satisfaction for the support received, do not differ significantly in the CA and the conventional samples. Finally, in the area of Makhoakhoeng, farmers reported to live far from the Resource Centre and 66% of them reported not to receive any support from the extension services.

4.4.4 Agriculture Related Features: Land Ownership, Field Size, and Crops

Most of the farmers own one or two fields for farming (44% and 38% of the conventional sample, respectively, and 45% and 29% of the CA sample, respectively), while 9% of the conventional sample and 10% of the CA sample do not own any. Very few farmers have got 3 or 4 fields and only one conventional farmer reported to own 5. Looking at the cultivated fields, the differences between CA farmers and conventional farmers tend to narrow since they also include the sharecropped fields not owned by the household. Including the sharecropped fields, the share of conventional and CA farmers cultivating 1 field (40% and 38%) or 2 fields (38% and 37%) is the same. On the other hand,

the differences in the number of fields cultivated by females versus males are greater, and females headed households own and cultivate less fields than male headed households. CA farmer cultivate average smaller fields than conventional (1.92 acres versus 2.35 acres). Thus, even though there is not a significant difference in the number of fields, the total cultivated land is on average smaller for CA than conventional. In both samples, male headed household cultivate on average 1 acre more than female headed HH.

As expected, both conventional and CA farmers planted mainly maize, sorghum and beans. Looking at the way the crops are mixed on each field, 27% of conventional farmers are cultivating more than one crop on the same field compared to 37% of CA farmers. The percentage of CA farmers cultivating maize and beans (almost 20%) is significantly higher than the conventional sample (less than 10%). A higher percentage of CA farmers is also growing beans (total 32.4%) compared to conventional farmers (17.5%). This is probably due to the fact that CA farmers are more aware of the importance of growing nitrogen fixing crops (such as beans).

4.4.5 Economic Analysis and Labour Productivity

This section compares CA and conventional practices on the basis of the economic costs and benefits. The analysis presented in Table 4.8, has been performed taking into account the information collected through the questionnaires and the open interviews to key stakeholders. Since in Lesotho agricultural labour is usually provided by household members, it was not possible to consider wages as a direct cost. The opportunity cost of labour has been approximated to zero because of two reasons: (i) almost all farmers are practicing subsistence agriculture; (ii) there is a high rate of unemployment and lack of alternative off-farm jobs, especially in rural areas. On the other hand, seen the high importance that the labour requirements play in the adoption of conservation practices, labour productivity has been analyzed separately.

Table 4.8 Total expenses (in Maloti, according to the field survey) and output (in Maloti, according to the yield assessment) per hectare, by farming practice

	Tractor	Tractor + Animal draught	Animal draught	Likoti
Fertilizer – 3:2:1 (50 kg)	270[a]	270[a]	270[a]	230[b]
Maize seeds – hybrids (10 kg)	241	241	241	241
Pesticide – Stalkborer granules[c]	0	0	0	0
Ploughing/Digging holes	494[f]	494[f]	0	0
Sowing	370	0	0	0
Weeding[d]	0	0	0	0
TOTAL COST	**1,375**	**1,004**	**511**	**470**
Output Qacha's Nek[e, g]	420	420	420	1,535
Profit Qacha's Nek	**-955**	**-584**	**-91**	**1,065**
Output Botha-Bothe[e, g]	1,460	1,460	1,460	2,175
Profit Botha-Bothe	**85**	**456**	**949**	**1705**

a) 2 x 50 kg bags, according to the survey results
b) 1.7 x 50 kg bags, according to the survey results
c) Very few farmers actually use pesticides
d) Weeding is done by hand
e) According to yields estimated by NUL (2005) for conventional farmers, and direct measurement for CA farmers
f) Tractors owners use to charge higher prices compared to those recommended by the MAFS in the "Review of Machinery Charges 2003/04". According to the information collected on the field, the analysis considers a price of M494 per hectare to plough and M370 per hectare to sow
g) Since the vast majority of farmers produce for self-consumption, it has been considered the price of maize meal, instead of that of maize grain. The price of 2.5 kg of maize meal is M4.49 in Botha-Bothe and M6.25 in Qacha's Nek (FAO/WFP 2006). The cost for milling the maize has been subtracted to the price of maize meal.
Source: Author's elaboration

The economic cost-benefit analysis shows that in Qacha's Nek, farmers who plough their fields occur in an economic deficit. The economic loss affects both farmers who use tractor and those who plough with animals, but it is worst for the former. Whereas in Botha-Bothe, due to average yields considerable higher than in Qacha's Nek, all farmers get a profit. In both districts, the yield obtained using *likoti* gives the farmers a significantly higher economic benefit: in Quacha's Nek using *likoti* gives a profit of M1,065 per hectare (compared to a deficit from ploughing), while in Botha- Bothe it gives a profit at M1,705 per hectare, compared to M456 from ploughing and planting with tractor and M949 from ploughing and planting with animals.

It could be questioned why farmers continue to cultivate the fields by ploughing, when they occur in an economic deficit. The average yield of 200 kg/ha obtained in the season 2005/06 is very low, even lower than usual (Qacha's Nek use to have the lowest average district yield in Lesotho). One reason for continuing to cultivate the fields could be to keep the right to cultivate the land, which otherwise can be reallocated by the chief. Also, it is assumed that farmers buy seeds and fertilizer, which is only the case for around one third of the farmers. Many farmers use their own seeds and kraal manure or no fertilizer, and have lower costs. Finally, maize stubbles also have a value as fuel and

fodder, which is difficult to quantify. However, taken into account all the above considerations, even if the yield was the double for the ploughed fields, the profit would still be marginal.

In the economic cost-benefit analysis, the opportunity cost of labour has been hypothesised to be nil due to the high rates of unemployment and because farmers mostly practice subsistence agriculture. Nonetheless, labour has to be included in the analysis to evaluate its productivity. The ratio profit/labour (an approximation of return to labour) can also be interpreted as the profitability associated to the farming practice.

Alternative types of work power (tractor, animals and human labour) can be used to prepare the land (ploughing/digging basins) and to plant. Both conventional and conservation farmers use to weed and harvest by hand, thus the time associated with these activities do not depend on the tillage method. Table 4.9 shows the time spent in land preparation, depending on the agricultural practice. The time spent using the tractor has no relevance as farmers pay the tractor owner on the basis of the area to plough and usually sow by themselves. According to the data collected from the CA trainers and other key local informants, the first season it takes approximately 280 hours to dig the recommended 17.778 basins on one hectare of land. Starting from the following seasons, it becomes easier and faster because the farmer does not have to measure the grid and also digging is simpler. The analysis takes into account the time required for land preparation from the second season onwards, that corresponds to 180 hours to dig holes on one hectare of land.

Table 4.9 Time spent to perform different farming activities, on the basis of the tillage method

Activity	Time (man hours/ha)
Ploughing and sowing with tractor, weeding once by hand	150
Ploughing with tractor, sowing with animals, weeding once by hand	200
Ploughing and sowing with animals, weeding once by hand	295
Digging holes, placing fertilizer and seeds in the holes by hand, weeding 2.5 times	650

Source: Author's elaboration

Conventional farmers use to weed only once, thus those who are ploughing and planting with the tractor only have to provide 150 man hours per hectare for weeding the field once. Many farmers choose to get their field ploughed with the tractor and then use animals for planting, therefore they should provide a total of 200 hours per hectare (50 hours for planting plus 150 for weeding once). If the farmer also ploughs with animals, she/he has to use 95 hours more for a total of 295 men/hours per hectare. Farmers using *likoti* have to provide labour to prepare the land, plant and fertilize by hand. Even though CA farmers are recommended to weed at least 3 times per season, the survey has shown

that they weed on average 2.5 times per season. As a whole, the time needed by CA farmers to accomplish the different farming practices is 650 hours per hectare, which is considerably higher compared to the conventional farming practices. However, it has been demonstrated that by weeding CA fields frequently and timely, the weed infestation reduces progressively over time becoming easier and easier to control. Therefore also weeding in *likoti* fields takes progressively less and less time.

Table 4.10 Labour productivity (Maloti/hour) in Qacha's Nek (a) and Botha Bothe (b)

	Qacha's Nek (a)			Botha Bothe (b)		
	Tractor+Animal draught	**Animal draught**	**Likoti**	**Tractor+Animal draught**	**Animal draught**	**Likoti**
Output (M/ha)	420	420	1,535	1,460	1,460	2,175
Profit (M/ha)	-584	-91	1,065	456	949	1705
Labour (hours/ha)	200	295	650	200	295	650
Output/Labour (M/hour)	**2.10**	**1.42**	**2.36**	7.30	4.95	3.35
Profit/Labour (M/hour)	--	--	1.64	**2.28**	**3.22**	**2.62**

Source: Author's elaboration

In Qacha's Nek, where average yields are usually very low, conventional farmers occurred in an economic loss, therefore it is not possible to compare the labour productivity on the basis of the economic profits. Comparing the different farming practices in relation to the ratio output/labour (Table 4.10, a), *likoti* get the highest remuneration (2.36 M/hour), in spite of the large workload, due to significantly higher yields. In Botha Bothe, the profitability calculated through the ratio profit/labour (Table 4.10, b) is higher than in Qacha's Nek and almost similar for the farmers who ploughed with animals and those who used *likoti* (3.22 and 2.62, respectively). Therefore, it is possible to conclude that the amount of labour required by *likoti*, although much higher compared to the conventional farming practices, is adequately compensated by the yield. Considering that the figures used for the calculations refer to the workload necessary in the early adoption phases, which is expected to decrease over time, the profitability of CA is likely to augment in the following seasons. However, if the work power is not enough to accomplish timely all the farming activities, the output can be badly affected, thus it is important to assess carefully the labour force available to the household in relation to the number and the size of the fields, in order not to incur in crop losses and get an adequate labour remuneration.

4.5 Concluding remarks

This chapter has provided wide evidence of the scope for adopting conservation farming practices in Lesotho. One of the most significant results is the positive impact of CA on agricultural productivity due to improved efficiency in the use of inputs and other resources. Conventional and CA practices were compared on the basis of the costs for the inputs and the other resources employed and the value of the output obtained in the production of maize that is the main staple food in Lesotho. In the analysis, the opportunity cost of labour, usually provided by household members, has been hypothesised to be nil, due to the high rates of unemployment and lack of alternative off-farm jobs for subsistence farmers. Remuneration to labour was taken into account separately. Although using *likoti* implies a considerable workload, especially in the early adoption, CA farmers get greater profits than conventional ones, thus labour productivity does not differ significantly from that of the conventional farming practices and in some cases is even higher. Considering that labour intensiveness is expected to decrease over time, the profitability of CA is likely to augment in the following seasons.

Higher future profitability should be assured also by the greater environmental sustainability of the conservation practices. According to the results of the soil tests – analysed by the NUL and the KVL – *likoti* fields show higher levels of nutrients and organic matter contents compared to the ploughed fields, but the difference is not statistically significant. However, according to a soil fertility index (SFI), the overall soil quality is significantly higher in the no tilled fields, indicating that fertility is building up or at least is not degrading as it occurs in the ploughed fields. In addition, as confirmed by field studies conducted in other African countries where planting basins systems have been adopted (see Chapter Three), the extent of land degradation decreases progressively over time. Taking also into account that the extent of soil cover and mulching in Lesotho is still limited, the potentials of CA in combating land degradation are still underexploited.

Since in Lesotho agriculture is mainly subsistence oriented, the potential advantages associated to CA have to be considered in a wider perspective than the pure economic analysis. A part from the potential profitability and the environmental sustainability, it is important to look at the suitability of the technology to the local socio-economic conditions, that in turn determines its social sustainability. As depicted also by the household survey, most families in rural areas can be classified as *poor*. In relative terms, some households can be considered *better off* because they rely on some kind of formal income or because they are endowed with land and productive assets, such as livestock. Others, instead, and especially households headed by vulnerable categories (elderly or sick people, orphans, widowed

women), rely on a reduced or unstable livelihoods basis, experiencing a depleting welfare and food security status. In the surveyed sample, both CA and conventional farmers showed general low wellbeing standard, but the households practicing *likoti*, and especially the female headed households, revealed to be more vulnerable in relation to several dimensions. These findings suggest that CA has been employed by poor households as a means to cope with scarcity of resources, and the fact that they have continued to practice it (often adoption was facilitated by the provision of incentives) would support the result that the method is suitable to their conditions. Thus the accessibility to the technology by all social categories, is one of the most important benefit associated with the adoption of CA.

While physical assets seem not to be critical to the adoption of CA, the frequency analysis shows that CA farmers, and especially women, are significantly more educated than the conventional, confirming the importance of education in the adoption of an innovation. Furthermore, the fact that the women of the CA sample are significantly more educated than the women of the conventional sample, suggests that human capital represents a determinant asset, particularly when the access to other assets is limited by socio-economic factors or gender bias, as it occurs in Lesotho.

In both phases of the household survey, the food security status was evaluated in relation to access and availability of food, frequency of meals and diversity of the diet. Based on a Food Consumption Score (FCS), in February the majority of the households consumed an adequate or a good diet; in August, after the harvest, the food security status measured through the FCS improved for both CA and conventional farmers. The analysis would also suggest that, compared to the conventional sample, CA farmers rely more on their own production, even though on average they cultivate smaller fields and employ fewer resources (they also give a higher importance to *Own Production* as main source of food). Considering that initially most of the CA farmers were involved in a CA project just because they had been targeted as vulnerable and food insecure (that was confirmed by the socio-economic analysis), the improvement in the FCS after the harvest would indicate that currently they manage to achieve an adequate food security status through their own production (nevertheless, the amount of produce is still inadequate to cover the needs of the family all year round, especially because CA farmers have less access to purchased food compared to conventional farmers).

According to the information collected through open interviews and workshops held with key stakeholders, the socio-economic suitability and the positive impact on food and nutrition security are counterbalanced by issues related to cultural and relational aspects, which may reduce the overall social

sustainability. As an example, the fact that labour usually done by animals or tractors is done by people can lead some to stigmatize the practice. Other cultural issues relate to customary rules which allow villagers to collect the crop residues and herd the livestock in the harvested fields. Farmers who do not allow the neighbours into their fields in order to keep the soil cover, could incur relational problems with the rest of the community. The next chapter discusses in detail social capital and cultural related aspects, and integrate the findings presented here in order to provide a more comprehensive discussion of the impacts of CA on sustainable livelihoods.

Chapter 5 The Role of Social Capital in the Adoption of *likoti* in Lesotho

This chapter seeks to assess the role of social capital factors in the adoption and the performance of *likoti* in Lesotho. The objective of the empirical analysis is to provide evidence to the previous discussion on the role of social capital in the adoption of agricultural innovation, and in particular its relevance to the adoption and the performance of conservation practices in SSA.

Starting from the data collected through the field survey, the different forms of social capital which characterize the sample are identified and discussed (Paragraph 5.1). Subsequently, social capital aspects are analysed along with socio-economic and farming related variables, in order to assess possible relationships and dependencies. The empirical analysis is conducted with the support of Bayesian networks, whose structure – learnt inferentially from the data – reflect the (conditional) dependencies among the variables. Paragraph 5.2 introduces briefly the theory of Bayesian network and the software used to perform the structural learning of the data; it also explains the reasons for choosing this methodology. Paragraph 5.3 shows the results obtained by performing the structural learning of the data for three different dimensions or groups of variables: socio-economic, farming related and social capital variables. Paragraph 5.4 discusses the results obtained through the empirical analysis. The interpretation of the results is supported also by the information collected through the open interviews and the workshops held with key stakeholders (see Annex IV), and integrated with the conclusions of Chapter Four.

5.1 The Relevance of Social Capital to CA and Conventional Farmers

In both phases of the household survey, several questions related to aspects of social capital were included in the questionnaire (see Annexes I and II). In order to assess the rate of participation to formal and informal networks, respondents have been asked about:

1. Membership in associations and groups
2. Attendance to church meetings and related activities
3. Attendance to the *Pitso* (public village assembly)
4. Occurrence of sharecropping agreements

In order to enquire about cognitive dimensions, such as trust and reciprocity, more questions related to:

5. Quality of the relationships among community members

6. Generalized trust
7. Rate of help exchange
8. Respect of rules on grazing and
9. Reasons to break such rules
10. Perception of traditional collective work parties (*matsema*)

Membership in associations and groups

Respondents were asked about their membership in one or more of the following groups/associations: CA Association, Livestock Group, Farmer Association/Group, Support Group[68], Grocery Association, Burial Association, Credit Association/Trust Fund, Religious Group, Youth Group, Sport Group. The variable *Membership in Associations/Groups* has been calculated as the sum of the associations/groups to which the head of the household belongs.

CA adopters belong to a higher average number of associations (3) compared to non adopters (2.4). In the lowlands sites, respondents belongs to a higher average number of associations compared to the mountains, and also the difference between the two farmer groups is greater (Table 5.1). In all cases, membership into associations does not vary with the gender of the head of the household.

The difference in the average number of associations to which CA and conventional farmers belong, is statistically significant in the lowlands (t=2.6; $t_{0.95}^{116}$=1.65), but not in the mountains (t=0.6; $t_{0.95}^{116}$ =1.65). Furthermore, a higher percentage of CA adopters belongs to a larger number of associations, and the difference is greater in the lowlands (Table 5.2).

Table 5.1 Average number of associations, by site and farmers type

Lowlands		Mountains	
CA	Conventional	CA	Conventional
3.4	2.6	2.5	2.3

Source: Author's elaboration

[68] Support groups are established for people living with HIV and caregivers as an important way of receiving material and psychological support from other community members, as well as for knowledge sharing and encouraging collective activities such as community gardens.

Table 5.2 Total number of associations to which the head of the household belongs, frequency distribution by site and farmer type

No of associations	Lowlands		Mountains	
	CA	Conventional	CA	Conventional
0	0%	4%	9%	7%
1 – 4	79%	92%	79%	89%
5 – 8	21%	4%	12%	4%
Total	*100%*	*100%*	*100%*	*100%*

Source: Author's elaboration

The types of association/group with the highest membership rate are (Table 5.3): Farmer Groups, which are more frequent in the mountains (28%) than in the lowlands (18%) and – in all sites – among CA adopters; Support Groups, more common in the lowlands, and especially among CA farmers; Burial Associations, which are significantly more present in the lowlands (75%) than in the mountains (47%). Burial associations are the only type of organization with a higher participation rate among conventional farmers in all sites, probably due to the fact that, on average, they are wealthier than CA farmers. The higher presence of farmer groups/associations in the mountains is consistent with the greater importance that farming has – even though at subsistence level – compared to the lowlands, and confirmed also by data on respondents' main occupation and frequency of sharecropping (discussed later).

Table 5.3 Membership rates in selected groups and association, by site and farmer type

Site	Adopter	Farmer Group	Support Group	Burial Association
Lowlands	CA	25%	43%	70%
	Conventional	6%	23.4%	83%
Lowlands Total		17,8%	35%	75%
Mountains	CA	34.5%	20.7%	41%
	Conventional	21%	19%	53%
Mountains Total		28%	20%	47%
Total		22,7%	27.6%	61.5%

Source: Author's elaboration

Attendance to church meetings and related activities

Attendance to religious meetings can be considered a proxy of participation into informal networking, due to the social ends of many of the activities organized by Christian churches and other religious groups (such activities are not only "simple" opportunities for gathering, but often they have local development objectives and safety net functions). Looking at the frequency of attendance,

participation in church related activities is higher among CA farmers. The difference is striking in the lowlands, and especially between the female respondents (Table 5.4 and Table 5.5).

Table 5.4 Attendance to church meetings and activities in the lowland sites, by gender and farmer type

Frequency of attendance	CA FHH	CA MHH	CA Total	CV FHH	CV MHH	CV Total
Never/Rarely	0%	22%	11,5%	32%	28%	29,5%
Sometimes	22%	27%	24,5%	42%	24%	32%
Often	78%	51%	64%	26%	48%	38,5%
Total	100%	100%	100%	100%	100%	100%

Source: Author's elaboration

Table 5.5 Attendance to church meetings and activities in the mountain sites, by gender and farmer type

Frequency of attendance	CA FHH	CA MHH	CA Total	CV FHH	CV MHH	CV Total
Never/Rarely	22%	25%	24%	31%	22,5%	24,5%
Sometimes	22%	30%	28%	31%	35%	34%
Often	56%	45%	48%	38%	42,5%	41,5%
Total	100%	100%	100%	100%	100%	100%

Source: Author's elaboration

Attendance to Pitso

The village assembly – *Pitso*, in Sesotho language – is called by the chief whenever it is necessary to discuss a theme of public interest. The participation is open to all community members, who can intervene and, if necessary, vote. Women use to participate in great numbers, but men always speak lauder [69].

Frequency of attendance to the *Pitso*, is used as a proxy of participation into local political decisions. According to the data, there are no significant differences among CA adopters and conventional farmers. In the lowlands sites, a higher share of CA farmers use to *Always* participate into the *Pitso* compared to the conventional, whereas the opposite occurs in the mountains. Independently on the site and the farmer category, male heads of the household attend more frequently than women, as one would expect according to the minor role that women traditionally play in Basotho social and political life.

[69]Interview with Ms. Thope Matobo, anthropologist and lecturer at the Department of Social Anthropology and Sociology of the NUL

Occurrence of sharecropping agreements

As highlighted previously (paragraph 5.1), sharecropping is a critical means to cope with scarcity of resources for households which lack either land, labour or inputs for farming. Even though the need to sharecrop stems primarily from economic constraints, the possibility to reach an effective agreement depends critically on the social capital belonging to the household, or the individual, as well as on the ability of making such social capital to work at the right time. This is the reason why the conclusion of a sharecropping agreement, either on thier own fields or on others' fields, is used here as a proxy of the respondents' involvement in local social networks.

The share of farmers who practice some form of sharecropping, is higher in the mountains (56% of respondents) than in the lowlands (30%), with no significant difference among CA and conventional farmers. The greater number of sharecropping agreements in the mountains is probably due to the higher incidence of poverty. However, as it has been said, the actual possibility to conclude these agreements is linked also to the presence of social networks as well as to adequate levels of trust and reciprocity among people.

Quality of the relationships among community members

Respondents were asked to rank the relationships among community members either as *Extremely bad*, *Bad*, *Neither bad or good*, *Good*, or *Very good*. Most of the CA farmers feel that the relationships in the community are good, even though in the lowlands sites also a relatively high percentage of CA farmers defined them *Bad* (18.6%) and *Neither bad or good* (37%). At the opposite, in the mountains, the share of CA farmers who defined the relationships as *Good* (65.5%) is much higher compared to those who defined them *Bad* (10%) and *Neither bad or good* (24%). Relative frequencies among the non adopters vary greatly depending on the site. In the mountains 75.5% of conventional farmers feel that relationships are *Good*, whereas in the lowlands only 34% think the same (Table 5.6).

Generally speaking, the quality of the relationships among community members seems to be significantly higher in the mountain sites compared to the lowlands. In the lowlands, CA farmers deem the relationships as *Good* more than conventional farmers do, whereas in the mountains the opposite occurs. However, in both sites the difference between the two groups of farmers is not striking.

Table 5.6 Quality of the relationships among community members, relative frequency, by site and farmer type

	Lowlands		Mountains	
Quality of relationships	**CA**	**Conventional**	**CA**	**Conventional**
Extremely bad/ Bad	19%	11%	10%	13%
Neither bad or good	37%	55%	24%	11%
Very good/ Good	44%	34%	66%	76%
Total	100%	100%	100%	100%

Source: Author's elaboration

Generalized trust

This variable has been obtained running a Multiple Correspondence Analysis (MCA) in Minitab.15 [70]. The first component obtained through the MCA (see Annex V) explains an inertia of 0.234 and shows high, correlated values for the following variables: *Trust among community members*, *Trust government officials*; *Trust the chief*; *Trust the extension officers*; *Trust the police*; *Trust people from neighbouring villages*; *Trust staff of NGOs and development organizations*. Furthermore, it shows a positive correlation between variables of trust and *High rate of help exchange* and a negative correlation between variables of trust and *Not belonging to any association/group* and *Describing the relations among community members as Neither bad or good.* The second component, with an inertia of 0.2, shows high correlation among the trust related variables and a positive correlation among these and *Describing the relations among community members as Very good*. The first component has thus been chosen in order to summarize the information expressed by the seven trust related variables listed above and it has been labeled "Generalized trust".

According to the value of the variable (which ranges between -2.5 and 2.5), to each respondent has been assigned either a *Low*, *Medium* or *High* level of generalized trust. Looking at the frequency distribution (Table 5.7), CA farmers are characterized by a significantly higher degree of trust

[70] The variables included in the MCA are: Number of groups/associations to which the HH belongs; Frequency of attendance to church meetings/gathering; Frequency of attendance to Pitso (village assembly); Frequency of theft (either crop, livestock, tool); Trust among community members; Quality of relations among community members; Perception of Matsema (collective work parties); Rate of help exchange; Respect of community rules on animal grazing, if any; Reason for not respecting the rules; Trust government officials; Trust the chief; Trust the extension officers; Trust the police; Trust people from neighbouring villages; Trust staff of NGOs and development organizations. See Annex V for further details.

compared to the conventional (z=1.88; $z_{0,95}$=1.64) and, in general, the level of trust is higher in the mountains than in the lowlands. It is worthy to notice also that a high percentage of conventional farmers did not know how to answer to one or more of the questions related to trust, thus demonstrating a higher closure or indifference towards the category/ies of people they were asked about.

Table 5.7 Level of generalized trust, frequency distribution by site and farmer type

		High	Medium	Low	Don't Know	Total
Lowlands	**CA**	28%	35%	25%	12%	100%
	Conventional	17%	17%	32%	34%	100%
Lowlands Total		23%	28%	28%	21%	100%
Mountains	**CA**	35%	37%	19%	9%	100%
	Conventional	23%	45%	15%	17%	100%
Mountains Total		29%	41%	17%	13%	100%
Total		26%	34%	23%	17%	100%

Source: Author's elaboration

Rate of help exchange

The rate of help exchange is used a s a proxy of the degree of cooperation and reciprocity among the community members, and it is measured on the basis of the help that the household gives and/or receives in one or more of the following six activities: Child care, Caring for the sick people, Fuel collection, Food, Keeping livestock, Small business. The value of the variable range among 0 and 12, and corresponds to the total number of exchanges in which the household is involved. Looking at the average number of exchanges, there are no significant differences with regard to the farming practice and the location (Table 5.8).

Table 5.8 Average number of help exchanges in selected daily activities

	Lowlands		Mountains		
	CA	**Conventional**	**CA**	**Conventional**	**Total**
Average number of exchanges	6	5	5	4.5	5
Max number of exchanges	12	10	8	9	12

Source: Author's elaboration

Taking into account the relative frequencies, in the lowlands a higher percentage of respondents (29% of CA farmers and 21% of conventional) reported a *High* rate of help exchange, compared to the mountains (10.5% of CA farmers and 7% of conventional). Conventional farmers seem to be involved in fewer exchanges, especially in the lowlands, however the differences are not statistically significant in none of the sites (Table 5.9).

Table 5.9 Rate of help exchange, frequency distribution by site and farmer type

	Lowlands		Mountains		
	CA	Conventional	CA	Conventional	Total
None	1%	9%	3.5%	4%	4%
Medium (1-6 exchanges)	69%	70%	86%	89%	78%
High (7-12 exchanges)	30%	21%	10.5%	7%	18%
Total	100%	100%	100%	100%	100%

Source: Author's elaboration

Respect of rules on grazing and reasons to break such rules

Traditionally, villagers are allowed herd livestock into the fields to graze after the harvest. More recently, many field owners have started to prohibit the free access of people and cattle in their fields, so communities have attempted to establish new rules on livestock grazing. The extent to which these rules are respected, along with the analysis of the reasons for breaking them, is used here as a proxy of cooperation and reciprocity within the community.

In the survey sample, two thirds of both farmer categories perceive grazing on harvested fields as a problem and 85% indicate that some rules on grazing have been established by the community (the share is higher in the lowlands, 97%, than in the mountains, 72%, where also a relatively high share of respondents, 8%, reported not to know about the existence and/or the respect of any rule) (Table 5.10).

Table 5.10 Existence and respect of rules on livestock grazing, frequency distribution by site and farmer type

	Lowlands		Mountains		
	CA	Conventional	CA	Conventional	Total
No rules	**3%**	**2%**	**15%**	**27%**	**11%**
Rules	**96%**	**98%**	**76%**	**67%**	**85%**
Rules always respected	32%	49%	29%	27%	34%
Rules not always respected	64%	49%	47%	40%	51%
Other/DK	**1%**	**0%**	**9%**	**6%**	**4%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Author's elaboration

Among the farmers recognizing the existence of some rule, only 40% says that these rules are always respected. In the lowlands, 33% of the CA farmers says that the rules are respected versus 50% of the conventional sample. Whereas there is no significant difference between conventional and CA farmers in the mountains. It is worthy to notice that the different perception of the respect of the rules may be motivated by the fact that in the sample a higher share of conventional farmers owns livestock.

In addition, conventional farmers are less affected by livestock grazing on their fields, compared to *likoti* farmers who instead need to keep the soil covered. As a consequence, the answer to the question if the rules are respected or not, may not reflect (or reflect only partially) the actual degree of cooperation and reciprocity in the community. Rather, it may reflect mostly the farmers' individual perceptions, in turn influenced by technical considerations.

Table 5.11 Reason for breaking the rules on livestock grazing, frequency distribution by site and farmer type

	Lowlands		Mountains		
	CA	**Conventional**	**CA**	**Conventional**	**Total**
Lack of community cohesion	55%	53%	7%	10%	35%
Respect traditions	3%	4%	30%	50%	18%
Weak authorities	42%	43%	63%	40%	47%
Total	100%	100%	100%	100%	100%

Source: Author's elaboration

More information about the degree of cooperation and reciprocity may be obtained looking at the reasons why rules are not respected (Table 5.11). In the lowlands, among the farmers who believe that rules are not always respected, 54% says that it is because of scarce community cohesion, 3% says that the reason is to respect the traditional system (which allows the access to fields after the harvest) and 43% says that it is because of too weak authorities (including the chief, the police and the court), with no differences among CA and conventional farmers. In the mountains, instead, only 7% of CA farmers and 10% of conventional farmers who believes that rules are not respected, think that it is because of lacking community cohesion. Whereas 63% of the CA farmers and 40% of the conventional think that it is because of ineffective authorities, and 30% of the CA farmers and 50% of the conventional adduce "respect of the tradition" as the main reason.

The figures suggest that in the lowlands a low degree of reciprocity stems from the scarce cooperation among the members (also confirmed by a worse perception of the quality of the relationships and a lower degree of trust). Indeed, during a workshop organized in Thaba Kholo (Makhoakhoeng), CA trainers said that one of the major challenge to the correct adoption of *likoti* was keeping the crop residues on the field. In fact, in spite of the presence of formal agreements done with the chief and the livestock owners, people continued to let the cattle graze into the fields. In some cases, the stubbles were burnt by the people who were not allowed to collect them just as a revenge. In the mountains, instead, elements of tradition still play an important role in the regulation of social life so that they might hamper the adoption of innovative practices. The scarce effectiveness of formal

institutions, such as the police and the courts, is considered the main reason for the scarce respect of the rules by a high share of respondents in all sites, but especially among CA farmers who live in the mountains.

Perception of Matsema *(collective work parties)*

Collective work parties, in which community members provide work on someone fields in exchange for food or, more recently, money, are part of those traditional social occasions which also have redistribution aims. As such, they can be considered a social asset for both the parties – the farmer who calls the *Matsema* and the participants. Respondents were asked to evaluate the effectiveness of this practice. On the whole, more than 70% of the respondents judge positively this traditional practice (Table 5.12). The high share of *Likoti* farmers living in the mountain districts who expressed a positive opinion (90%) may be due to the fact that CA trainers encourage collective work on individual fields in order to bear the workload requested by the conservation practice. However, in conclusion, it is not possible to highlight any significant difference in the evaluation of traditional collective work parties with regard to the farming practice nor the location.

Table 5.12 Perception of *Matsema* (work parties)

	Lowlands		Mountains		
	CA	Conventional	CA	Conventional	Total
Negative	25%	28%	10%	28.5%	23%
Positive	75%	72%	90%	71.5%	77%
Totale complessivo	100%	100%	100%	100%	100%

Source: Author's elaboration

According to the discussion above, it seems that social capital takes different forms in the lowlands and in the mountains. In the lowlands, membership into association, participation into church related activities and attendance to Pitso – which are all considered proxies of participation into formal and informal networks – are higher than in the mountains. Therefore, it would seem that a "network dimension" is more developed in the lowlands than in the mountains. In general, CA farmers shows higher level of participation into networks, but the difference is especially striking in the lowlands.

The occurrence of sharecropping agreements, that was also included among the "network variables", is higher in the mountains, reflecting the greater importance of farming as a livelihood strategy, but also the higher level of trust among people. In the mountains, in fact, the sense of community and the tradition are stronger. All the respondents, with no significant difference between

conservation and conventional farmers, believe that the degree of trust and reciprocity are high and the quality of the relationships among community members are good. Whereas the opposite occurs in the lowlands, which is confirmed also by the fact that the scarce cohesion within the community has been adduced as the first reason for breaking the rules on livestock grazing.

The different dimensions of social capital characterizing the lowlands and the mountains – a "network dimension" and a "trust dimension", respectively – somehow reflect the different impacts that the socio-economic trends discussed in Chapter Four are having on the local communities. In the lowlands, where temporary migration towards RSA and urban and peri-urban areas is more frequent, and traditional copying strategies are less effective, community and kinship linkages deteriorate faster than in the mountains. At the same time, "looser", choice-based networks (see Paragraph 1.3) play an important role. Consistently with the process described by Cross et al. (1998), under change conditions, community based groups that used to operate under principles of generalized reciprocity are evolving into a differentiated, decentralized webbing of individual networks based on balanced reciprocity. Compared to the past, "social capital as a community asset available to everyone is evolving to an individual asset based on the ability to meet reciprocal obligations", implying that those who are not able to meet these obligations, such as most vulnerable people, are likely to be dropped from the networks (Frankenberger and Garret, 1998)

While in the mountains the "trust dimension" of social capital is equally relevant to CA and conventional farmers, in the lowlands, CA farmers' significantly higher participation into networks, would suggest that this dimension has somehow affected the adoption and the diffusion of the conservation technology.

The information collected by interviewing three chiefs in Qacha's Nek (mountains) and three chiefs and two Pastors in Butha Buthe and Leribe (lowlands) (see Annex IV) confirm that while in the mountains people are coming back from RSA and outward migration has decreased sharply, in the lowlands temporary migratory flows towards urban and peri-urban areas are substituting long-term employment in the mining sector in RSA. Furthermore, while all the interviewed chiefs felt that the quality of the relationships and the degree of cooperation are worse than in the past, mostly due to the general impoverishment of the people, interviewees in the lowlands especially stressed the decrease in reciprocal trust and the diffusion of a nascent "pay-back" mentality.

The rest of the chapter analyses the relationships among social capital dimensions, socio-economic features and farming related variables, in order to assess if and how social capital has affected the adoption and the diffusion of the conservation technology. The dependency among variables is tested by using Bayesian networks. The next paragraph introduces this methodology, highlighting the main advantages associated to its use.

5.2 Methodology: Bayesian Networks

In order to assess the possible relationships between social capital and the adoption of the conservation technology, the likely dependency among the variables of interest has been tested through the use of Bayesian Networks.

Bayesian networks are graphical models built as directed acyclic graphs (DAG). The DAG is made of nodes and arcs (edges) and is characterized by a descendant path. The nodes represent random variables, each variable assuming certain values or states. The arcs express the likelihood that two variables are (conditionally) dependent. When two variables are (conditionally) independent[71], they are not connected. Critical elements of a Bayesian network are the prior probabilities associated to all root nodes (nodes with no parents) and the conditional probabilities associated to all non-root nodes, given considering all possible combinations of their direct predecessors (Charniak, 1991). Each node having direct parents is assigned the conditional probability table (CPT) of the variable, given its parents. For variables without parents, the node contains an unconditional (also called a marginal) distribution.

A Bayesian Network can be drawn upon the knowledge of the system, as derived by the review of the literature, the analysis of the existing data, as well as the information collected through direct appraisal and/or consultation with experts and knowledgeable stakeholders. In this case, the network structure and parameters are based on a subjective approach to the quantification of probability (as developed by Ramsey, Savage and De Finetti), and the probabilities are elicited considering the likelihood of an event that the network builder can consistently estimate on the basis of the knowledge he/she acquired. The process starts from the evidence associated to the former nodes and continues by

[71] Two sets of variables, A and B, are said to be (conditionally) independent given a third set C of variables if when the values of the variables C are known, knowledge about the values of the variables B provides no further information about the values of the variables A.

attributing to each junction a set of probabilities that quantify the upper junction effects. Once the network has been parameterized (all the probabilities have been elicited), it is possible to use a software, among those existing, to calculate the probability of an output, given the weight put on each variable and parameter of the system (Baran, Jantunen, 2004).

Alternatively (as it has been the case here), the structure of the Bayesian network can be learnt directly from a set of data through an inferential process. This method is called structural learning and works by testing the conditional (in)dependence among one variable and all the other variables through an iterative process: for each couple of variables, the (in)dependence is tested conditionally to the subset of all the other variables.

The statistical software that has been employed in this analysis – Hugin Researcher 7.0 – allows to learn the structure of the dependencies directly from the data by using either the PC-Algorithm or the NPC-Algorithm. Basically, both the structural learning algorithms perform dependence tests that calculate a test statistic which is asymptotically chi-squared distributed assuming (conditional) independence. Before starting the learning process, the user has to set the level of significance, which represents the probability of rejecting a true independence hypothesis. Hugin set a default value of 0.05. This threshold is deemed to be appropriate for most learning sessions, however it can take on any value in the open interval (0;1). In general, the higher the significance level, the more links will be included in the learned structure, but also the strength of these links will be weaker.

The PC algorithm belongs to the class of constraint-based learning algorithms, and performs the following steps: (i) statistical tests for conditional independence are performed for all pairs of variables (unless some kind of structural constraint has been specified in the previous Learning Wizard steps); (ii) undirected links are added between each pair of variables for which no conditional independences were found, in order to get the so called *skeleton* of the learned structure; (iii) *colliders* – or links directed such as they meet in a node – are then identified, and edges are traced ensuring that no directed cycles occur; (iv) next, directions are enforced for those links whose direction can be derived from the conditional independences and the colliders identified; (v) finally, the remaining undirected links are directed randomly, ensuring that no directed cycles occur.

Just as the PC algorithm, the NPC algorithm generates a skeleton derived trough statistical tests for conditional independence. The NPC seeks to repair the rigidities and deficiencies of the PC algorithm, which occur especially in the face of limited data sets. By including a criterion known as the

necessary path condition[72] (for which NPC stands), the NPC algorithm highlights all the existing ambiguous regions (sets of inter-dependent uncertain links) and relies on user interaction to solve them. The user can choose to include or exclude uncertain links on the basis of his/her knowledge of the system, or looking at the p-value, which represents the degree to which two sets of variables, A and B, are (conditionally) (in)dependent[73]. Instead of randomly determining the directionality of the links of the learned structure that cannot be determined automatically from the data, the NPC algorithm gives the user also the opportunity to determine the directionality of such links.

The use of graphical models responds to the need of testing analytical instruments for assessing and measuring the impacts of social capital, alternative to the conventional approaches which have been used so far. In particular, the empirical literature which attempt to test the impacts on social capital on development – both at micro and macro level – mostly rely on econometric tools. However, this approach has been strongly criticized for a number of reasons. Issues related to data aggregation, inaccurate model specification and identification, exchangeability, unobserved heterogeneity and use of instrumental variables, have been discussed extensively in paragraph 1.2.

Those who highlight the limitations posed by the econometric analysis, suggest – as a preliminary condition – to move from the "grandiose approaches to social capital" towards the analysis of specific social components of individual behaviour (Durlauf and Fafchamps, 2004). The shift from the macro to the micro dimension, and from generalities to specific mechanisms, should avoid the problems related with data aggregation and use of macro-indicators of social capital, which often describe tautologically its outcomes. It should also allow to deal more effectively with issues of endogeneity and exchangeability, since it can facilitate more precise and comprehensive modeling of causal mechanisms.

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[72] Informally, the necessary path condition says that in order for two variables X and Y to be independent conditional on a set S, with no proper subset of S for which this holds, there must exist a path between X and every Z in S (not crossing Y) and between Y and every Z in S (not crossing X). Otherwise, the inclusion of Z in S is unexplained. Thus, in order for an independence statement to be valid, a number of links are required to be present in the graph.

[73] The marginal dependence between A and B is defined as one minus the marginal p-value associated with {A,B}. Thus, a marginal dependence of 0 (high p-values) means that A and B are completely independent, while a marginal dependence of 1 (p-values close to 0) means that A and B are completely dependent.

Further critics to the conventional approach to the assessment of the impacts of social capital, point out that the frequent empiricists' treatment of social capital indicators as independent variables in neoclassical growth functions founds on the unrealistic assumption that social and institutional phenomena can be considered as one- or two-dimensional concepts (Wallis et al., 2003). Last but not least, many critics to the empirical social capital literature complain also the scarce availability of data survey which were originally conceived for collection of specific social capital related information.

The use of graphical models thus allows – first of all – to bypass the problems stemming from econometric modeling. In particular, the structural learning allows to appraise the structure of dependencies inferentially, with no need of prior specifying the model. Furthermore, Bayesian networks can represent a truthful description of the reality even when a pure deterministic analysis is not possible, due to unavailability of complete or sufficient quantitative data, or due to the need to integrate quantitative with qualitative information (as it is often the case when dealing with variables of social capital).

However, the main advantage associated to the use of Bayesian network for investigating inherently context-dependent, micro-level concepts – such as social capital and other socio-economic dimensions – is that the analysis expresses interdependency relationships more complex than mere causality directions. Moreover, a software such as Hugin can be used to forecast possible scenarios and also to simulate the impacts of alternative situations/policies/actions by influencing differently the variables' values and states. By modifying manually the marginal distribution or the CPT associated to a root or a non-root node, respectively, all the backward and the forward linkages change subsequently. Also, it is possible to *propagate the evidence* for a certain variable state or value – that is, to simulate that the variable always assume that state or value throughout the whole sample – and see how this affects the whole dependence structure.

Finally, it is worthy to notice here that also the choice of the scope of the analysis, as well as the source of the data, seek to overcome some of the limits often attributed to conventional studies on the impacts of social capital. The household survey from which the dataset was built, was designed taking into account the peculiar social and cultural characteristics of the study sites. The results of the questionnaires were completed with open interviews to key stakeholders and knowledgeable informants. Thus, also the interpretation and the generalization of the results take carefully into account this complementary information base. Finally, the questions related to social capital did not include any explicit reference to the objectives of the survey. In other words, the interviewees were asked to

respond to fact based questions, formulated without any relationship with the dimensions to which they have been eventually related.

5.3 Analysis of the data through Bayesian networks

As already mentioned, in order to test the possible impacts of social capital on the adoption of CA, the dependence among different variables has been tested through Bayesian networks, whose structure has been learnt from the dataset created under the household survey. All the Bayesian networks have been built using Hugin Researcher 7.0, running the NPC-Algorithm at a level of significance set at 0.05. Three kind of variables have been included in the statistical analysis; Table 5.13, Table 5.14 and Table 5.15 show the complete list of variables, grouped according to the relative dimension: Socio-demographic; Farming related; Social Capital variables.

Table 5.13 Socio-demographic variables

Label	Variable	Value/States
Gender	Gender of the head of the household	F = female; M = male
Age	Age of the head of the household	19-35; 36-59; more than 60
Marital St	Marital status of the head of the household	Single; Married; Widowed; Divorced/separated
Size HH	Size of the household	Cardinal number
Occupation	Main occupation of the head of the household in the last 12 months	None/Unemployed; Subsistence agriculture; Commercial agriculture; Piecework/Petty trade; Salary job
Education	Highest level of education of the head of the household	Illiterate; Literate; Primary School; Secondary School; High School/University
Diet	Average of the household Food Consumption Score (FCS) in January and the FCS in July (see paragraph4.4.3)	Range 0-48; Low (FCS<10), Adequate (10=<FCS<22), Good (22=<FCS<48).
Asset Index	Asset Index: measures endowement with productive assets (see paragraph4.4.3)	Range 0-100; Very poor (AI<=20), Poor (20<AI=<40), Moderate (40<AI=<60), Better off (60<AI=<80), rich (80<AI=<100)
Outcome Index	Outcome Index: measures capabilities in terms of consumption (see paragraph4.4.3)	Range 0-100; Very poor (OI<=20), Poor (20<OI=<40), Moderate (40<OI=<60), Better off (60<AI=<80), rich (80<OI=<100)
Capab Index	Capability Index: measures capabilities of generating welfare (see paragraph4.4.3)	Range 0-100; Very poor (CI<=20), Poor (20<CI=<40), Moderate (40<CI=<60), Better off (60<CI=<80), rich (80<CI=<100)
Location	Location	Lowlands (areas of Makhoakhoeng, Thaba Kholo and Ha Mamathe); Mountains (areas of Tebellong, Tsoelike, and Linakeng)

Table 5.14 Farming related variables

Label	Variable	States
Adopter	Kind of adopter	Non adopter; Potential; New adopter; Early adopter
Marginal fields	Number of fields located on a hill or foot slopes	Cardinal number
TrainCA	Ever received training on CA	Yes; No
Subsides	Ever received subsides to introduce CA	Yes; No
Intercrop	Practice intercropping	Yes; No
Crop Rot	Practice crop rotation	Yes; No
Crop Resid	Leave crop residues as mulch on the field	Yes; No
Graze Out	Keep animals out of the field after harvest	Yes; No
Know CA[74]	Degree of knowledge about *likoti*	Range 0-6; Very low (K<2); Low (2≤K<3); Medium (3≤K<4); Good (4≤K≤6)

[74] The degree of knowledge about the conservation technique is calculated on the basis of an index which take into account the answers to a number of questions related to both the practice and the "theory" of CA. The questions are:

Have you ever practiced intercropping?

Have you ever practiced crop rotation?

Do you keep crop residues on the field as mulch?

Do you manage to keep animals out of the fields?

Have you noticed increasing yields in CA fields?

Have you noticed decreasing erosion in CA fields?

Can you practice CA with all crops?

Can you practice CA in your garden?

Can you practice CA on a large scale?

For each question, to a positive answer is attributed the value "1", to a negative answer the value "0". The index is calculated as {(a+b+c+d)+[(e+f)/2]+[(g+h+i)/2] } and ranges between 0 (no knowledge) and 6 (optimal knowledge).

Table 5.15 Social Capital variables

Label	Variable	States
Associations	Number of groups/associations to which the head of the HH belongs	0; 1-4; 5-8
Church Attend	Frequency of attendance to church meetings/gathering	Never/Rarely; Sometimes; Often
Pitso Attend	Frequency of attendance to Pitso (village assembly)	Never; Sometimes; Always
Relations commun	Relations among community members	Extremely bad; Bad; Neither bad or good; Good; Very good
Evalu Coll Work	Perception of Matsema (collective work parties)	Negative; Positive; DK (Don't know)
Help exchange	Rate of help exchange (see paragraph 5.1)	None; Medium (1-6); High (7-12)
Respect Rule	Respect of community rules on animal grazing, if any	No rule/Don't Know; Respect tradition; Weak authorities; Lack of community cohesion
Gen Trust	Generalized Trust (see paragraph 5.1)	Range -2.5 – 2.5; Low (-2.5≤GT< -0.5); Medium (-0.5 ≤GT<0.5); High (0.5≤GTK≤2.5); DK (Don't know)
Sharecrop	Practice any form of sharecropping	Yes; No

Initially, separate analysis have been conducted with the socio-demographic and the farming related variables in order to identify dependencies within each group/dimension. These preliminary findings allowed to select key variables/nodes to be then included in the analysis of the relationships between social capital and the adoption of the technology. For each dimension/group of variables, three Bayesian networks have been built: one based on the whole dataset, one based on the sub-sample of the adopters75 of the technology and one based on the sub-sample of the non adopters.

First, conditional dependencies among the socio-demographic variables were tested. The variables "Adopter" and "Know CA" were also included in the analysis. Figure 5.1 shows the BN for the whole sample. The links between Diet and Outcome Index and that between Occupation and Capab Index are

[75] Cross-checking the information about the time they have been practicing *likoti*, the willingness to continue, and the tillage method actually used to prepare the field for the following season, farmers have been classified in:

Non adopters: farmers who never practiced or dropped CA and won't start it in the future

Early adopters: farmers who have been practicing CA since at least two seasons and will continue

New adopters: farmers who have just started CA and will continue

Potential adopters: farmers who have never practiced CA, but showed a concrete interest in starting

somehow straightforward since the quality of the diet and the main occupation of the head of the household contribute to the construction of the Outcome and the Capability Indexes, respectively.

By entering evidence in the Occupation node (Figure 5.2), it emerges that salary jobs characterize Moderate and Better off wealth categories, whereas subsistence agriculture and piece work are the most important occupation of the Poor and the Very Poor. The links between Gender and Marital St and Size HH and Marital St confirm that female heads of the household use to be widows and also that widowed women are often in charge of large households.

Figure 5.1 Conditional dependence among socio-economic variables, whole sample

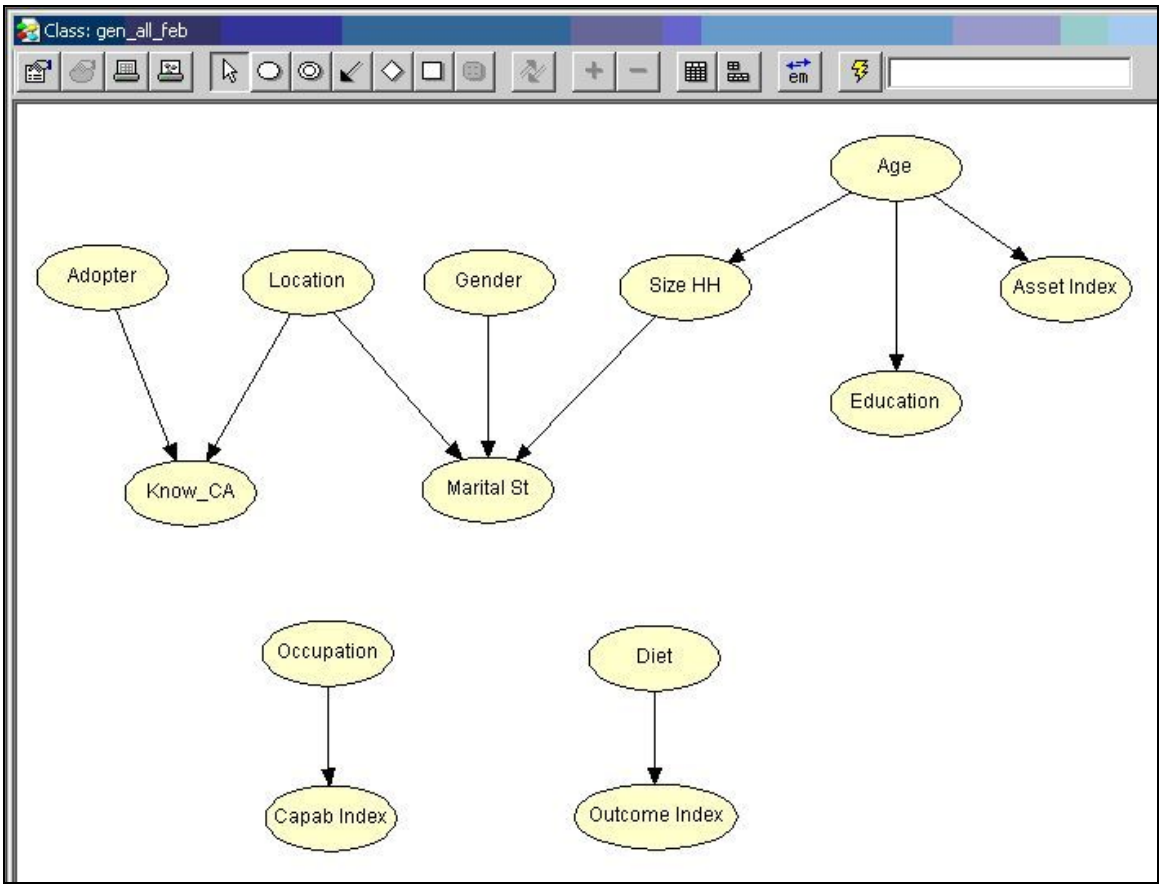
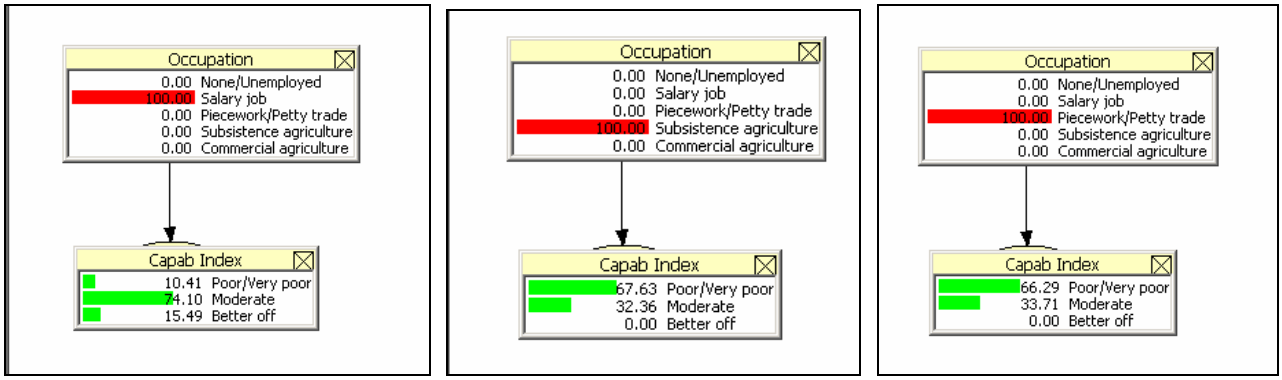


Figure 5.2 Conditional dependence among socio-economic variables, whole sample. Evidence in the *Occupation* node



Especially interesting are the links between Age and Size HH, Education and Asset Index. By entering evidence in the Age node (Figure 5.3), it emerges that the youngest heads of the household are better educated compared to the other age categories, but also that they are poorer in terms of assets and held smaller families. At the opposite, if the sample was made only of elderly people (more than 60 years), about 30% of them would be in charge of large households of more than seven members. These results reflect the changing patterns of social reproduction discussed in Chapter Four: increasing poverty and vulnerability do not allow young men and women to start a family, whereas the elderly continue to be in charge of their sons and daughters (in the past it used to be the opposite) and often also of their grandchildren (if the parents are working away or died from AIDS).

None of the socio-demographic variables is linked with either "Adopter" or "Know CA" but the location (Figure 5.4, as it will be discussed later, farmers living in the mountains have a better knowledge of the technique compared to those living in the lowland sites). This would confirm that demographic features, such as the gender or the age of the farmer, and the socio-economic status, including ownership of assets, do not influence the adoption of the technology and the way it is applied.

Figure 5.3 Conditional dependence among socio-economic variables, whole sample. Evidence in the *Age* node

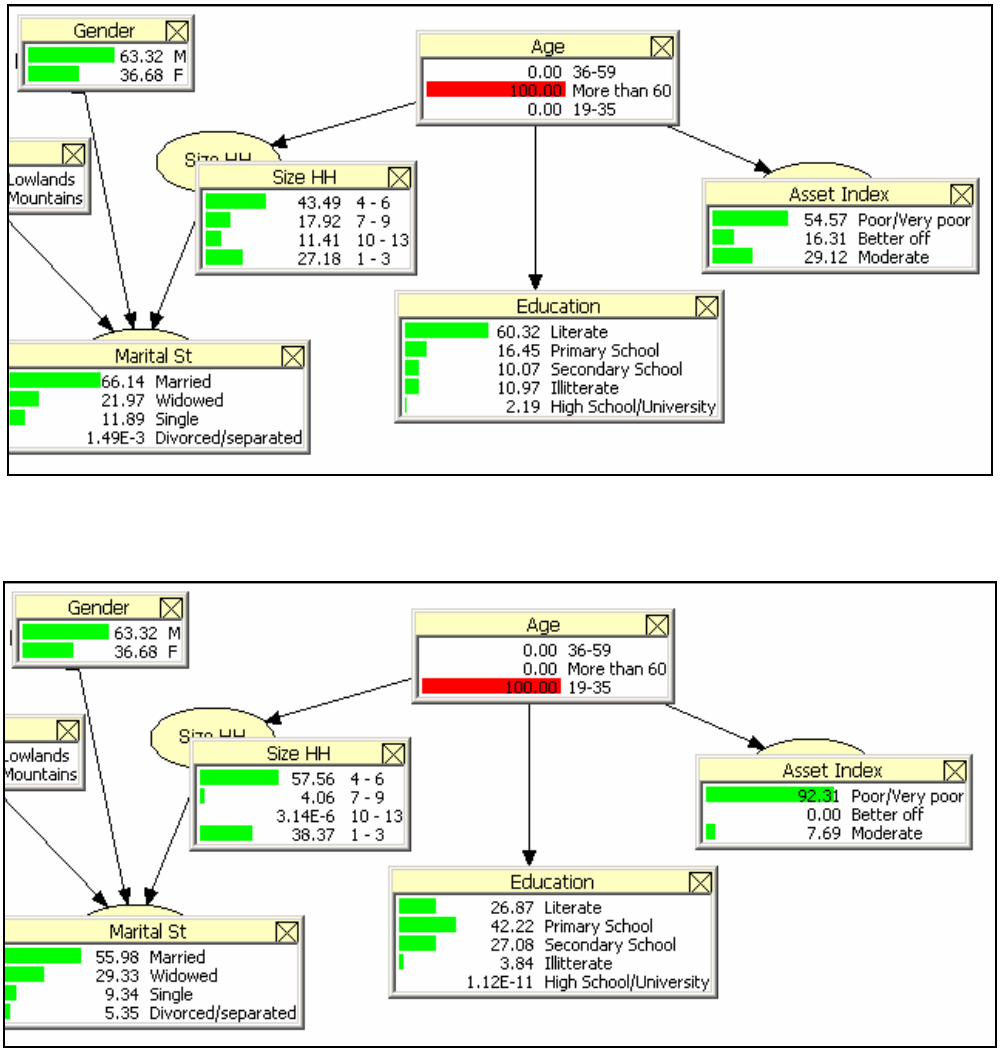


Figure 5.4 Conditional dependence among socio-economic variables, whole sample. Evidence in the *Adopter* and *Cluster* nodes

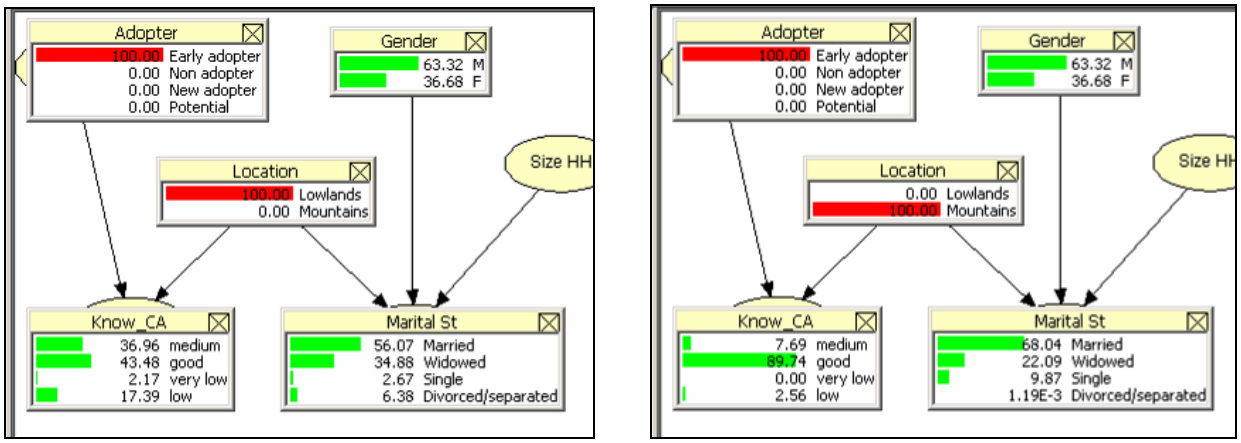
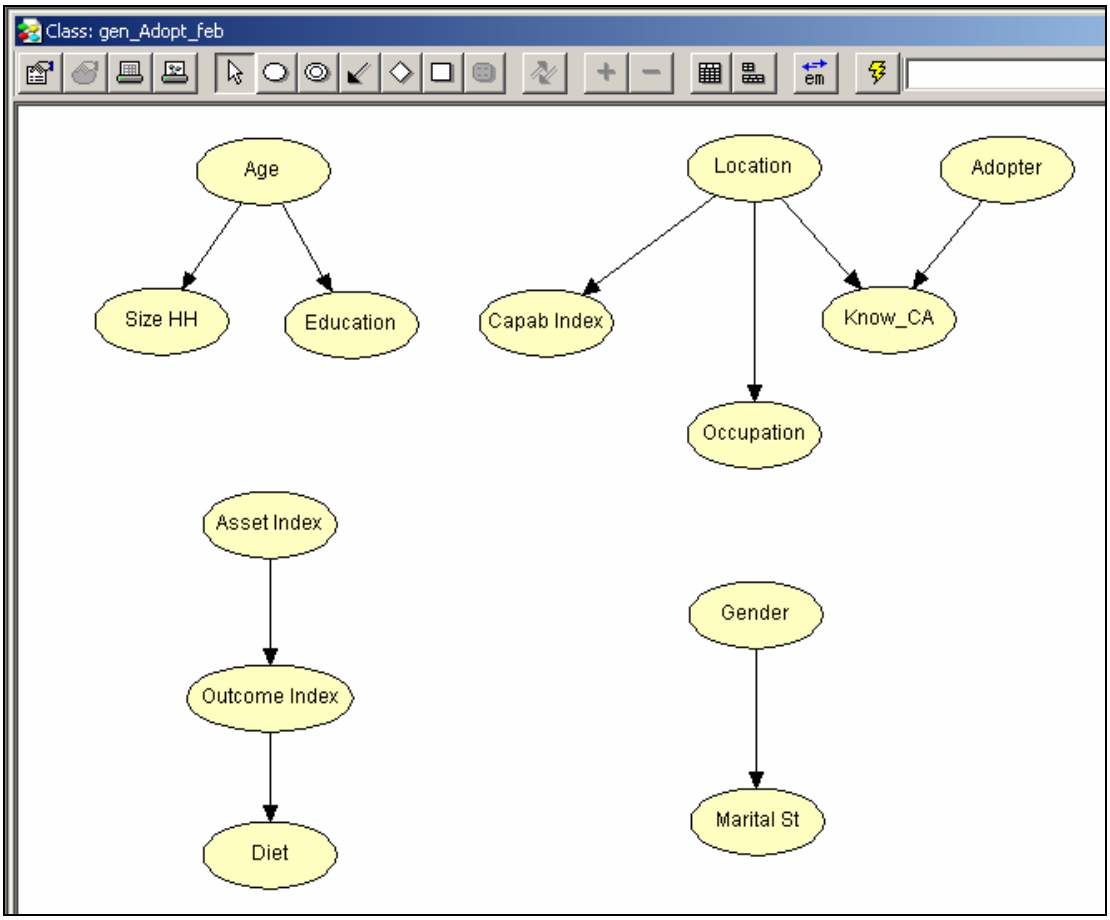


Figure 5.5 and Figure 5.7 show the linkages among the socio-economic variables among the adopters and the non adopters sub-sample, respectively. Both networks present some similarities with the first one.

Figure 5.5Conditional dependence among socio-economic variables, Adopter sub- sample



By entering evidence in the Cluster node in Figure 5.6, if the whole sample was made of adopters living in the lowlands, the vast majority (86%) would say to be unemployed, 10% would have a salary job and only 4% would consider subsistence agriculture as his/her main occupation. In the mountains, 21% of respondents would consider subsistence agriculture as the main occupation, 7% would say salary job, 7% piecework and 62% would say not to have any employment. Notwithstanding the high share of respondents who define themselves unemployed, the share of poor and very poor in the lowlands would be much lower than in the mountains. This may be due to that, being more integrated in the urban economy, respondents in the lowlands do not consider farming and other temporary activities as real occupations. Whereas in the mountains people still rely on farming and the

informal economy as concrete livelihood strategies and they consider them as such. Among the non adopters (Figure 5.7), the structure of dependence among socio-economic variables is different. In particular, the location does not influence any other variable a part from the level of knowledge about CA (Figure 5.8).

Figure 5.6 Conditional dependence among socio-economic variables, Adopter sub- sample. Evidence in the *Cluster* node

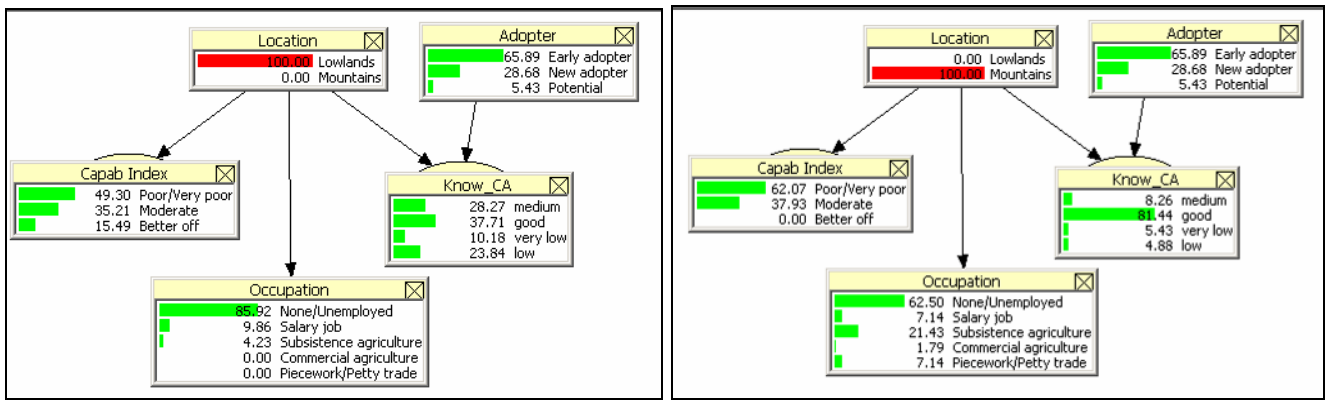


Figure 5.7 Conditional dependence among socio-economic variables, Non adopter sub- sample

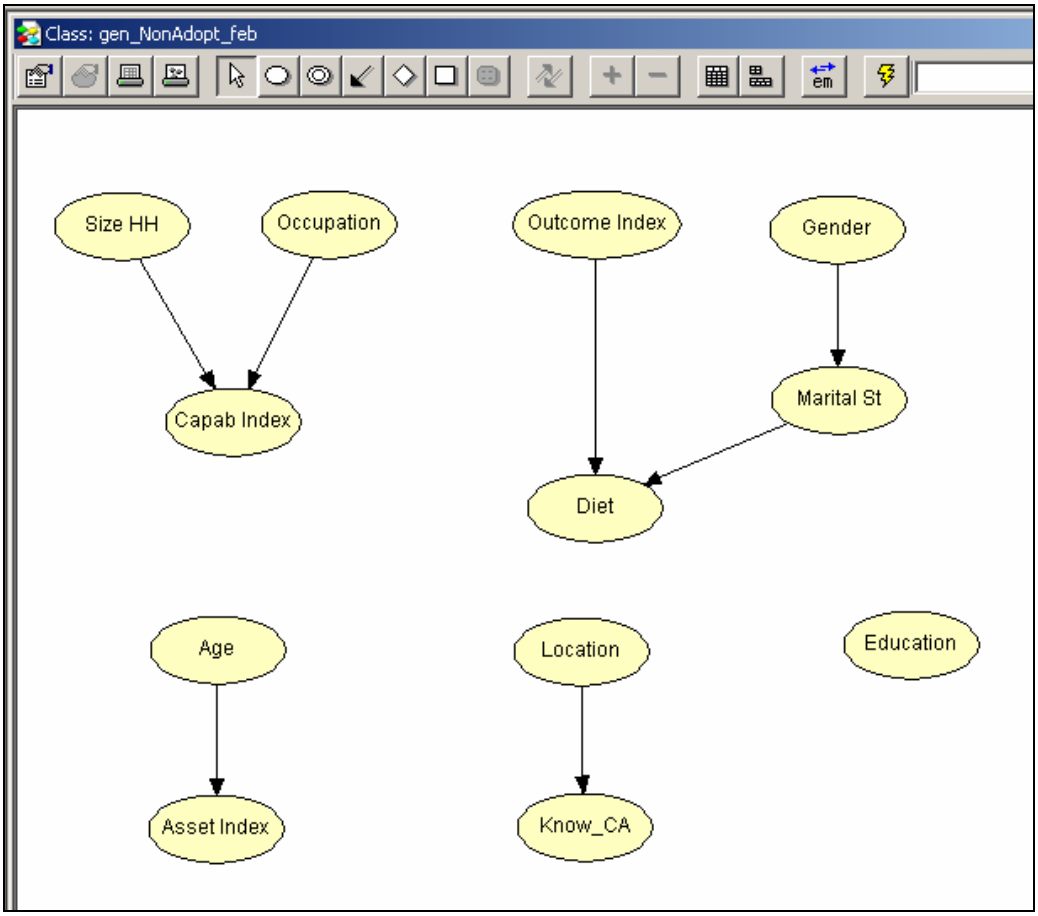
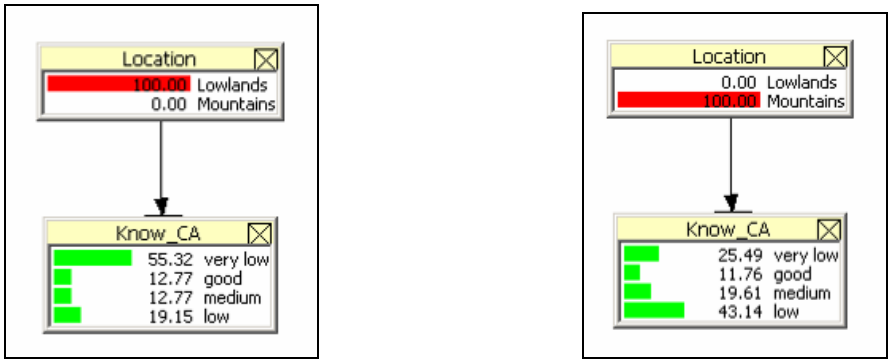


Figure 5.8 Conditional dependence among socio-economic variables, Non adopter sub- sample. Evidence in the *Cluster* node



The second group of variables taken into account include those related to farming (Table 5.14), which have been analysed along with Clust, Education, Asset Index, Capab Index, Outcome Index, and Gender.

Figure 5.9 shows the relationships among socio-economic and farming related variables for the whole sample. The effect of Subsides and Training on Adopter and Know CA is consistent with the expectations, so are the linkages among Know CA and the practices of Crop Rot, Graze Out, Crop Resid and Intercrop. None of the socio-economic variable, nor the ownership of Marginal Fields, are linked to any agriculture related aspect, suggesting that they do not play a critical role in the adoption and the diffusion of the practice.

Entering the evidence in the TrainCA and the Subsides nodes separately, it results that the combination of training and incentives has a stronger effect on the adoption than training alone (Figure 5.10), whose effect is more relevant to the degree of knowledge. However, the degree of knowledge changes substantially depending on the location. Entering the evidence in the Adopter node in order to simulate that the whole sample is made of early adopters, and then entering the evidence in the Clust node, the share of farmers who have a Good knowledge of the conservation practice would be 77% in the mountains and only 53% in the lowlands. In turn, a higher share of CA farmers in the mountains would adopt correct conservation farming practices compared to CA farmers in the lowlands (Figure 5.11). The practice of intercropping, however, is employed by 23% of farmers in both sites, and seems not to be affected by none of the variables mentioned above.

Figure 5.9 Conditional dependence among farming related variables, whole sample

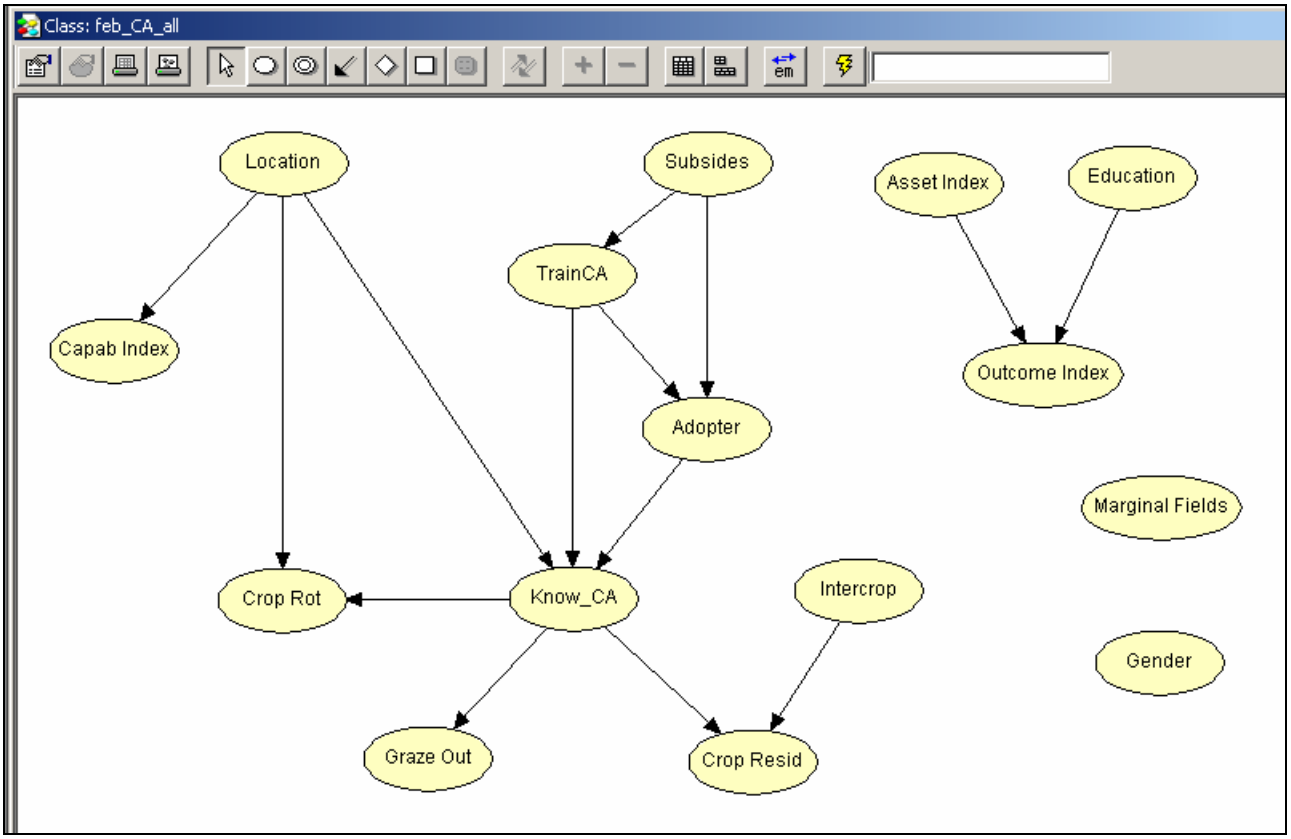


Figure 5.10 Conditional dependence among farming related variables, whole sample. Evidence in the *Training* and *Subsides* nodes

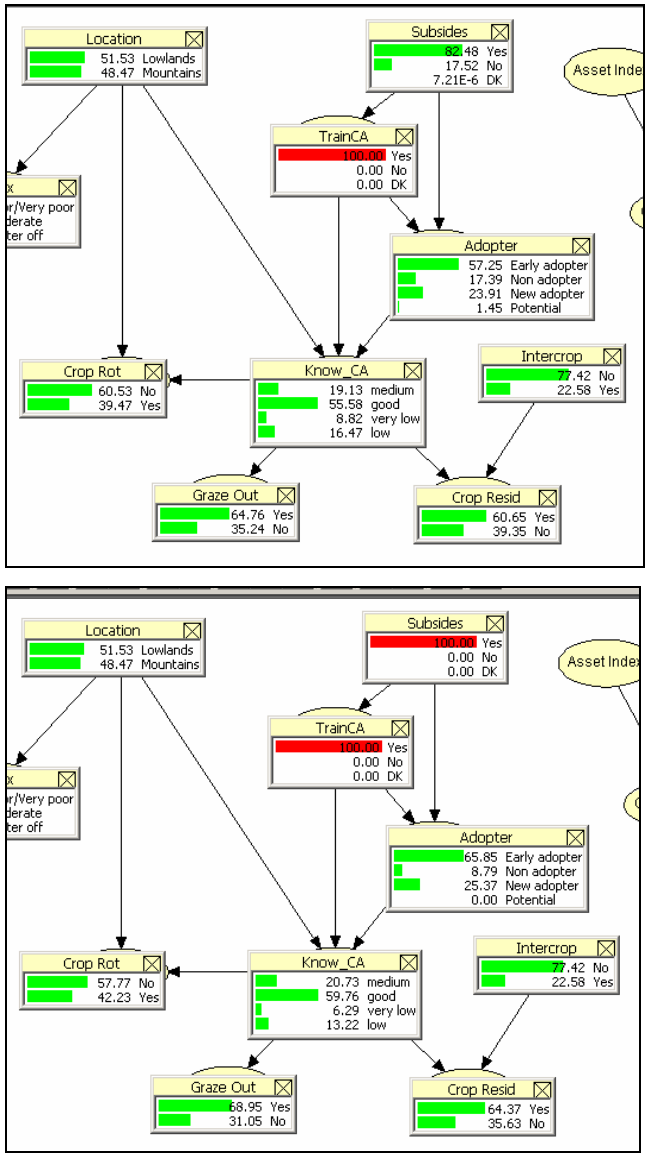
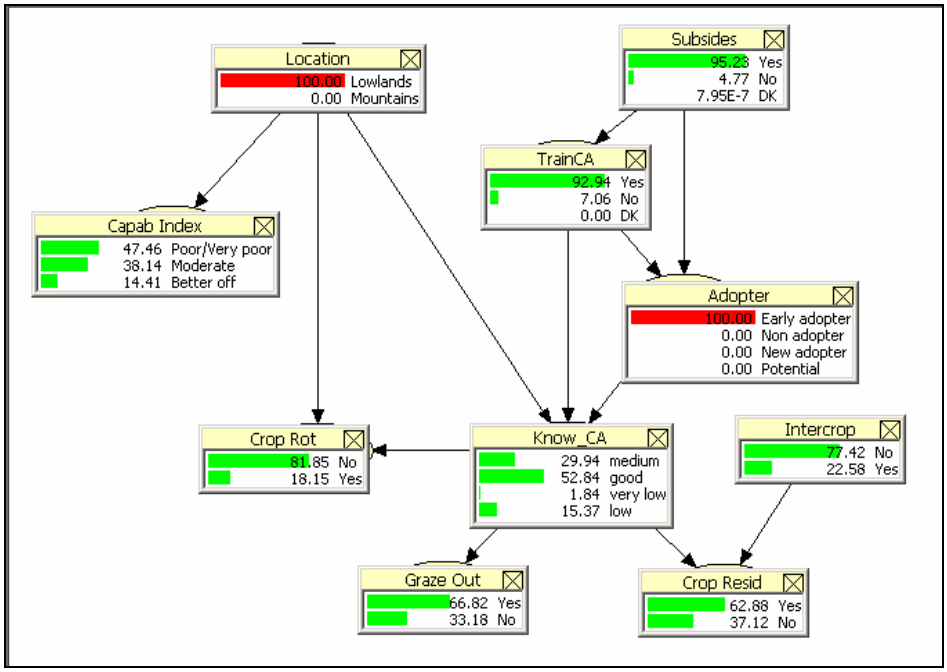
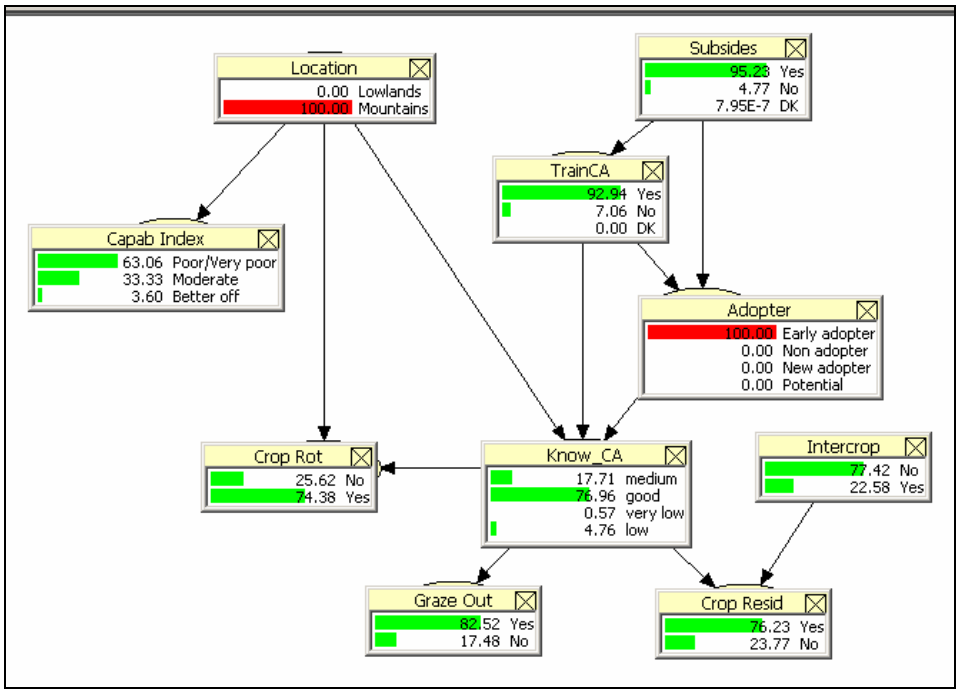


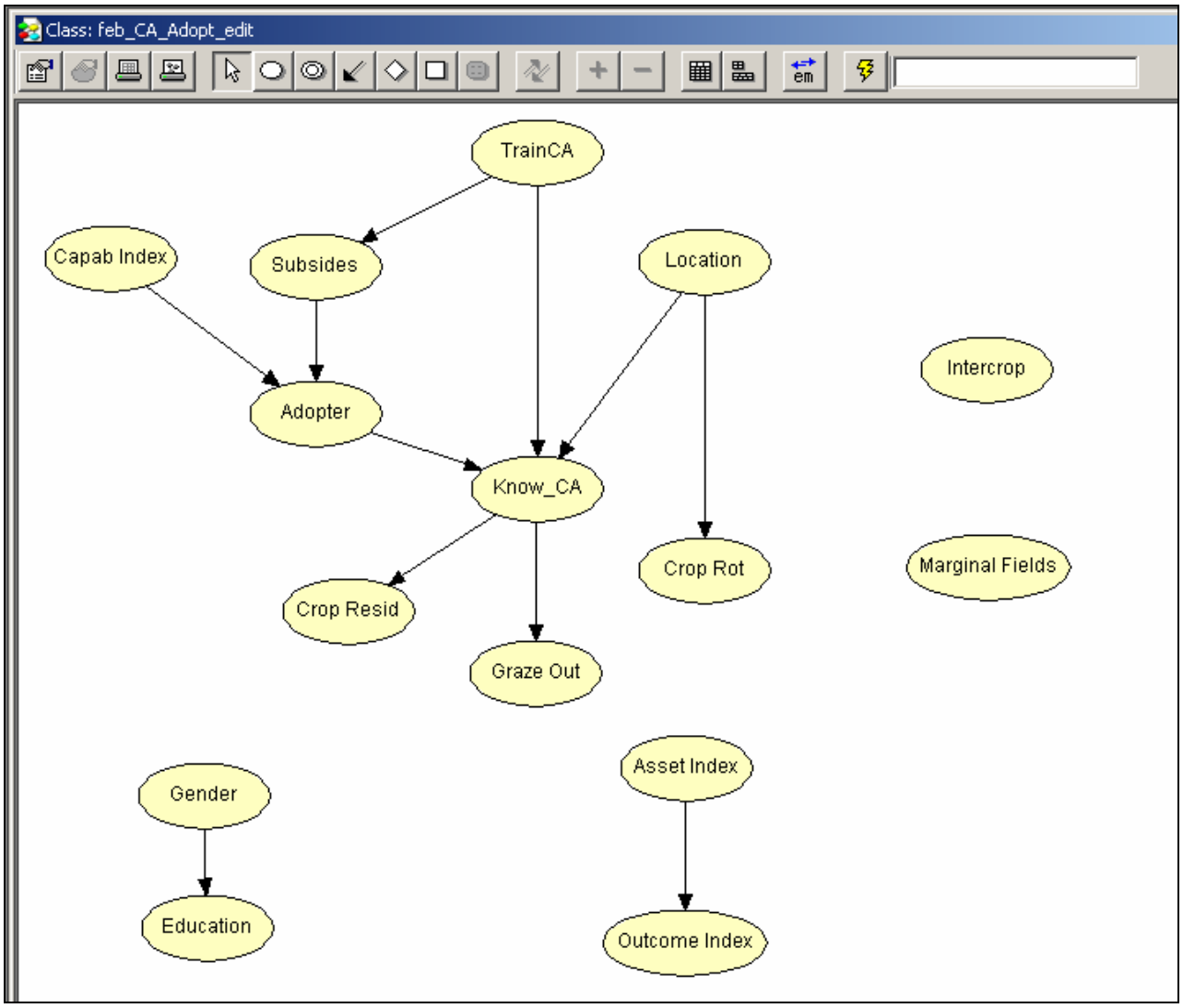
Figure 5.11 Conditional dependence among farming related variables, whole sample. Evidence in the *Cluster* and *Adopter* nodes





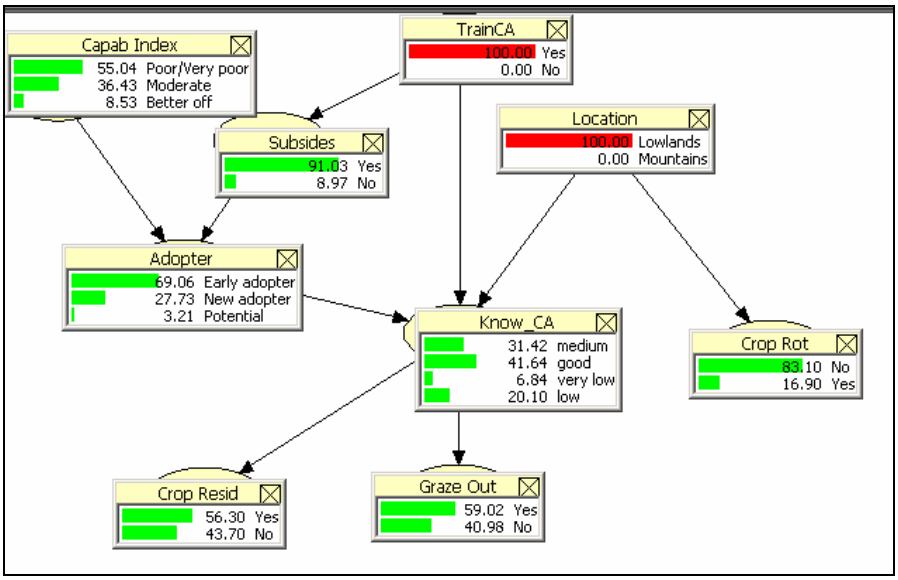
The Bayesian network learnt from the Adopter sub-dataset, confirms most of the results discussed previously (Figure 5.12).

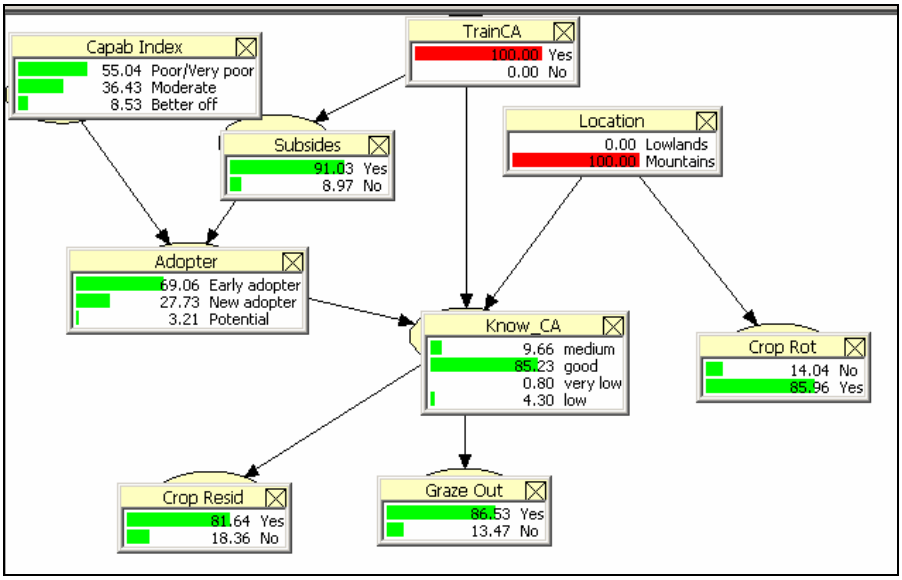
Figure 5.12 Conditional dependence among farming related variables, Adopter sub-sample



By entering the evidence in the Clust node (Figure 5.13), the effect of training on knowledge and, in turn, the effect of the location and the knowledge on the employment of conservation measures, are weaker in the lowlands than in the mountains. The variable Intercropping is excluded from the network, confirming that this practice plays a marginal role also among the adopters (and suggesting that farmers might deem it not suitable to the local agricultural practice).

Figure 5.13 Conditional dependence among farming related variables, Adopter sub-sample. Evidence in the *Cluster* and *Training* nodes





Looking at the socio-economic variables, the ownership of marginal fields, the endowment with assets and the gender of the head of the household do not affect neither the adoption nor the performance of CA. However, the educational level and the gender of the CA farmers are interrelated (Figure 5.14), confirming that better educated women are more likely to adopt the conservation technology, as shown also by the tests performed on the frequencies in Chapter Four.

Figure 5.14 Conditional dependence among farming related variables, Adopter sub-sample. Evidence in the *Gender* node

The Bayesian network learnt from the Non adopter sub-dataset reflects most of the expectations (Figure 5.15). It is interesting to notice that the degree of knowledge of CA affect the adoption of conservation practices also amongst the conventional farmers. In fact, by entering evidence in the Know CA node (Figure 5.16), if all conventional farmers had a Good degree of knowledge, a high share of them would apply some of the conservation principles.

Figure 5.15 Conditional dependence among farming related variables, Non adopter sub-sample

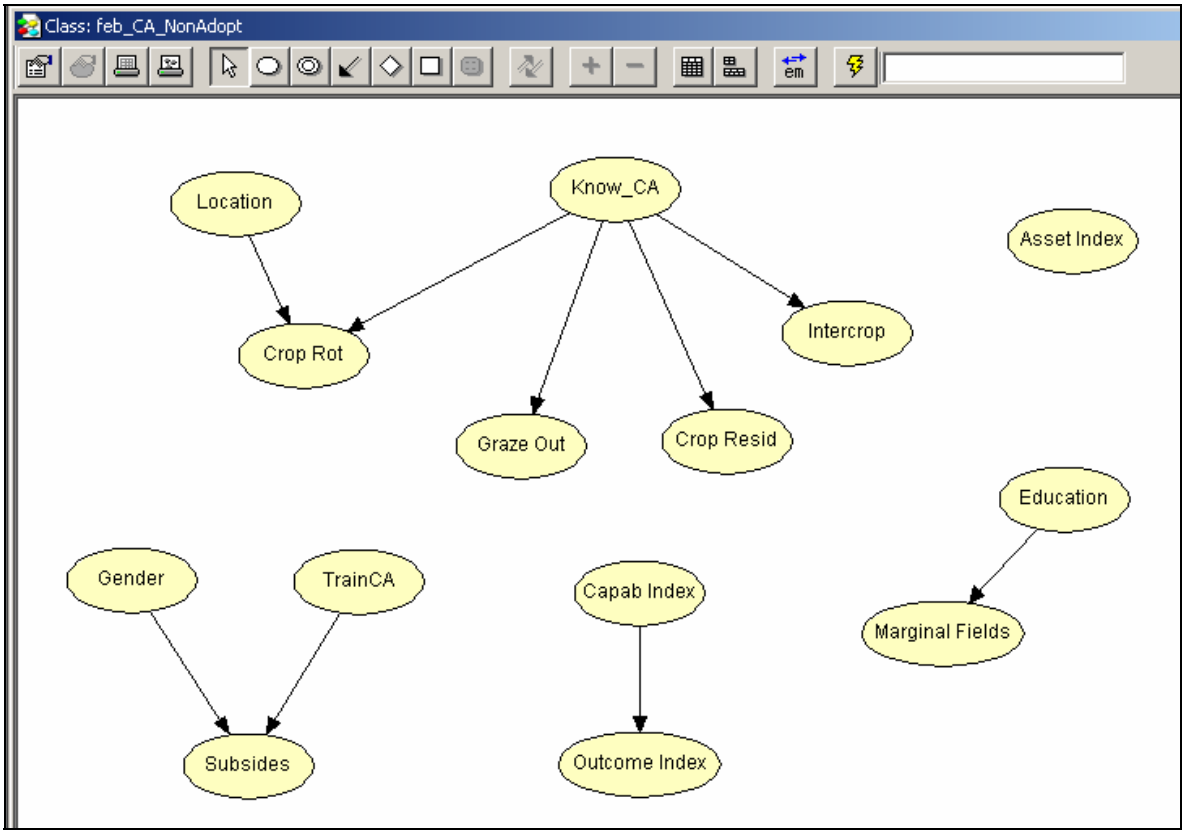
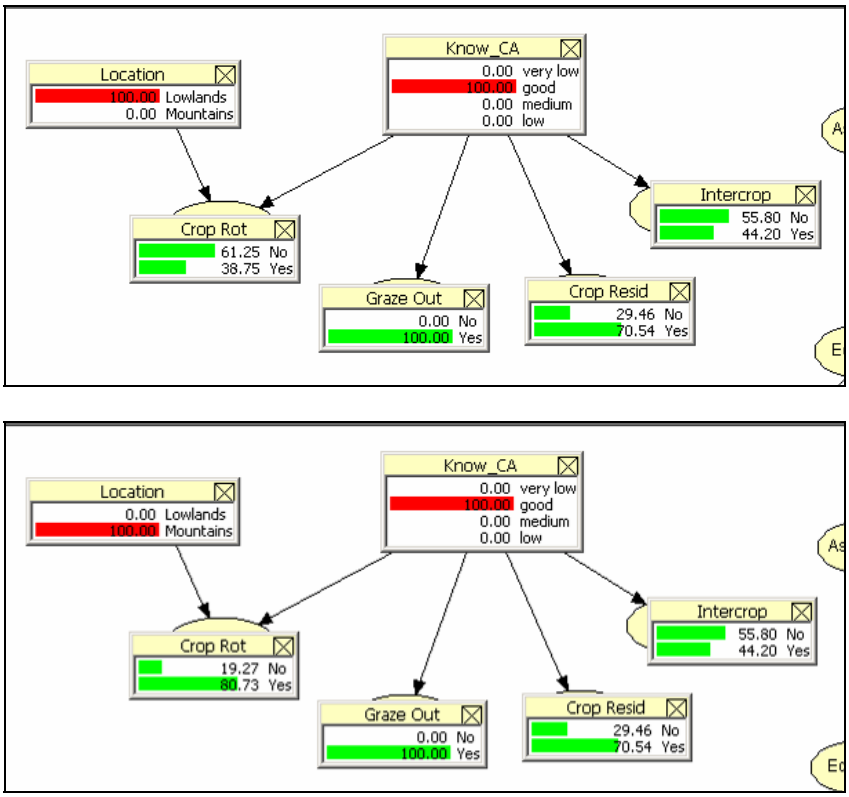
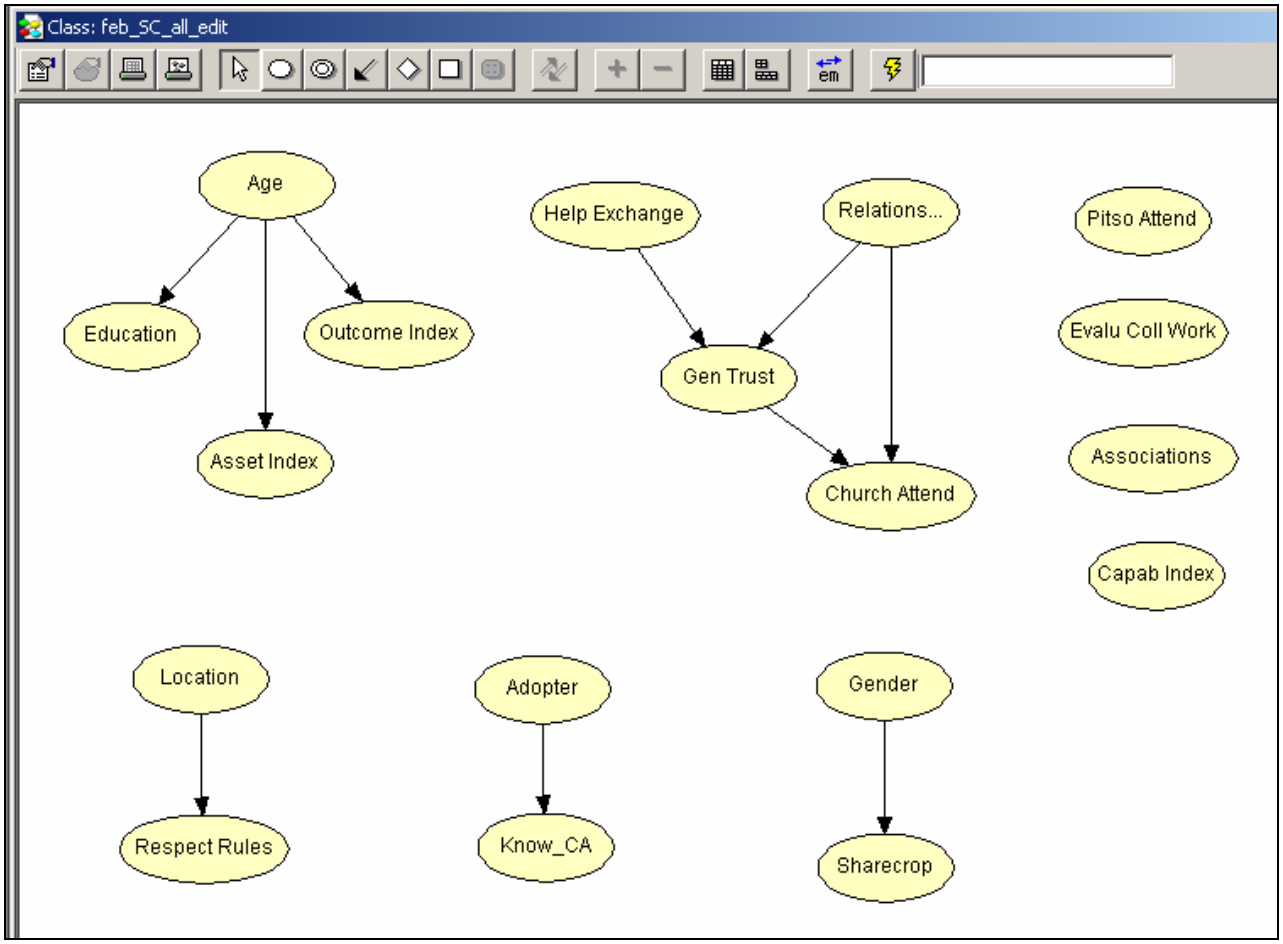


Figure 5.16 Conditional dependence among farming related variables, Non adopter sub-sample. Evidence in the *Cluster* and *Know CA* nodes



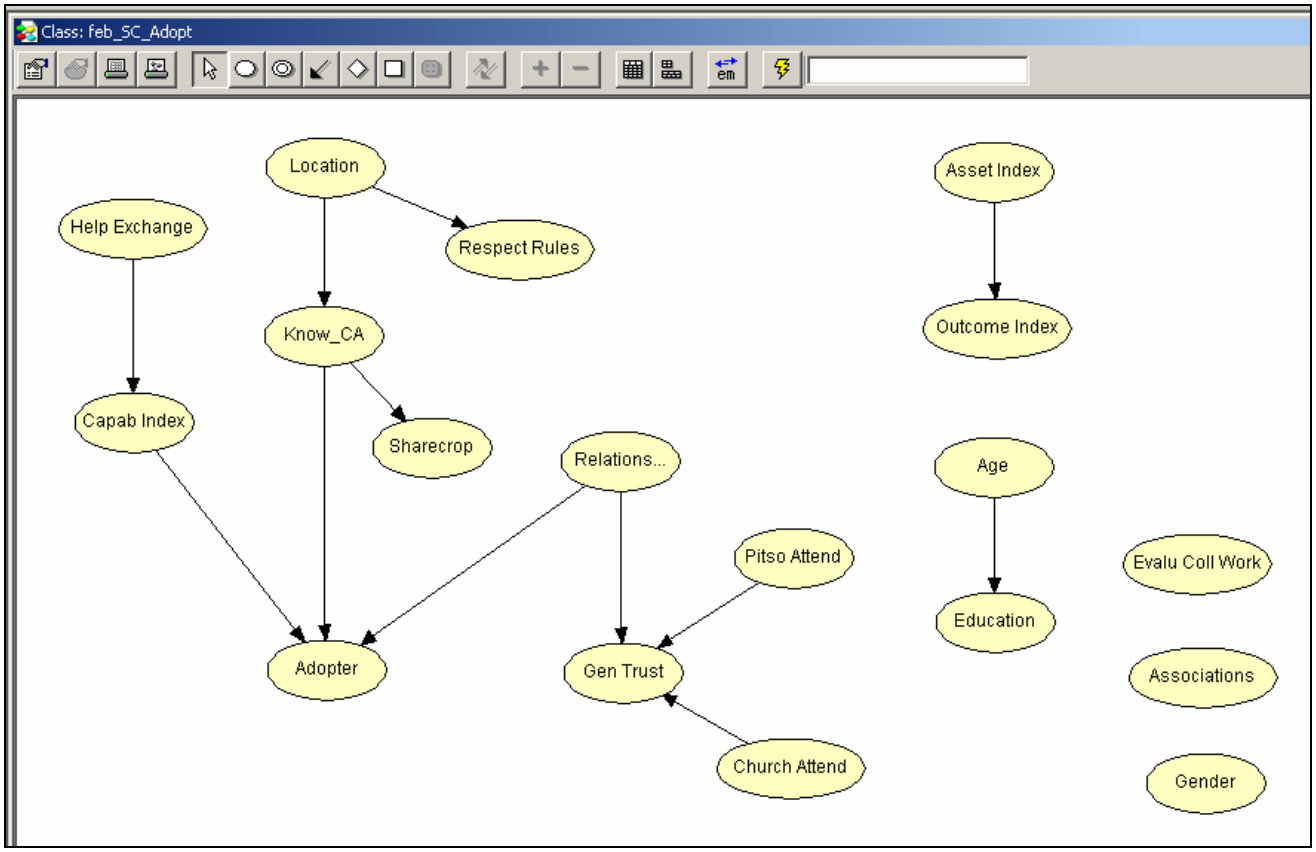
On the basis of the previous findings, the analysis of the relationships among social capital and adoption of CA has taken into account, beyond all variables included in Table 5.15, also the following: Adopter, Know CA, Clust, Asset Index, Capab Index, Outcome Index, Age, Education, and Gender. Figure 5.17 shows the Bayesian network learnt from the whole dataset. In this network, the different dimensions (groups of variables) remain mostly unrelated. However, the structures learnt from the Adopter and the Non adopter sub-dataset, are different from the first one and provide many interesting insights.

Figure 5.17 Conditional dependence among social capital and adoption related variables, whole sample



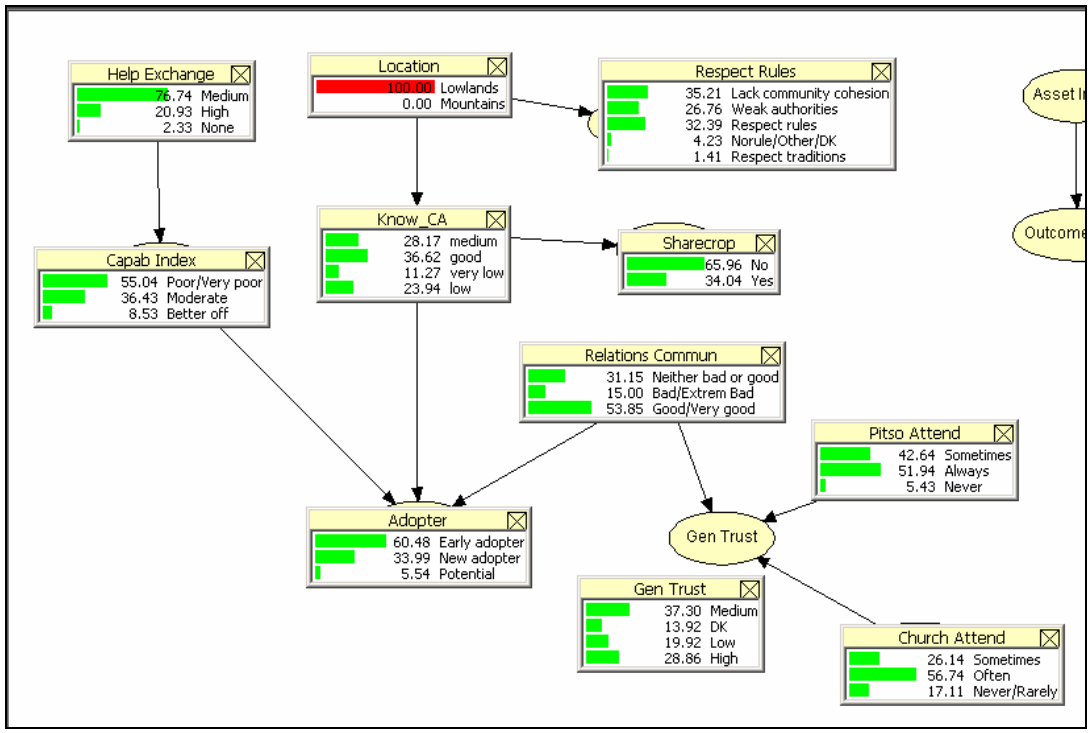
Among the adopters (Figure 5.18), the quality of the relationships in the community, the level of trust, the attendance to church gatherings and to the Pitso are all interrelated and, through the node Relations Commun, affect the Adopter variable. Adopter is also influenced indirectly by the rate of help exchange. These findings support the hypothesis that both the dimensions of social capital identified in Chapter Four are relevant to the adoption of CA, even tough the frequency analysis would suggest that the importance of the "network dimension" is greater for the CA farmers in the lowlands than the importance of the "trust dimension" for the CA farmers in the mountains.

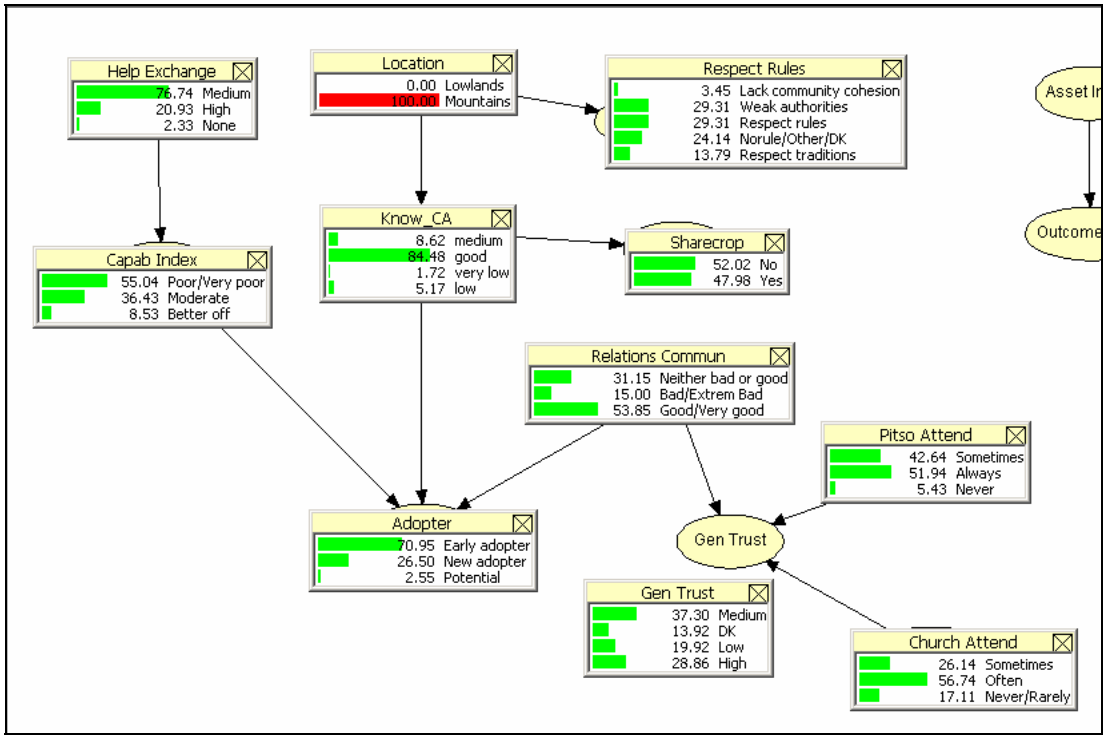
Figure 5.18 Conditional dependence among social capital and adoption related variables, Adopter sub-sample



The location influences the respect of the rules on livestock grazing and, through the degree of knowledge, the occurrence of sharecropping agreements. By entering the evidence in the Clust node (Figure 5.19), the propagation of the effects confirms the result that a high share of CA farmers in the lowlands lament scarce community cohesion as the main reason for breaking the rules, whereas in the mountains this share is very small. Furthermore, as already mentioned, the CA adopters in the mountains show a better knowledge of the technology and a higher propensity to conclude sharecropping agreements, and these two features are interrelated. Finally, it is worthy to notice that the variables Associations and Evalu Collective Work are excluded by the network, and also that, a part from the Capability Index, the other socio-economic variables are not linked to any social capital or agriculture related variable.

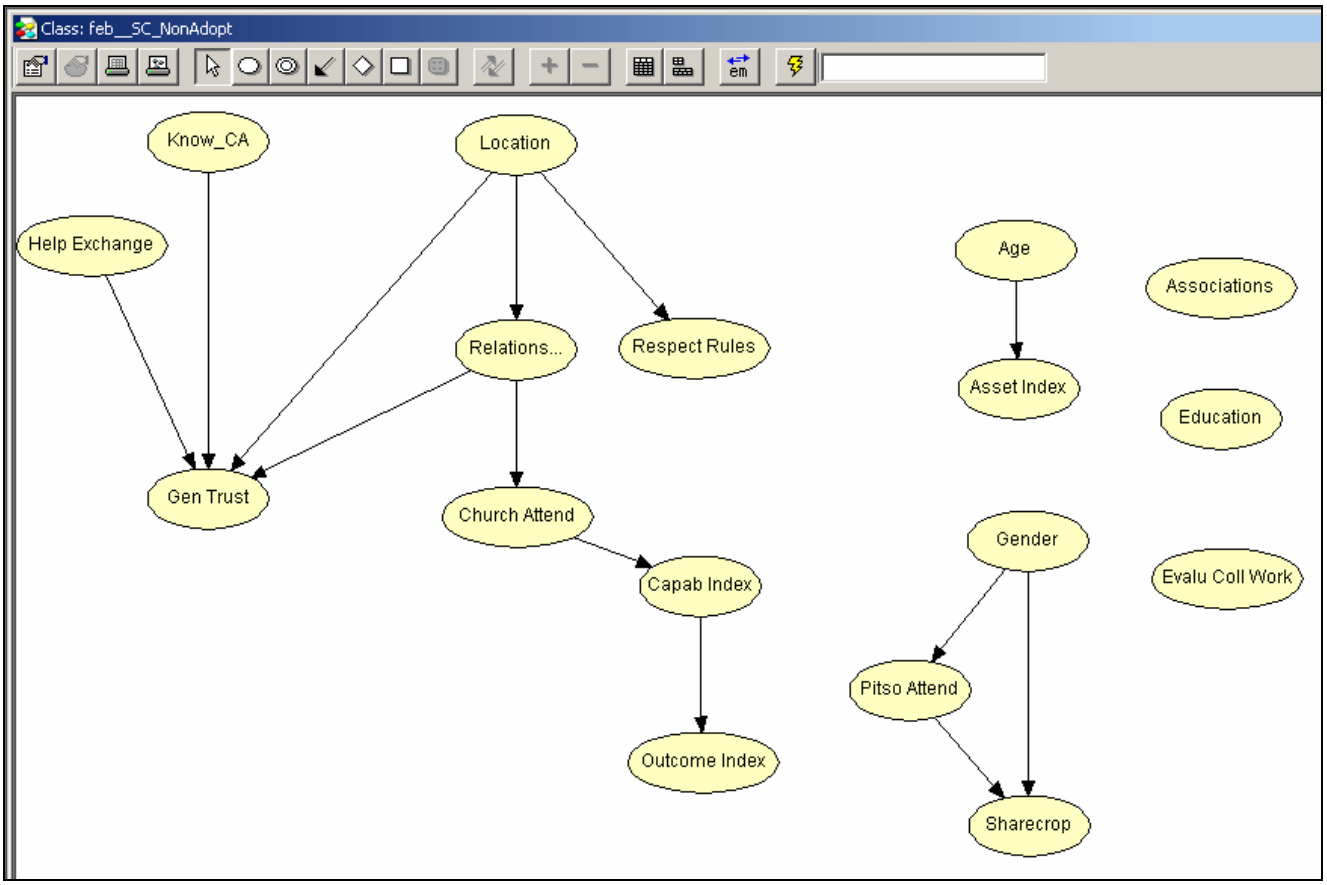
Figure 5.19 Conditional dependence among social capital and adoption related variables, Adopter sub-sample. Evidence in the *Cluster* node





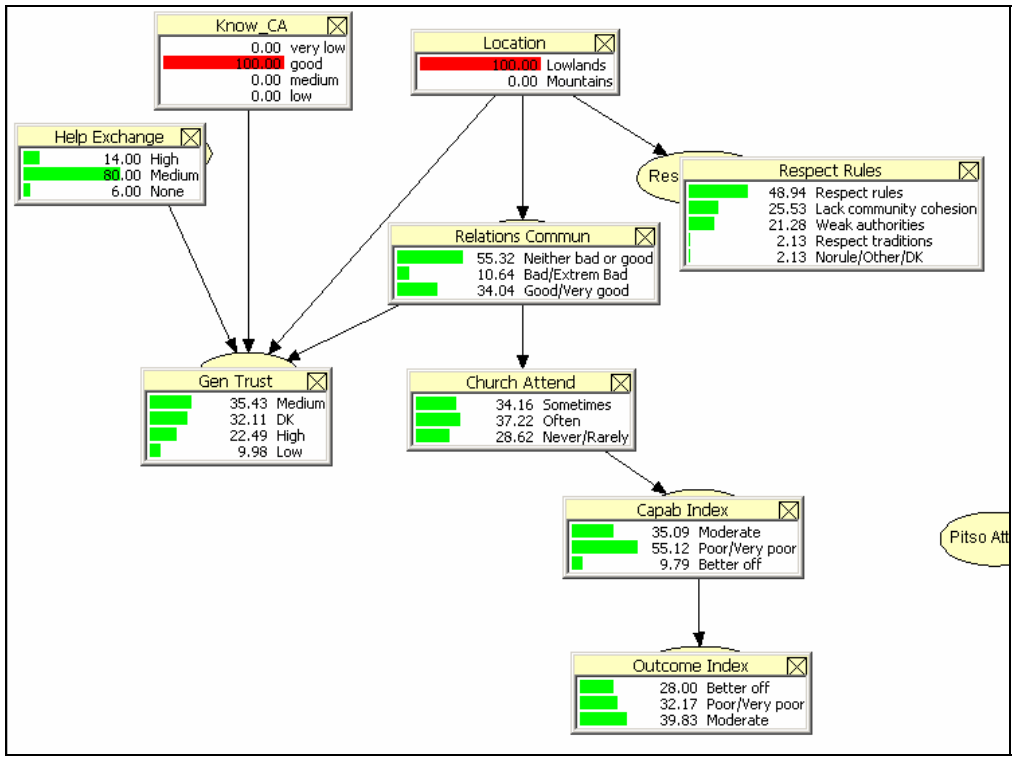
Also the Non adopter network (Figure 5.20) has a more complex structure than the network learnt from the whole dataset. The rate of help exchange, the level of trust, the quality of the relationships and the attendance to Church gathering are all directly or indirectly interrelated. Also among the non adopters, the location influences the level of trust and community cohesion, which are higher in the mountains.

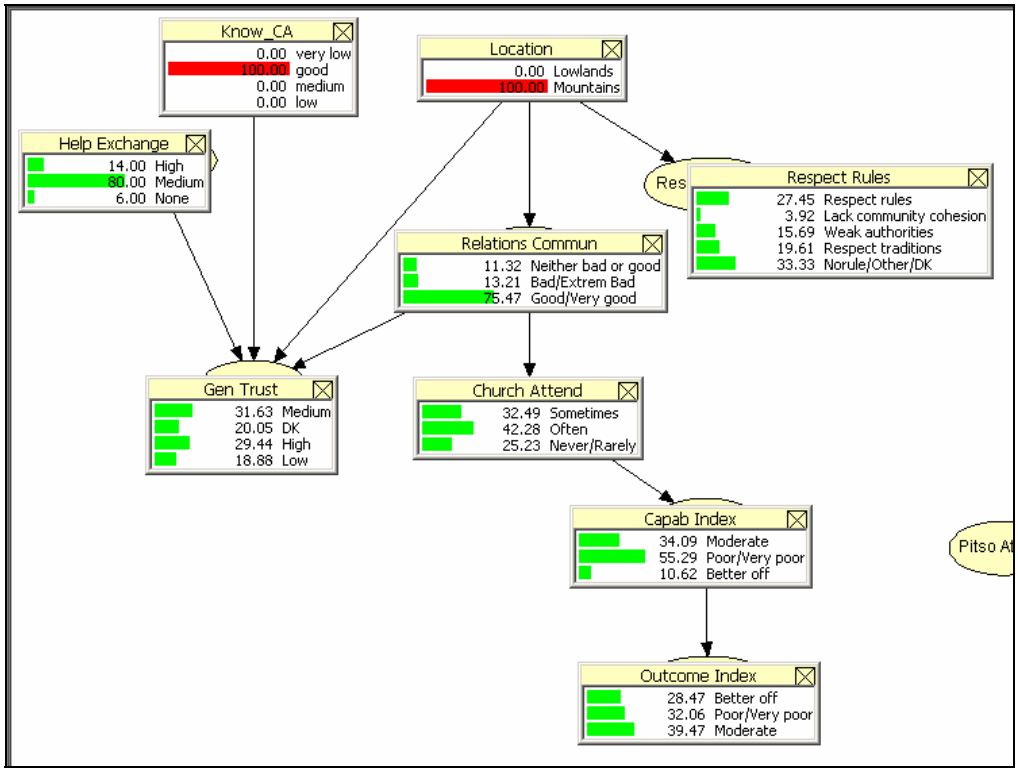
Figure 5.20 Conditional dependence among social capital and adoption related variables, Non adopter sub-sample



It is worthy to highlight that the level of generalized trust and the degree of knowledge of CA principles are dependent. In particular, by entering the evidence in the Know CA node (Figure 5.21), it results that if all the conventional farmers had a Good knowledge of CA, the share of them having a high level of trust would augment. Even if the knowledge of CA and the level of trust result positively correlated, it is not possible to infer the direction of causality from the Bayesian structural learning, thus it is not clear if trustful people have a positive attitude towards the assimilation of the CA principles, or if the spread of the knowledge about conservation farming enhance the level of trust among people, or both.

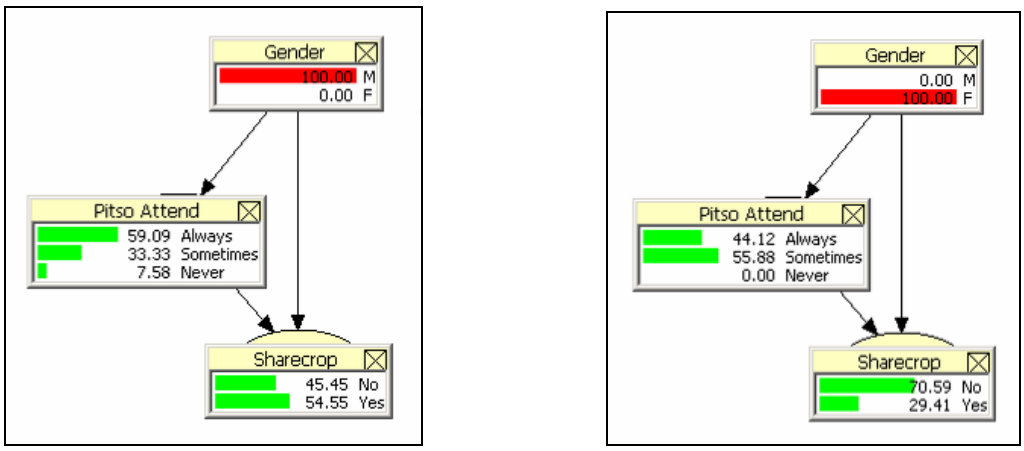
Figure 5.21 Conditional dependence among social capital and adoption related variables, Non adopter sub-sample. Evidence in the *Cluster* and *Know CA* nodes





Differently from the previous network, the variable Gender is linked to two social capital variables: Pitso Attend and Sharecrop. By entering evidence in the Gender node(Figure 5.22), it results that among conventional farmers, female heads of the household (who are significantly less educated than women in the CA sub-sample) are excluded from sharecropping agreements, suggesting a higher economic and social marginalization. Finally, as in the previous network, the variables Associations and Evalu Collective Work remain on their own, confirming their irrelevance to the adoption of the technology, but also the independence with the other social capital variables.

Figure 5.22 Conditional dependence among social capital and adoption related variables, Non adopter sub-sample. Evidence in the *Gender* node



5.4 Concluding Remarks

Chapter Four and Five have provided wide evidence of the scope for adopting conservation farming practices in Lesotho. Chapter Four has discussed the economic costs and benefits associated to the adoption of the technology, focusing in particular on efficiency and returns to labour, as well as the social and the environmental sustainability. This chapter has focused on the relationships among different aspects of social capital and the adoption of the conservation technology. Furthermore, the performance of a preliminary empirical analysis of the relationships among the socio-economic variables, has confirmed and integrated some of the findings discussed in the previous chapter.

According to the analysis of the variables of social capital, supported by the structural learning of Bayesian networks, CA farmers are more endowed with social assets compared to conventional farmers. In particular, a "network dimension" characterizes the CA farmers in the lowlands, while a "trust dimension" is stronger among respondents in the mountains. The distinction reflects the diverse

impacts that recent socio-economic transformation are having in the two areas, as they were described also by local knowledgeable informants. However, the Bayesian network learnt from the social capital variables, shows that the two dimensions of social capital are interrelated, and that both are linked to the variable *Adopter*. On a mathematical basis, it is not possible to give a conclusive interpretation of the causality of the linkages present in a Bayesian network. Therefore, in theory, the probability that social capital affects the adoption of the technology is equal to the probability that the adoption affects the quality of social capital. However, on a logical basis, it is possible to conclude that a higher endowment with social assets, as in the case of CA farmers, fosters the adoption of innovation. Furthermore, this result is consistent with the most recent literature on agricultural innovation, and in particular with the AIS approach (extensively discussed in Chapter Two), as well as with the conclusions of Chapter Three on the relevance of social capital to the adoption of CA in Africa. At the same time, it is not possible to exclude the presence of backward linkages, and this is actually one of the reasons for preferring graphical models to econometric analysis. In reality, in fact, it is likely that the diffusion of CA has in turn facilitated adopters' access to those social assets which had previously fostered the adoption of the practice.

In the network learnt from the Adopter sub-dataset, the location influences directly the reason for breaking the rules on livestock grazing and, through the variable Know CA, the occurrence of sharecropping agreements. This result confirm that the correct adoption of CA may be hampered by social and cultural factors, such as the scarce community cohesion in the lowlands – an issue stressed also by local CA trainers – and (even though to a minor extent) the relevance of traditional rules in the mountains. The possibility of concluding sharecropping agreements, which is at the same time a proxy of trust and participation into social networks, is related to a good level of knowledge and, subsequently, to the correct application of the CA principles. As it has been mentioned, in fact, aspects of trust and reciprocity may help the effective adoption of CA in a number of ways: by fostering the share of productive assets, including labour, by facilitating the respect of rules on the access into harvested fields, by improving the community acceptance of innovative tillage methods, by promoting a collective perception of the social and the environmental benefits associated to the use of CA, among other issues.

It is worthy to notice that – as resulting by the Bayesian networks learnt from the socio-economic as well as the farming related variables – the knowledge on CA is strongly correlated to the attainment of training, and the effect of training on the degree of knowledge is stronger in the

mountains than in the lowlands. That is, adopters in the mountains have a better knowledge of the CA principles and apply them more correctly than adopters in the lowlands do. Even though the variable *Training*, *per se*, does not provide any information about the quality of the training received, from the qualitative information collected under the survey, and in particular drawing on the results of the workshops held with the CA trainers, it results that the CA trainers in Qacha's Nek (the mountain district) use to interact with the trainees more frequently than CA trainers in Butha Buthe and Leribe (in the lowlands). In addition, the formers use to organize field visits and gatherings to discuss problems and issues, and they also encourage farmers to work collectively. At the opposite, in the lowlands trainers complain that they can not rely on farmers cooperation in spite of their efforts to foster it. The positive impact of the commitment of CA trainers in Qacha's Nek confirms the critical role that a proper combination of social capital and capable agency play in the achievement of local development objectives, as highlighted by the recent literature.

The degree of knowledge of CA principles and social capital, in the form of generalized trust, are positively correlated also in the Bayesian network learnt from the Non adopters sub-dataset. Also in this case, the effect of the degree of knowledge on the level of trust is stronger in the mountains than in the lowlands. As already mentioned, it is not possible to infer conclusively the direction of causality, thus it is not clear if trustful people have a positive attitude towards the assimilation of the CA principles, or if the spread of the knowledge about conservation farming enhance the level of trust among people, or both. However, considering what has been said on the differences which characterize the diffusion of *likoti* in diverse locations, it is possible to hypothesize that the higher level of trust among respondents in the mountains, along with the participatory approach used by CA trainers, have facilitated a positive attitude towards the innovation also among the non adopters.

The results on the role that social capital aspects have on the adoption and the performance of *likoti* in Lesotho, along with the findings on other relevant socio-economic and environmental factors, are discussed more extensively in the next chapter. The relative importance of each factor is identified in order to delineate the main policy implications, and define the extent to which these can be generalized and extended to other countries.

Chapter 6 Key Findings and Policy Implications

This work has sought to assess if – and how – social capital is relevant to the adoption of conservation agriculture (CA), with a special focus on African small-scale farmers. The present chapter recaps the discussion presented in the first three chapters, highlighting the aspects of social capital which mostly count for the effective adoption of CA as an innovative approach to reduce poverty and vulnerability is SSA. Subsequently, it discusses the results of Chapter Four and Chapter Five, in order to

- describe the relative importance of the factors which revealed to be determinant to the adoption of conservation farming in Lesotho, including social capital,
- compare these results with the existing literature and, on this basis,
- derive consistent policy implications for the successful diffusion of innovative conservation practices in SSA.

In this work social capital (SC) has been defined as: the social relations within a group and among this and other groups, and the features and the norms that characterise these relations, which enable the individuals and/or the groups (through collective action) to reach desirable outcomes. This definition equates social capital to all types of social interactions that can be established within a group or a community (networks, formal and informal associations, kinship and friendship ties,…) – or bonding social capital – and among different groups or communities (such as associations among members of different ethnic or religious groups, networks of associations,…) – or bridging social capital. Secondly, it includes the attributes (such as behavioural norms, shared moral values, personalized and generalized trust, …) as well as the informal and formal agreements through which these relationships work. Institutions, such as government and governance attributes, as well as traditional and customary rules, are not included in the definition because they can be considered at the same time a source and a manifestation – but not a component – of social capital. However, due to the critical role they play in the process of social capital (re)generation, they are closely related to the concept.

The above definition has a functional connotation. In fact, among all the social interactions and the related attributes on which a group relies, only those which foster the achievement of valuable outcomes for the group and/or the group members count as 'capital', no matter what the original purpose of the social interaction was. This definition implies a multi-dimensional and dynamic nature of social capital, which takes different forms depending time by time on the scope of the analysis and the unit of observation. Furthermore, the functional notion of social capital, conceived as an appropriable resource, is compatible with a definition of capital seen as the output of a dynamic, regenerative process. That is, social capital can well be assimilated to other forms of capital and, as such, it has a potential to foster development processes both at micro and macro level.

Indeed, beyond having an intrinsic social and cultural value, social interactions (along with their attributes) may positively contribute to the welfare of given groups and individuals also by generating one or more of the following externalities: enhanced knowledge about other agents; reduced transaction costs; risk mitigation; improved access to information and technological knowledge; and reduction of collective action dilemmas. The channels by which these externalities, and the relative outcomes, manifest themselves are mainly information sharing, group identity, and explicit coordination. Explicit coordination, or purposeful collective action, in turn requires either capable agents or clear rules on decision making, or a combination of the two, in order to become effective.

So far, empirical studies focusing on specific development issues at micro-level have been more successful than aggregate studies in explaining the relationships between social capital and development. The most recurrent fields of application identified by the literature on less developed countries are: common pool resources, diffusion of innovations, imperfect information, markets for insurance, and effectiveness of public services.

With regard to agricultural innovation, from the analytical review of the literature, it emerges that until recently, social capital, as it has been defined in this work, was not considered a determinant or even a component of the innovation process. Starting from the Nineties, the *Social Organization of Innovation* approach has recognized a more concrete, active role of social interactions in innovation generation and diffusion. By taking especially into account the issues of power and equity which stem from the different degree of access to knowledge by different actors, this branch of literature has addressed more deeply the relationships between social capital and agricultural innovation than the *Farmers First* approach did. Subsequently, the attention to social interactions and norms has further

widened to include a number of social dimensions, many of which represent different aspects of social capital.

The recognition of the relevance of social and cultural aspects has gone together with the acknowledgement that innovation might be a conflict process, so that different actors are needed in order to 'get the opportunities right'. At the end of the Nineties, these ideas have leaded some scholars to borrow the concept of 'national system of innovation' from the Industrial Economics, in order to apply it to agricultural innovation. An *agricultural innovation system* (AIS) is comprised of the networks of agents involved in the innovation process (organizations, enterprises, and individuals), their actions and interactions, and the formal and informal institutions that regulate this system (Ekboir and Parellada, 2002). The AIS approach focuses on the process rather than the product, and on capacity strengthening rather than technology delivery. Therefore, compared to the previous literature on agricultural innovation, it attributes a higher importance to social and institutional factors both as determinants and products of the social learning process that leads to innovation.

Social capital, due to the role it plays in managing conflicts and promoting cooperative behaviours, is thus recognized as a critical determinant of the innovation process. Especially in unfavourable environments, successful innovation for poverty reduction depends on building local institutions, networks and organizations that help communities mobilize their scarce resources, and link them to external networks. In particular, the presence of bridging social capital, along with institutions that facilitate the shift from bonding to bridging social capital, are important in order to allow the poorest to participate in all the phases of generation, diffusion and adaptation of innovation.

The recent spread of conservation agriculture (CA) in many African countries can be considered as an innovative approach to combat land degradation and sustain rural livelihoods. The potential benefits associated with the use of conservation practices are many. Among the most important are: long-term yield increase and output stability; reduced wind and water erosion and reduced land degradation; improvement of agro-biodiversity; and reduced contamination of soil, water sources and the atmosphere. The increase in yields is often accompanied by a decrease of the costs, leading to higher net profitability, greater social sustainability and (especially important in Sub-Saharan countries) higher food security, compared to conventional farming methods. Furthermore, conservation techniques which rationalize the use of labour, are particularly helpful in those rural areas where

migration and health emergencies have reduced the labour supply and leaded to an increasing "feminization" of the agricultural sector.

The review of the recent empirical literature has identified a number of factors which determine the effective adoption of conservation practices and the achievement of the associated benefits. The most important are:

- literacy and education
- adequate training, effective support from extension services, and organization of field activities
- farmers participation and interaction of formal research and indigenous knowledge
- multiple stakeholder partnerships (including also the private sector), adaptive research and flexible promotion strategies

In addition, a number of cross-cutting issues have also been identified. These are the need for an effective policy support, the relevance of gender oriented activities, and the multiple roles of social capital.

With regard to social capital, two broad – interrelated – aspects have to be considered: the relevance of SC to CA as part of soil and water conservation measures; the role of social capital in the adoption and the performance of CA as an innovation process. It has been widely demonstrated that social capital improves the effectiveness of SWC practices, including CA, in several ways. It raises awareness on the impacts of soil degradation, improving skills and knowledge through better information flow. It encourages institutional agreements and cooperative behaviours (such as participation and collective action in learning, planning and implementing conservation measures), and supports the link of local groups to wider networks and other institutions. If an incentive scheme is in place, strong civicness, trust and cooperation improve fairness and transparency. However, higher levels of trust and reciprocity, as well as an easier access to labour and credit (for example through labour exchanges, social networks and associations), help farmers to internalize social costs and benefits associated with the implementation of conservation measures, thus reducing the need for external incentives.

By fostering cooperation and collective action, social capital facilitates extension and field activities, and encourages adaptive research by enabling the formation of farmer groups and networks among researchers, extensionists and farmers at different levels. As a means to support institutional

agreements, avoid conflicts and foster community participation, SC may also help to solve the problems related to the use of common pool resources, such as land tenure and grazing rights, which seriously affect the correct adoption of CA in SSA.

On of the most important advantages of conservation practices, is that they can be suited and adapted to all kinds of farming systems, including small-scale subsistence agriculture, and to most agro-ecological conditions. But, just because of its adaptive and dynamic nature, successful application greatly relies upon the skills of the practitioners to combine and adapt tillage methods, input and equipment, according to their own needs and conditions. This is why, in the promotion of conservation farming, it is especially important to strengthen the capacity to innovate rather than just introducing and diffusing the practices. As stressed by the AIS approach, several social capital aspects are extremely relevant to the enablement of farmers' innovation capabilities. Last but not least, social capital fosters a good attitude towards the cultural and institutional changes that – along with conflicts – often accompany technological transformations, and which can be especially problematic in the transition from conventional to conservation tillage methods.

Drawing on the analysis of the data collected under a household survey, Chapters Four and Five have provided wide evidence of the scope for adopting conservation farming practices in Lesotho. In particular, Chapter Four has assessed the socio-economic and the environmental sustainability of the technique employed, while Chapter Five has tested the possible dependences among socio-economic, farming related and social capital variables through the structural learning of Bayesian networks. Compared to conventional tillage practices, the most significant advantages associated to the use of conservation tillage can be summarized as:

- Greater environmental sustainability due to improved soil structure and enhanced fertility
- Higher agricultural productivity, due to improved efficiency in the use of inputs and other resources
- Higher social sustainability, due to the accessibility to the technology by all social categories, including the most vulnerable

Table 6.1 and

Table 6.2 summarize the actual and the potential advantages and disadvantages associated with the use of conservation farming. Costs and benefits have been divided on the basis of their nature

(private/collective and economic/non economic), the temporal horizon, and the dimension (farming, social, environment, etc.).

Table 6.1 Actual and potential benefits associated with the use of CA

	Private/ economic	Private/NOT economic	Collective/NOT economic
Farm management			
Reduced costs for inputs	**S**		
Increase of yields	**S**		
Increase of soil fertility		**M**	
Water harvesting		**S**	
Improved water holding capacity		**M**	
Environment			
Decreased soil erosion		**M/L**	**M/L**
Conservation of soil-based biodiversity		**M/L**	**M/L**
Regulation of CO_2 emission			**M/L**
Social			
Alternative employment opportunity		**S**	**M/L**
Food Security			
Higher availability of food	**S**	**S**	**M**
Improvement of food nutritional values		**M**	**M**
Livelihoods			
Suitability to poor welfare/highly vulnerable status	**S**	**S/M**	

Table 6.2 Actual and potential costs associated with the use of CA

	Private/ economic	Private/NOT economic	Collective/NOT economic
Farm management			
Increased labour requirements	**S**	**S**	
Initial immobilisation of nutrients		**S**	
Success heavily dependent on new management skills		**S**	
Social			
Breakdown of traditional norms on grazing and use of crop residues	**S**		**S**
Need to find alternative sources of fuel and fodder	**S**		**S**
Provision of (public funded) training and technical assistance			**S**
Provision of (public funded) subsidies			**S**
Overcome cultural prejudice		**S**	**S**

Legend: S: short term; M: medium term; L: long term

Source: Adapted from Silici, Pedersen and Mapeshoane (2007)

The identification of the features characterizing the adopters of the most spread conservation farming practice, locally called *likoti*, leaded to results which are very much consistent with those from the literature review. The factors that so far have mostly determined the adoption of CA in Lesotho are:

Literacy

CA farmers are more educated than conventional farmers. In particular, female adopters, who are the less endowed with economic assets and other resources, are significantly more educated (even though at low levels of education) than the other categories, and especially compared to female conventional farmers. Thus, human capital has revealed to be important, especially in presence of limited access to other resources, as it is the case for many Basotho women.

Suitability of the technology to different farming systems

Initial lack of assets and income, as well as the socio-demographic features of the farmers and their households, do not affect the possibility to adopt the technology. It is worthy to underline that the great majority of the respondents received some forms of incentive – either inputs or food – in order to start practicing CA, but this support, a part few cases, stopped after the first season. The fact that most of the farmers continued to apply the technology would confirm its sustainability.

Social capital

CA farmers are more endowed with social assets compared to conventional farmers. In particular, a "network dimension" characterizes the CA farmers in the lowlands, while a "trust dimension" is stronger among respondents in the mountains. The different dimensions of social capital characterizing the lowlands and the mountains – a "network dimension" and a "trust dimension", respectively – somehow reflect the different impacts that the socio-economic trends discussed in Chapter Four are having on the local communities. In the lowlands, "looser", choice-based networks based on balanced reciprocity, are substituting community based groups that used to rely on generalized reciprocity. Even though these networks represent an important asset for their members, compared to the past, vulnerable groups are more likely to be marginalized. In the mountains sites, instead, the "trust dimension" seems to be closely related to the persistence of traditional institutions, including community support mechanisms.

However, the Bayesian network learnt from the social capital variables, shows that the two dimensions of social capital – network and trust – are interrelated, and that both are linked to the variable *Adopter*. These findings are consistent with the most recent literature on agricultural

innovation, and in particular with the AIS approach (extensively discussed in Chapter Two), as well as with the conclusions of Chapter Three on the relevance of social capital to the adoption of CA in Africa.

Training and capable agency

The knowledge on CA results strongly correlated to the attainment of training, and the effect of training on the degree of knowledge is stronger in the mountains than in the lowlands. That is, adopters in the mountains have a better knowledge of the CA principles and apply them more correctly than adopters in the lowlands do. Drawing on the results of the workshops held with local CA trainers, it results that CA trainers in Qacha's Nek (the mountain district) use to interact with the trainees more frequently than CA trainers in Butha Buthe and Leribe (in the lowlands). In addition, the formers use to organize field visits and gatherings to discuss problems and issues, and they also encourage farmers to work collectively. At the opposite, in the lowlands trainers complain that they can not rely on farmers cooperation in spite of their efforts to foster it. The higher level of trust among respondents in the mountains, along with the participatory approach used by CA trainers, have facilitated a good attitude towards the innovation also among the non adopters. The positive impact of the commitment of CA trainers in Qacha's Nek on the performance and the acceptance of the technology, confirms the critical role that a proper combination of social capital and capable agency play in the achievement of local development objectives, as highlighted by the literature.

Further parallelisms between the literature and the results from the case study can be traced by considering which have been, so far, the major constraints to the adoption and the performance of *likoti*. Some of the factors which have been commonly identified as determinant in the adoption of CA, in fact, are lacking or absent in Lesotho. One of the most important lacking aspect has been policy support. In spite of Government's acknowledgment of the benefits associated with minimum tillage techniques, the concrete involvement of the Ministry of Agriculture and Food Security (MOAFS) in the diffusion of CA has been limited. The scarce commitment of the MOAFS is reflected also in the lack of support from the extension services, as admitted also by the local extension officers interviewed under the field survey (see Annex IV). At policy level, neither the creation of the CFNG, which involved also Government officials, nor the support that FAO and WFP gave to the organizations that firstly promoted *likoti*, did translate in an operative multiple stakeholder partnership. Lack of interaction among farmers and other actors, including extension services, in turn affected the degree of farmers

participation in the diffusion and, most importantly, in the adaptation of the technology to the local conditions.

The scarce interaction of formal research and farmers' indigenous knowledge has been another important missing aspect. In particular, institutional issues related to land tenure, such as the use of the stubbles as fuel or fodder by the villagers, and the integration of the livestock and the farming systems, have received inadequate attention by promoters of *likoti*. For what concerns the adaptation of CA principles, some trainers in Qacha's Nek have started to collect examples of successful experimentations made by individual farmers in order to further improve the technology and widen the range of opportunities stemming from its adoption. However, interacting with innovating farmers is not part of the promotion strategy neither of the NGOs and the international organizations involved nor the MOAFS.

Using the AIS lexicon, in Lesotho the promotion of innovative conservation practices has not been based on "a dynamic process of interacting embedded in specific institutional and policies contexts" (Hall, 2006). Scarce stakeholders interaction and inadequate policy support not only limit the potential benefits associated with the use of the technique, but they also hamper the internalization of social costs and benefits, discourage the social acceptance of the innovative practices, and ultimately affect the rate of adoption.

Drawing on the discussion above, a number of consistent policy implications for the successful diffusion of innovative conservation practices in SSA can be derived. The most important are:

Incentives to the adoption of CA practices

Conservation farming has revealed to be particularly suitable to poor and vulnerable households, who are less endowed with assets and other resources. At the same time, many of these households largely rely on their own production for food consumption, so investments in subsistence oriented farming can directly improve their food security status. The critical impact that a proper utilization of CA would have on the livelihoods of these categories would thus justify the provision of some incentives, such as inputs or micro-credit, that would enable them to start practicing. Whereas food aid and other forms of subsides, despite useful for those households who need to recover their livelihoods basis, should be used carefully in order not to create dependency nor discouraging self-production of food. In all cases, in order to foster an efficient use of the resources, any kind of support should be

given on a provisional basis and under payback schemes. Moreover, participation in training and demonstration activities should be a condition in order to access external assistance.

Initial labour intensiveness is still a major deterrent to the adoption of *likoti*, just as it happens in other African countries where similar planting basins systems have been adopted. If the fields are properly managed, the workload diminishes over the time, but if there is not enough workforce available, it becomes harder and harder to achieve the potential benefits. Thus some kind of temporary support could be provided to overcome the possible initial labour constraint. For example, incentives in form of availability of hired labour, could be integrated with other programmes targeting vulnerable households which do not own fields.

Finally, beyond having positive impacts on agricultural yields and food security, CA has also a critical role in the conservation of the environment and the natural resources. The environmental impacts can be considered as positive externalities from which the whole society benefits, but that are not perceived by the individuals, especially when an adequate policy support is lacking. Furthermore, looking at Table 6.1 and

Table 6.2, it is immediate to notice that most of the benefits (including some private ones) would manifest themselves on a medium or a long term, whereas all costs have a short temporal horizon. Therefore, a dichotomy between the social desirability of the technology and its on-farm attractiveness exists and must be overcome. Public support to the spread of conservation practices, including more effective advisory services, should be considered also in the perspective of maximizing social benefits that would not occur otherwise.

Education, Information and Advocacy

More information about the concept of conservation agriculture and its potential advantages should circulate countrywide among all types of farmers. The main objectives of broad information campaign are: to reduce the scepticism and achieve a wider acceptance of CA also amongst the non-adopters; and to raise awareness about the long-term environmental and social benefits. The ‘supply’ of information should be accompanied by an adequate investment in farmers’ receptive capacities. In other words, whenever necessary, a more general effort is needed to enhance education, which in the case of Lesotho has been particular relevant to women.

Special training and information sessions have to be conceived and organized for researchers, officials of the Ministry of Agriculture and the extension staff in order to provide farmers with both

training and technical assistance. A deeper involvement of the extension staff in training and field activities would also foster a wider acceptance of the conservation practices.

Participation and Training

The importance of participatory processes in the adoption of agricultural innovation has been extensively discussed. Participation at community level of all members, and especially of the local leadership, allows a better understanding and a wider acceptance of new ideas and practices. In the case of *likoti*, a number of issues have been raised that would need to be discussed and solved by the communities through a more participatory approach. For instance, the access by herders and other villagers into CA fields after the harvest, is one of the most important deterrent to the correct application of the CA principles. In order to overcome it, community members should not just discuss the issue of herding the livestock in the fields, but they should also find feasible solutions for the livestock owners and alternative fodder and fuel sources. Under this approach, common rules on rangelands and promotion of CA would be complementary elements of an integrated strategy that aim to combat land degradation and conserve the natural resource basis.

The extent of farmers participation is important also with regard to training. The effectiveness of conservation practices largely depends on the timely and appropriate management of all the farming activities. Therefore, the enhancement of technical knowledge and precision skills through adequate training is critical. However, equally important is the approach used by the trainers. It has been demonstrated, in fact, that the promotion of participative field activities and a close interaction between farmers and trainers lead to the better assimilation of the CA principles and, in turn, to a more appropriate application.

Adaptive and participative research

The introduction of conservation techniques, tools and management practices may provide a sustainable answer to problems of poverty and land degradation in Africa. However, *adapting these innovations* to the local conditions is the key for successful adoption. To some extent, *likoti* has already been adapted to local conditions in relation to technical issues such as the size of the grid and the plant density. But these changes have been experimented and introduced by the promoting organizations. Consultation with innovating farmers and participative on-field research have been lacking, and in this sense a research vacuum still exist.

Adaptive research based on the constant interaction among formal researchers, technology promoters and local farmers, is especially important in the diffusion of conservation practices, just because of their flexible nature. In order to fully exploit the benefits of a technology that can be suited to different environment conditions, in fact, farmers need to enhance their innovation capabilities, which are not only of technical nature. Participatory research activities are critical also in order to include aspects of indigenous knowledge and traditional institutions, and ultimately facilitate the tremendous mind shift that has to take place in the transition from conventional to conservation practices and which is one of the biggest challenges to their adoption. However, according to Fowler and Rockstrom (2001), "identification and recognition of local traditions or indigenous knowledge is important, but it is the actual possibility of building on these that has real potential. […] For this approach to succeed, the social environment should be conductive, the intervention must involve communities not individuals, the activities must involve all potential players." In other words, an AIS, adequately supported by certain aspects of social capital, should be in place.

A critical component of a working participatory and adaptive research system should be the creation of multiple stakeholder partnerships. As it has been described by the Swiss Commission for Research Partnerships with Developing Countries (KFPE), "ideally, a research partnership should strive for a *dynamic equilibrium* in which all involved parties are open to a multiple transformation in terms of mutual learning, cultural understanding, scientific upgrading, capacity building, and attitudinal behaviour towards all partners. Applying trans-disciplinary or multi-level, multi-stakeholder approaches, where all relevant stakeholders are actively participating, helps generate meaningful results and fosters processes that promote impact. In such partnerships all partners have a voice in decision-making processes and their capacities are used and further developed in a complementary and most fruitful way" (Maselli, Lys, and Schmid, 2006).

Last but not least, two broader, cross-cutting policy implications should also be considered:

- the need for a political change in the overall approach to agricultural innovation
- the need to consider more effectively social capital aspects in development oriented strategies

Most of the issues discussed above have policy implications in the sense that the choice to provide sustainable incentives, raise awareness through information campaigns, promote education, support participation in training and research, and encourage the creation of multiple stakeholders partnerships, need all to be sustained to some extent by policy makers. However, these choices should

not be the result of isolated decisions. Rather, they should stem from a more general, concrete shift from conceiving innovation just as a technical matter to its interpretation as a political and social process, as suggested by the AIS approach.

Indeed, as it has been previously mentioned, many NGOs, research institutions and development agencies have stressed the potential of the AIS framework to promote pro-poor innovation. Nonetheless, a part from few exceptions, so far the application of the innovation system concept to developing countries agriculture – for instance as part of agricultural development strategies – has been quite limited. This is in part due to methodological limitations as well as to some structural features of the agricultural sector. However, there may be also more complex, political reasons. The innovation system approach deserves attention just because it promises to be an effective approach to promote innovation through institutional change at local as well as national level. But this implies to accept a new, somehow revolutionary perspective and, in spite of some changes in the approach of national research institutions, international organizations and donors, there is still a large gap between what is known about enabling innovation for development and what is evident in mainstream policies and practices. In addition, conceiving innovation as a social learning process founded on stakeholder partnerships and wide participation, may imply radical transformations in the decision making rules, which can be hardly accepted by national governments and, more generally, by the formal and informal institutions which are currently in place.

The second broad policy implication is the need to consider more effectively social capital. According to the review of the recent literature on CA and agricultural innovation, several social capital dimensions play a critical role in the adoption and the diffusion of CA practices, above all by enabling the conditions for the creation of new knowledge through participative, adaptive research. The empirical analysis has largely confirmed these results, even though in Lesotho aspects of participation and interaction among farmers and promoters are still lacking. Inquiring into the possibility of 'investing in social capital' as part of innovation promotion strategies, naturally follows.

Drawing on the discussion presented in Chapter One and in Chapter Three, there are two different aspects to be taken into account with regard to conservation agriculture. On one hand, the careful assessment of the institutional and the social capital related features may facilitate the identification of suitable technologies thanks to a deeper understanding of the farmers' perception of land degradation problems and possible related solutions. On the other hand, fostering selected social capital aspects (such as the presence of associations, the occurrence of community interaction or the

degree of reciprocity) could help speed up the rate of technology adoption, improve the performance as well as enhance the social acceptability. Both aspects have practical and policy implications.

The feasibility to describe the social capital belonging to a certain group or community depends only partially on the ability to identify the sources, the components and the outcomes of social capital in that specific context (which has been discussed in the beginning of the chapter). Rather, it largely depends on the willingness of policy makers to consider social capital in the feasibility assessment of development projects and programmes. The actual possibility to influence the existing forms of social capital is a much more trickier and debated issue. As discussed in Chapter One, it is possible to identify two extreme positions. The 'interventionist' approach, supported since the Nineties by the World Bank, deems possible to invest in social capital as part of development strategies, and to this aim attributes an important role to macro-institutions. At the opposite, according to a 'deterministic' interpretation of the formation of social capital, such as the one given by Putnam in his well-known study of the regional differences in Italy, there is no chance to influence the patterns of development through social capital.

Most likely, a more realistic approach to the question lies in the middle. While it is unlikely that external driven social experiments could lead to meaningful outcomes, the previous assessment of the social capital which characterize a given group or community may substantially affect the sustainability of development processes. Consequently, with regard to the promotion of agricultural innovation, the choice of the most appropriate technology, along with the form of diffusing it, should depend on the dimensions of social capital which have been identified. In addition, the empirical literature has recognized the relevance of a number of social capital 'enabling factors' (such as education, capable agency of committed leaders, and the presence of meso-institutions), which can be included in consistent policy interventions. As a result, the issue of 'investing in social capital' may be better reformulated as the question of 'how to take social capital into account effectively, and how to identify and deal with its enabling factors'.

In essence, this chapter has sought to respond to the second objective of this work, namely to derive consistent policy implications in order to maximize the benefits stemming from the adoption of conservation practices in SSA. From the discussion above, it emerges that beyond technical and organizational aspects, the feasibility of the identified issues depends critically on wider transformations in the approach to agricultural innovations – and more generally to rural development. In fact, in spite of many declarations about the relevance of concepts such as participation, partnerships and AIS, agricultural research and innovation policies mostly follow conventional schemes in which

the ‘tangible’ aspects of development are still more important than the ‘intangible’ ones, such as human and social capital. The possible explanations are manifold.

One reason is probably that a concrete mindset shift hasn’t followed the theoretical changes yet, and policy makers, researchers as well as development agents still lack the capacities to implement these changes. Further reasons might be of a political nature. On one hand, as already mentioned, existing institutions may be reluctant to support any transformation in the current approach to agricultural innovation, which may ultimately change the decision making rules. On the other hand, often development policies, including the promotion of pro-poor agricultural innovation, are still influenced by a donor-driven approach which favours ‘tangible’ aspects. In this sense, the reasons why social capital is rarely taken into account are similar to those which explain why most agricultural innovation strategies still focuses on the transfer of technology rather than the improvement of farmers’ innovation capabilities.

To conclude, CA practices have already shown a meaningful potential for reducing poverty and combating land degradation in SSA. In spite of the major role that social capital plays in the effective adoption of CA, this aspect is rarely taken adequately into account by agricultural innovation policies. Therefore, a stronger policy support to wider transformations in the approach to agricultural innovation is needed in order to fully achieve the potential benefits associated with the use of CA by small-scale farmers in Africa.

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ANNEX I Questionnaire submitted in the first phase of the household survey

Baseline Study on Conservation Agriculture Practices in Lesotho

Quest #
Cluster #

BASELINE STUDY ON CONSERVATION ARICULTURE PRACTICES IN LESOTHO

Enumerator _____ Date _____

Area _____ Village _____

Name of the Head of the Household: _____

SECTION 1 - Background Household Information

I. INFORMATION ON THE RESPONDENT FARMER (RF)

1. Name of the Respondent Farmer (RF) _____
2. Gender of RF: 01 ☐ Female 02 ☐ Male
3. Age of RF: b1 ☐ less than 18; 02 ☐ 19 - 35; 03 ☐ 36 - 59; 04 ☐ more than 60
4. Main occupation of RF during the past 12 months (TICK ONE (1) ANSWER): 00 ☐ None/Unemployed; 01 ☐ Subsistence agriculture (crops); 02 ☐ Subsistence agriculture (livestock); 03 ☐ Commercial agriculture (crops, fruit, vegetables); 04 ☐ Commercial agriculture (livestock); 05 ☐ Work on other farmers' fields; 06 ☐ Piecework/Petty trade; 07 ☐ Salary job in Lesotho –specify _____; 08 ☐ Salary job in RSA – specify _____; 77 ☐ Other– specify _____
5. Marital status of RF: 01 ☐ single; 02 ☐ married; 03 ☐ widowed; 04 ☐ divorced/separated
6. Highest level of education completed by the RF: 00 ☐ None, CAN'T read and write; 01 ☐ None, BUT CAN read and write; 02 ☐ Finished Primary School Standard 7; 03 ☐ Finished Secondary School Form C; 04 ☐ Finished High School Form E; 05 ☐ Vocational training; 06 ☐ University education

II. INFORMATION ON THE HEAD OF THE HOUSEHOLD (HH)

7. Name of the head of the household (HH) (99 IF RESPONDENT FARMER IS THE HEAD OF THE HOUSEHOLD) _____; 99 ☐ RF and HH coincide (go to 13)
8. Gender of HH: 01 ☐ Female 02 ☐ Male

Baseline Study on Conservation Agriculture Practices in Lesotho

9. Age of HH: 01 ☐ less than 18; 02 ☐ 19 - 35; 03 ☐ 36 - 59; 04 ☐ more than 60
10. Marital status of HH: 01 ☐ single; 02 ☐ married; 03 ☐ widowed; 04 ☐ divorced/separated
11. Main occupation of HH during the past 12 months (TICK ONE (1) ANSWER): 00 ☐ None/Unemployed (living near or in the household); 01 ☐ None/Unemployed (living far from the household); 02 ☐ Subsistence agriculture (crops); 03 ☐ Subsistence agriculture (livestock); 04 ☐ Commercial agriculture (crops, fruit, vegetables); 05 ☐ Commercial agriculture (livestock); 06 ☐ Work on other farmers' fields; 07 ☐ Piecework/Petty trade; 08 ☐ Salary job in Lesotho –specify _____; 09 ☐ Salary job in RSA – specify _____; 77 ☐ Other– specify _____
12. Highest level of education completed by the HH: 00 ☐ None, CAN'T read and write; 01 ☐ None, BUT CAN read and write; 02 ☐ Finished Primary School Standard 7; 03 ☐ Finished Secondary School Form C; 04 ☐ Finished High School Form E; 05 ☐ Vocational training; 06 ☐ University education

III. INFORMATION ON THE MEMBERS OF THE HOUSEHOLD

13. How many persons usually live in this house? ☐☐ people

Member	(13.1) Gender	(13.2) Age	(13.3) Main occupation	(13.4) Relationship with the HH
.a	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter- adopted 05 ☐ son/daughter- in law 06 ☐ grandchild 07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.b	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild 07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.c	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild 07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.d	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law

		04 ☐ more than 60	household's fields 03 ☐ In school	04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	10 ☐ brother/sister 77 ☐ other
.e	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.f	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.g	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.h	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.i	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.j	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.k	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other
.l	01 ☐ F 02 ☐ M	01 ☐ less than 18 02 ☐ 19 – 35 03 ☐ 36 – 59 04 ☐ more than 60	00 ☐ Unemployed 01 ☐ Employed 02 ☐ Work in the household's fields 03 ☐ In school	01 ☐ HH 02 ☐ spouse 03 ☐ son/daughter –natural 04 ☐ son/daughter-adopted 05 ☐ son/daughter- in law 06 ☐ grandchild	07 ☐ nephew/niece 08 ☐ father/mother–natural 09 ☐ father/mother – in law 10 ☐ brother/sister 77 ☐ other

IV. SOURCES OF INCOME AND EXPENDITURES		
14. Which are the TWO MOST Important source/s of income for the household? (NO MORE THAN TWO (2) ANSWERS ALLOWED)	01 ☐ Salary/wage from public sector 02 ☐ Salary/wage from private sector 03 ☐ Pension 04 ☐ Remittances	05 ☐ Sale of crops and vegetables 06 ☐ Sale of livestock and/or livestock products 07 ☐ Casual job/informal market 77 ☐ Other
15. Which are the most important expenditure items for the household? (NO MORE THAN 2 ANSWERS ALLOWED)	01 ☐ Food 02 ☐ Clothes 03 ☐ School fees 04 ☐ Medical Expenses	05 ☐ Agricultural inputs 77 ☐ Other – specify _____
V. ACCESS TO ESSENTIAL SERVICES		
16. How do you usually travel?	01 ☐ on foot 02 ☐ Using animal traction	03 ☐ Using motorized transport 77 ☐ Other
17. How long does it take from here to reach nearest public transport?	01 ☐ less than 15 minutes 02 ☐ between 15 and 30 minutes	03 ☐ between 30 minutes and 1 hour 04 ☐ more than 1 hour
18. How long does it take for the scholars to reach the nearest primary school from here?	01 ☐ less than 15 minutes 02 ☐ between 15 and 30 minutes	03 ☐ between 30 minutes and 1 hour 04 ☐ more than 1 hour
19. How long does it take from here to reach nearest clinic or hospital?	01 ☐ less than 15 minutes 02 ☐ between 15 and 30 minutes	03 ☐ between 30 minutes and 1 hour 04 ☐ more than 1 hour
VI. ASSETS		
20. How many of the following assets are owned by you or any member of your household? (INSERT NUMBER)	20.1 Paraffin stove ☐☐ 20.2 Gas stove ☐☐ 20.3 Sickle ☐☐ 20.4Hoe ☐☐ 20.5 Garden tools ☐☐	20.6Axe/saw ☐☐ 20.11 Tractor ☐☐ 20.7Plough ☐☐ 20.12 Car ☐☐ 20.8Planter ☐☐ 20.13 bicycle ☐☐ 20.9Cultivator ☐☐ 20.14 Radio ☐☐ 20.10 Ox cart ☐☐ 20.15 Television ☐☐
21. In the past three months did your household buy any of these assets?	01 ☐ Yes	00 ☐ No
22. In the past three months did your	01 ☐ Yes	00 ☐ No (GO TO 24)

household sell any of these assets?			
23. What was the main reason for sale of assets? (NO MORE THAN TWO ANSWERS ALLOWED)	01 No longer needed 02 Pay daily expenses 03 Buy food 04 Pay medical expenses	05 Other emergency 06 Pay debt 07 Pay social event	08 Pay funeral 09 Pay school 77 Other_____
24. How do you usually heat the house?	01 Electricity 02 Gas	03 Paraffin 04 Coal 05 Wood	06 Cow dung 07 Crop waste 77 Other

VII. LIVESTOCK

25. Does the household keep animals? (ANY KIND OF ANIMAL)	01 Yes 00 No (GO TO 38)	
26. Does the household have cattle?	01 Yes 00 No (GO TO 28)	
27. If has cattle	a. Present number of Bulls 0-12 months	
	b. Present number of Bulls 12 - 24 months	
	c. Present number of Bulls 24 months and over	
	d. Present number of Oxen 0-12 months	
	e. Present number of Oxen 12 - 24 months	
	f. Present number of Oxen 24 months and over	
	g. Present number of Cows/Heifers 0-12 months	
	h. Present number of Cows/Heifers 12-24 months	
	i. Present number of Cows/Heifers 24 months and over	
28. Does the household have sheep or goats?	01 Yes 00 No (GO TO 30)	
29. If has sheep and goats	a. Present number	

30. Does the household have horses?	01 Yes 00 No (GO TO 32)	
31. If has horses	a. Present number of horses 0-12 months	
	b. Present number of horses 12 - 24 months	
	c. Present number of horses 24 months and over	
32. Does the household have donkeys and mules?	01 Yes 00 No (GO TO 32)	
33. If has donkeys	a. Present number of donkeys/mules 0-12 months	
	b. Present number of donkeys/mules 12 - 24 months	
	c. Present number of donkeys/mules 24 months and over	
34. Does the household have small animals (chickens, hens, geese, rabbits)?	01 Yes 00 No (GO TO 36)	
35. If has small animals	a. RABBITS, Present number	
	b. INDIGENOUS CHICKENS, Present number	
	c. COMMERCIAL POULTRY, Present number	
36. Does the household have pigs?	01 Yes 00 No (GO TO 38)	
37. If yes	a. Present number of pigs	
38. In the past SIX months, did the household sell any animal?	01 Yes 00 No (GO TO SECTION 2)	
38.1 If yes, specify		

38.2 If yes, what was the main reason for sale of animals? (NO MORE THAN TWO ANSWERS ALLOWED)	01 No longer needed 02 Make profit 03 Buy food 04 Pay medical expenses	05 Other emergency 06 Pay debt 07 Pay social event	08 Pay funeral 09 Pay school 77 Other_____

SECTION 2 - Food availability

1. Which are the main source/s of food for the household? (NO MORE THAN TWO ANSWERS ALLOWED)	01 ☐ Own production 02 ☐ Purchase 03 ☐ Private gifts	04 ☐ Food aid (from whom: _____) 05 ☐ Food for labour (from whom: _____)
2. How much does the household spend for food items on average every month?	Maloti ☐☐☐	
3. Do you eat your own produce from the fields all year around?	01 ☐ Yes	00 ☐ No

4. For the following products, could you specify:

	a. Own-produced?	b. Always available?	c. If not, indicate shortage month/s
4.1 Maize	01☐ Yes 00☐ No	01☐ Yes 00☐ No	
4.2 Sorghum	01☐ Yes 00☐ No	01☐ Yes 00☐ No	
4.3 Beans	01☐ Yes 00☐ No	01☐ Yes 00☐ No	
4.4 Vegetables	01☐ Yes 00☐ No	01☐ Yes 00☐ No	
4.5 Meat product	01☐ Yes 00☐ No	01☐ Yes 00☐ No	

5. Does the household face shortages in food items any time during the year? (CONSIDER OWN PRODUCE AND PURCHASED FOOD)	01 ☐ Yes	00 ☐ No (GO TO 7)	
6. Indicate the months during which the household faces shortages in food items			
7. What is the main source of water for the household?	01☐ Piped water on premises 02☐ Piped community water 03☐ Catchment's tank	04☐ Private well 05☐ Public well 06☐ Covered spring	07☐ Uncovered spring 08☐ River 09☐ Borehole 77☐ Other
8. How long does it take from here to reach nearest supply of drinking water?	01☐ less than 15 minutes 02☐ between 15 and 30 minutes	03☐ between 30 minutes and 1 hour 04☐ more than 1 hour	
9. Has this household ever received donations of food? (DO NOT INCLUDE PRIVATE DONATIONS AND FOOD FOR LABOUR)	01 ☐ Yes	00 ☐ No (GO TO 11)	
10. When was the last time you receive a donation of food?	Month and year of most recent donation		
11. Has this household ever received donations of inputs (seeds or seedlings, fertilizer, garden	01 ☐ Yes	00 ☐ No (GO TO 13)	

tools)? (do not include private donations)		
12. When was the last time you receive a donation of inputs?	Month and year of most recent donation	
13. Has any member of this household ever participated in a food for labour programme?	01 ☐ Yes	00 ☐ No (GO TO 17)
14. What kind of job was he/she involved in?	_____ _____ _____	
15. Which organization was promoting the programme?	01 ☐ World Food Program (WFP) 02 ☐ Ntate Moroti (the Pastor) 03 ☐ Caritas	04 ☐ The Government 05 ☐ Red Cross 77 Other_____
16. When was the last time a member of this household participated in a food for labour programme?	Month and year of most recent donation	
17. How many meals did the children (below 5 years) in this household eat yesterday?	Number of meals ☐☐	00 ☐None 99 ☐ no children
18. How many meals did the others (children above 5 years and adults) in this household eat yesterday?	Number of meals ☐☐	00 ☐None

19. I would like to ask about different foods that the household ate in the past three days as part of a meal or a snack

- ✓ ASK WHAT THE HOUSEHOLD ATE ON A GIVEN DAY
- ✓ THEN READ ALOUD EACH CATEGORY TO MAKE SURE NOTHING WAS FORGOTTEN
- ✓ DO NOT LEAVE FIELDS BLANK

		a. Yesterday			b. 2 days ago			c. 3 days ago		
19.1	Maize (papa)	Y	N	DK	Y	N	DK	Y	N	DK
19.2	Sorghum	Y	N	DK	Y	N	DK	Y	N	DK
19.3	Rice, Pasta	Y	N	DK	Y	N	DK	Y	N	DK
19.4	Bread	Y	N	DK	Y	N	DK	Y	N	DK
19.5	Potatoes	Y	N	DK	Y	N	DK	Y	N	DK
19.6	Vegetables, leaves	Y	N	DK	Y	N	DK	Y	N	DK
19.7	Milk (fresh, sour)	Y	N	DK	Y	N	DK	Y	N	DK
19.8	Beans, Peas	Y	N	DK	Y	N	DK	Y	N	DK
19.9	Beef, red meat	Y	N	DK	Y	N	DK	Y	N	DK
19.10	Poultry	Y	N	DK	Y	N	DK	Y	N	DK
19.11	Pork	Y	N	DK	Y	N	DK	Y	N	DK
19.12	Fish	Y	N	DK	Y	N	DK	Y	N	DK
19.13	Eggs	Y	N	DK	Y	N	DK	Y	N	DK
19.14	Fruits	Y	N	DK	Y	N	DK	Y	N	DK
19.15	Sugar, sugar products	Y	N	DK	Y	N	DK	Y	N	DK
19.16	Oils, fat, butter	Y	N	DK	Y	N	DK	Y	N	DK
19.17	CSB (mix for children)	Y	N	DK	Y	N	DK	Y	N	DK

20. Did any child (below 5 years) living in this household have one of these diseases in the last two weeks?	01 ☐ Yes	00 ☐ No	99 ☐ no children (GO TO 22)

Child member	20.1 Age		20.2 Diarrhoea			20.3 Cough			20.4 Fever		
.a	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.b	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.c	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.d	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.e	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.f	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK
.g	01☐ 0-1 year	02☐ 2-5 years	Y	N	DK	Y	N	DK	Y	N	DK

21. Does any child (below 5 years) living in this household suffer from any chronic illness or recurrent illness?	01 ☐ Yes	00 ☐ No	99☐ no children
21.1 If yes, could you specify which one/s?	____________		
22. Do any other member of the household (children above 5 years and adults) suffer from any chronic illness or recurring illness?	01 ☐ Yes	00 ☐ No	
22.1 If yes, could you specify which one/s?	____________		
22.2 Does this affect their ability to work?	01 ☐ Yes	00 ☐ No	
23. Did the household experience any death because of chronic illness in the last year?	01 ☐ Yes	00 ☐ No	

SECTION 3 - Farmers' associations and Community organization

1. How many farmers' associations are active in your community? (SPECIFY NUMBER)	☐☐ Associations	00 ☐ None (GO TO 2)

For each farmers' association active in your community, could you please specify:

1.1 Its name (indicate if cooperative or other legal framework)	1.2 Its main activities:	1.3 If you or any other member of the household belong to this organization	1.4 When do you or any other member of the household attend its meetings/gatherings?
	01☐ Crop/Veg Production 02☐ Livestock Production 03☐ Conservation agriculture 04☐ Training 77☐ Other	01 ☐ Yes 00 ☐ No	00☐ Never 01☐ Once a week 02☐ Twice a month 03☐ Once a month 04☐ Less than once a month
	01☐ Crop/Veg Production 02☐ Livestock Production 03☐ Conservation agriculture 04☐ Training 77☐ Other	01 ☐ Yes 00 ☐ No	00☐ Never 01☐ Once a week 02☐ Twice a month 03☐ Once a month 04☐ Less than once a month
	01☐ Crop/Veg Production 02☐ Livestock Production 03☐ Conservation agriculture 04☐ Training 77☐ Other	01 ☐ Yes 00 ☐ No	00☐ Never 01☐ Once a week 02☐ Twice a month 03☐ Once a month 04☐ Less than once a month
	01☐ Crop/Veg Production 02☐ Livestock Production 03☐ Conservation agriculture 04☐ Training 77☐ Other	01 ☐ Yes 00 ☐ No	00☐ Never 01☐ Once a week 02☐ Twice a month 03☐ Once a month 04☐ Less than once a month

2. Do you belong to any Christian Church?	01 ☐ Yes	00 ☐ No (GO TO 3)
2.1 How often do you attend a Christian Church service or related meetings/gatherings?	00☐ Never 01☐ Once a week 02☐ Twice a week	03☐ Twice a month 04☐ Once a month 05☐ Less than once a month
3. Do you contribute to any community trust fund/revolving fund?	01 ☐ Yes	00 ☐ No (GO TO 4)
3.1 How much do you contribute?	M ☐☐☐ per year	
3.2 What is the main scope of this common fund or revolving fund?	01☐ Procurement of input 02☐ Social community activities	03☐ Provision of loans for the members 77☐ Other

4. Are collective farming activities on individual fields (such as letsema) a common practice in your community?	01 ☐ Yes	00 ☐ No (GO TO 5)
4.1 If yes, who usually promotes them?	01 ☐ The chief 02 ☐ One farmer 03 ☐ A group of farmers	04 ☐ A farmers' association 05 ☐ Government (Resource Centre) 77 ☐ Other_____
4.2 If yes, what are the main activities implemented through collective work/matsema?	01 ☐ Ploughing 02 ☐ Excavation of holes 03 ☐ Sowing 04 ☐ Weeding	05 ☐ Harvesting 06 ☐ Looking after the fields 77 ☐ Other _____ _____
4.3 How do the farmers decide how many people have to work on an individual field and when and for how many days?		
4.4 Do you usually participate in collective farming activities/matsema?	01 ☐ Yes	00 ☐ No
5. Do you think that collective work/letsema is a good practice?	01 ☐ Yes, why	
	00 ☐ No, why	
6. Is grazing on harvested fields (Ho phunya mohoang) a common practice in your community?	01 ☐ Yes	00 ☐ No
7. Did your community establish any rule on livestock grazing?	01 ☐ Yes	00 ☐ No
8. Do the community ALWAYS respect these rules?	01 ☐ Yes (GO TO 9)	00 ☐ No
8.1 If not, what is the main reason for breaking rules on livestock grazing?	01 ☐ Lack of legal consequences 02 ☐ Indifference of local authorities 03 ☐ Respect of the tradition	04 ☐ Lack of community cohesion 77 ☐ Other _____ _____

9. Do you think that grazing on harvested fields (Ho phunya mohoang) is a problem for your fields?	01 ☐ Yes	00 ☐ No (GO TO 10)
9.1 If yes, how would you solve it?	01 ☐ Involvement of the police 02 ☐ Legal action by the court 03 ☐ Change tradition/ customary law	04 ☐ More power to the chief 05 ☐ Individual/personal action 77 ☐ Other _____ _____
10. Has your household ever experienced theft of livestock?	00 ☐ Never	01 ☐ Very often 02 ☐ Sometimes
11. Has your household ever experienced theft of crops/vegetables?	00 ☐ Never	01 ☐ Very often 02 ☐ Sometimes
12. Has your household ever experienced theft of tools/equipment?	00 ☐ Never	01 ☐ Very often 02 ☐ Sometimes
13. Do you have good relationships with your neighbors?	00 ☐ No	01 ☐ Yes 02 ☐ Don't care
14. Do you have good relationships with the Chief?	00 ☐ No	01 ☐ Yes 02 ☐ Don't care
15. Do you or any other member of your family attend the Pitso:	00 ☐ Never	01 ☐ Always 02 ☐ Sometimes

COMMENTS from THE RESPONDENT

COMMENTS from THE ENUMERATOR

SECTION 4 - Agricultural production activities

1. Do you own a land for farming?	00 ☐ No 01 ☐ Yes, freehold title 02 ☐ No, I rent it	03 ☐ No, but I've got a right to farm (usufruct) 04 ☐ No, I borrow it
2. If you rent the land, how long would you use it?	01 ☐ 1 season 02 ☐ 2 seasons	03 ☐ 3 seasons 04 ☐ more than 3 seasons
3. How many fields do you cultivate?		

Please fill the following tables for each of your fields, starting from the one located at the top to the one at the bottom:		
FIELD A, INDICATE NAME OF THE FIELD (IF ANY): _____		
A.1 Where is this field located?	01 ☐ Valley 02 ☐ Hill 03 ☐ Foot slopes	04 ☐ Plain 05 ☐ Garden
A.2 What is the size of this field? SPECIFY UNIT		
A.3 How much did you cultivate? SPECIFY UNIT	a. This year ☐☐ _____	b. Last year ☐☐ _____
A.4 How much did you leave fallow? SPECIFY UNIT	a. This year ☐☐ _____	b. Last year ☐☐ _____
A.5 How did you prepare and plant this field?		
A.6 Crop 1		
A.7 Variety		
A.8 Planted on (SPECIFY MONTH)		
A.9 Approximate size of area planted (SPECIFY UNIT OR PROPORTION)		
A.10Amount of seeds used (SPECIFY UNIT)		
A.11Source of seeds	01 ☐ Purchased 02 ☐ Donation	03 ☐ Own stock 77 ☐ Other
A.12If planted also last year, Yield obtained last year (SPECIFY UNIT)		
A.13Crop 2		
A.14Variety		
A.15Planted on (SPECIFY MONTH)		
A.16Approximate size of area planted (SPECIFY UNIT OR PROPORTION)		

A.17Amount of seeds used (SPECIFY UNIT)		
A.18Source of seeds	01 Purchased 02 Donation	03 Own stock 77 Other
A.19If planted also last year, Yield obtained last year (SPECIFY UNIT)		
A.20Crop 3		
A.21Variety		
A.22Planted on (SPECIFY MONTH)		
A.23Approximate size of area planted (SPECIFY UNIT OR PROPORTION)		
A.24Amount of seeds used (SPECIFY UNIT)		
A.25Source of seeds	01 Purchased 02 Donation	03 Own stock 77 Other
A.26If planted also last year, Yield obtained last year (SPECIFY UNIT)		
A.27Did you use artificial fertilizer?	01 Yes	00 No (GO TO A.31)
A.28If yes, type of artificial fertilizer applied?		
A.29If yes, amount of artificial fertilizer applied (SPECIFY UNIT)		
A.30If yes, source of artificial fertilizer	01 Purchased 02 Donation	03 Own stock 77 Other
A.31Did you use organic fertilizer?	01 Yes	00 No (GO TO A.35)
A.32If yes, type of organic fertilizer applied?		
A.33If yes, amount of organic fertilizer applied (SPECIFY UNIT)		
A.34If yes, source of organic fertilizer	01 Purchased 02 Donation	03 Own stock 77 Other
A.35What type of pest or disease management control did you use?	01 Pesticide 77 Other, _____	00 None (GO TO A.39) (GO TO A.39)
A.36If pesticide, what type?		
A.37If pesticide, amount applied (SPECIFY UNIT)		
A.38If pesticide, source of	01 Purchased 02 Donation	03 Own stock 77 Other
A.39Did you use herbicides?	01 Yes	00 No (GO TO NEXT)
A.40If yes, type of herbicides applied?		

A.41If yes, amount of herbicides applied (SPECIFY UNIT)		
A.42If yes, source of herbicides	01 Purchased 02 Donation	03 Own stock 77 Other

SAME TABLE FOR FIELDS B-H

FIELD B, INDICATE NAME OF THE FIELD (IF ANY): _____		
B.1 Where is this field located?	01 Valley 02 Hill 03 Foot slopes	04 Plain 05 Garden
B.2 What is the size of this field? SPECIFY UNIT		
B.3 How much did you cultivate? SPECIFY UNIT	a. This year ☐☐ _____	b. Last year ☐☐ _____
B.4 How much did you leave fallow? SPECIFY UNIT	a. This year ☐☐ _____	b. Last year ☐☐ _____
B.5 How did you prepare and plant this field?		
B.6 Crop 1		
B.7 Variety		
B.8 Planted on (SPECIFY MONTH)		
B.9 Approximate size of area planted (SPECIFY UNIT OR PROPORTION)		
B.10Amount of seeds used (SPECIFY UNIT)		
B.11Source of seeds	01 Purchased 02 Donation	03 Own stock 77 Other
B.12If planted also last year, Yield obtained last year (SPECIFY UNIT)		
B.13Crop 2		
B.14Variety		
B.15Planted on (SPECIFY MONTH)		
B.16Approximate size of area planted (SPECIFY UNIT OR PROPORTION)		
B.17Amount of seeds used (SPECIFY UNIT)		
B.18Source of seeds	01 Purchased 02 Donation	03 Own stock 77 Other
B.19If planted also last year, Yield obtained last year (SPECIFY UNIT)		
B.20Crop 3		

4. Do you practice sharecropping?	01 ☐ Yes, since _____ 00 ☐ No
5. If yes please indicate how	
6. Do you practice crop rotation?	01 ☐ Yes, since _____ 00 ☐ No
7. If yes please indicate how	
8. Do you practice intercropping or multi-cropping (eg lines of beans between rows of maize)?	01 ☐ Yes, since _____ 00 ☐ No
9. If yes please indicate how	
10. How did you prepare your fields?	01 ☐ Likoti 02 ☐ Plough with tractor 03 ☐ Plough with oxen 04 ☐ Plough with cow or bull 77 ☐ Other, specify_____
11. Source of labour for preparing the fields	01 ☐ Hired labour/tractor 02 ☐ Household provided 03 ☐ Sharecropping 04 ☐ Collective work camps (matsema) 05 ☐ Food for Work 77 ☐ Other _____
12. If hired labour or tractor, how much did it cost? (SPECIFY FOR LIKOTI AND FOR PLOUGHING)	M ☐☐☐ (LIKOTI) M ☐☐☐ (PLOUGHING)
13. How many people were working to prepare the field?	☐☐ PEOPLE
14. How many days did it take preparing the field?	☐☐ DAYS
15. How many hours per day did you work in the field?	☐☐ HOURS PER DAY
16. How did you plant your fields?	01 ☐ Place seeds in holes 02 ☐ Tractor planter 03 ☐ Oxen planter 04 ☐ Broadcasting 05 ☐ Zero-tillage planter 77 ☐ Other
17. Source of labour for Planting the field	01 ☐ Hired labour/tractor 02 ☐ Household provided 03 ☐ Sharecropping 04 ☐ Collective work camps (matsema) 05 ☐ Food for Work 77 ☐ Other _____
18. If hired labour or tractor, how much did it cost?	M ☐☐☐

19. How many people were working to plant the field?	☐☐ PEOPLE
20. How many days did it take planting the field?	☐☐ DAYS
21. How many hours per day did you work in the field?	☐☐ HOURS PER DAY
22. How do you weed your field?	01 ☐ Hoe/hand 02 ☐ Tractor 03 ☐ Oxen/animal drawn 04 ☐ Herbicides 77 ☐ Other _____
23. How many times do you weed your field in one season?	☐☐ TIMES PER SEASON
24. Source of labour for weeding	01 ☐ Hired labour/tractor 02 ☐ Household provided 03 ☐ Sharecropping 04 ☐ Collective work camps (matsema) 05 ☐ Food for Work 77 ☐ Other _____
25. If hired labour or tractor, how much did it cost?	M ☐☐☐
26. How many people work in the field to weed?	☐☐ PEOPLE
27. How many days does it take weeding?	☐☐ DAYS
28. How many hours per day does it take weeding?	☐☐ HOURS PER DAY
29. How do you manage your crop residues?	01 ☐ Cut for stall feeding 02 ☐ Let livestock grass in the field 03 ☐ Leave for mulching 77 ☐ Other _____
30. If left for mulching, do you manage to keep animals out of the field?	01 ☐ Yes 00 ☐ No
31. Do you let the animals graze on your fields after the harvest?	01 ☐ Yes (GO TO 32) 00 ☐ No
31.1 If no, what do you do to exclude livestock from your fields?	01 ☐ Talk to my neighbours 02 ☐ Talk to the chief 03 ☐ Talk to the police 04 ☐ Look after the fields 05 ☐ Fence 77 ☐ Other _____

32. Do you have any problems to access any of the inputs you need?	01 ☐ Yes	00 ☐ No (GO TO 35)
33. If yes, which inputs? (MORE THAN ANSWER ALLOWED)	01 ☐ Seeds 02 ☐ Inorganic fertilizer 03 ☐ Organic fertilizer 04 ☐ Herbicides	05 ☐ Pesticides 06 ☐ Labour 77 ☐ Other
34. Main reason for difficult access?	01 ☐ Lack of money 02 ☐ Unavailability from usual retailers	03 ☐ Long distance from retailers 77 ☐ Other
35. Do you use to sell your crop produce?	01 ☐ Yes	00 ☐ No (GO TO 39)
36. If yes, where and to whom do you use to sell the produce?	01 ☐ locally in the village or in neighboring villages 02 ☐ to buyers at the farm gate	03 ☐ in marketplaces far from the village 04 ☐ to buyers in towns far from the village

37. Fill out the table for the following crops in relation to the past cropping season, using the blank rows for crops that are not included in the list:

37.1 MAIZE. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.2 SORGHUM. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.3 BEAN. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.4 WHEAT. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.5 POTATO. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.6 SUNFLOWER. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.7 _____. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG
37.8 _____. How many bags did you sell last season? At what price?	☐☐ BAGS SOLD	☐☐☐ MALOTI/BAG

39. Does the household have a vegetable garden?	01 ☐ Yes	00 ☐ No (GO TO 43)
40. Do you practice Likoti in your garden?	01 ☐ Yes	00 ☐ No (GO TO 42)
41. If yes, what do you grow in your garden?	_____ _____ _____ _____	

42. Do you use to sell your garden produce?	01 ☐ Yes	00 ☐ No (GO TO 43)
42.1 If yes, what is the proportion of garden produce did you sell last season?	01 ☐ less than half	02 ☐ half 03 ☐ almost all
42.2 If yes, where and to whom do you use to sell the produce?	01 ☐ locally in the village or in neighboring villages 02 ☐ to buyers at the farm gate	03 ☐ in marketplaces far from the village 04 ☐ to buyers in towns far from the village
43. Does the household have fruit trees?	01 ☐ Yes	00 ☐ No (GO TO NEXT SECTION)
44. Do you use to sell your fruit produce?	01 ☐ Yes	00 ☐ No (GO TO NEXT SECTION)
44.1 If yes, what is the proportion of fruit produce did you sell last season?	01 ☐ less than half	02 ☐ half 03 ☐ almost all
44.2If yes, where and to whom do you use to sell .the produce?	01 ☐ locally in the village or in neighboring villages 02 ☐ to buyers at the farm gate	03 ☐ in marketplaces far from the village 04 ☐ to buyers in towns far from the village

SECTION 5 – Knowledge on conservation agriculture practices

1. Have you ever heard about Conservation Agriculture (CA) practices?	01 ☐ Yes	00 ☐ No
1.1. From whom?	01 ☐ MOAFS (Resource Centre) 02 ☐ Food and Agriculture Organization (FAO) 03 ☐ World Food Programme (WFP)	04 ☐ Ntate Moroti (the Pastor) 05 ☐ Red Cross 77 ☐ Other_____
2. Were you given any form of training on Conservation Agriculture?	01 ☐ Yes	00 ☐ No (GO TO 3)
2.1. When? (SPECIFY YEAR)		
2.2. From whom?	01 ☐ MOAFS (Resource Centre) 02 ☐ Food and Agriculture Organization (FAO) 03 ☐ World Food Programme (WFP)	04 ☐ Ntate Moroti (the Pastor) 05 ☐ Red Cross 77 ☐ Other_____
2.3. Would you like to receive (more) training on CA?	01 ☐ Yes	00 ☐ No
3. Have you ever received any subsides to introduce CA practices?	01 ☐ Yes	00 ☐ No (GO TO 4)
3.1 If yes, what type of subsides did you received? (MORE THAN ONE ANSWER ALLOWED)	01 ☐ Fertilizer 02 ☐ Seeds 03 ☐ Implements	04 ☐ Food 77 ☐ Other _____
4. Have you ever practiced conservation farming?	01 ☐ Yes (GO TO 5)	00 ☐ No
4.1 If not, you never adopted CA, would you consider adopt CA practices in future?	01 ☐ Yes, explain why (THEN GO TO 13) 00 ☐ No, explain, why (THEN GO TO 13)	
5. If yes, explain what kind of conservation farming practices have you been practicing?		

6. When did you start?		
7. Why did you start CA practices? (NO MORE THAN ONE ANSWERS)	01 ☐ Provision of economic incentives 02 ☐ Provision of food/assets 03 ☐ Being involved in a church practicing CA 04 ☐ Higher yields than conventional 05 ☐ Less expensive than conventional 77 ☐ Other – specify _____	
8. Are you still practicing CA?	01 ☐ Yes (GO TO 10)	00 ☐ No
9. If you're not practicing CA anymore, why did you stop?	(THEN GO TO 13)	
10. If yes, how many fields did you cultivate with CA?	a. This year ☐☐ fields	b. Last year ☐☐ fields
11. If yes, will you continue with the CA practices?	01 ☐ Yes	00 ☐ No
12. If yes, would you recommend this practice to other farmers?	01 ☐ Yes	00 ☐ No
13. Compared to conventional farming practices, CA involve:	01 ☐ more money 02 ☐ the same money 03 ☐ less money	
14. If more money, specify the three activities/ items that require more money	1) 2) 3)	
15. Compared to conventional farming practices, CA is:	01 ☐ more labour intensive 02 ☐ the same 03 ☐ less labour intensive	
16. If more labour intensive, specify the activity that requires more labour (NO MORE THAN ONE ANSWER ALLOWED)	01 ☐ Soil preparation 02 ☐ Sowing 03 ☐ Weeding 77 ☐ Other – specify	
17. Have you noticed any increase in yields in CA fields?	01 ☐ Yes	00 ☐ No
18. Have you noticed any reduction in soil erosion in CA fields?	01 ☐ Yes	00 ☐ No

19. Can you practice CA with all type of crops?	01☐ Yes	00 ☐ No
20. Can you practice CA in your garden?	01☐ Yes	00 ☐ No
21. Can you practice CA on a large scale?	01☐ Yes	00 ☐ No

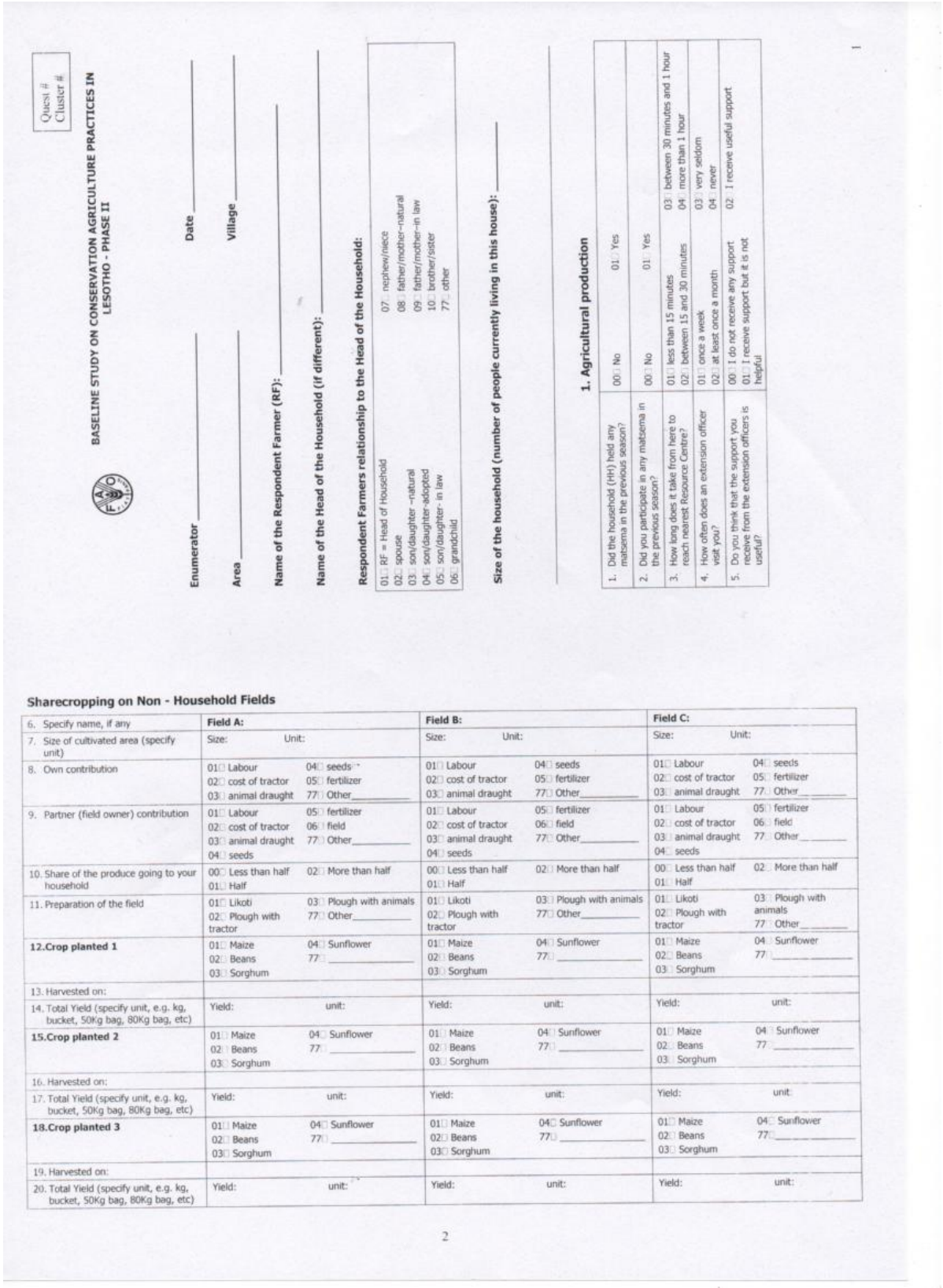
22. Do you think that NOT ploughing the soil is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
23. Do you think that planting direct into UNPLOUGHED soil is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
24. Do you think that keeping livestock out of the land after harvest is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
25. Do you think that leaving crop residues on the surface of the soil is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
26. Do you think that growing green manure cover crops for livestock feed is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
27. Do you think that growing green manure cover crops for soil cover and/or Nitrogen fixation is:	01 ☐ A GOOD IDEA	02☐ POSSIBLE	03☐ IMPOSSIBLE
28. The 3 main principles of Conservation Agriculture are: minimum/zero tillage, soil residue cover and crop rotation. Would you be interested in planting your fields using these three practices at the same time?	00☐ No 01☐ Yes, all my fields	02☐ Yes, some of my fields 03☐ Yes, but no more than two fields	

29. What are the main advantages of CA compared to conventional practices? (NO MORE THAN THREE ANSWERS ALLOWED)	01 ☐ Money saving 02 ☐ Higher yields 03 ☐ Less labour intensive 04 ☐ Decrease in soil erosion	05 ☐ Time saving 06 ☐ Increase in soil fertility 77 ☐ Other _____
30. What are the main disadvantages of CA compared to conventional practices? (NO MORE THAN THREE ANSWERS)	01 ☐ More expensive 02 ☐ Lower yields 03 ☐ More labour in weeding 04 ☐ Time wasting	05 ☐ Harder work in soil preparation 77 ☐ Other _____

COMMENTS from THE RESPONDENT

COMMENTS from THE ENUMERATOR

ANNEX II Questionnaire submitted in the second phase of the household survey



Quest #
Cluster #

BASELINE STUDY ON CONSERVATION AGRICULTURE PRACTICES IN LESOTHO - PHASE II

Enumerator _____ Date _____

Area _____ Village _____

Name of the Respondent Farmer (RF): _____

Name of the Head of the Household (if different): _____

Respondent Farmers relationship to the Head of the Household:

01. RF = Head of Household	07. nephew/niece
02. spouse	08. father/mother--natural
03. son/daughter --natural	09. father/mother--in law
04. son/daughter- adopted	10. brother/sister
05. son/daughter- in law	77. other
06. grandchild	

Size of the household (number of people currently living in this house): _____

1

1. Agricultural production

1. Did the household (HH) held any matsema in the previous season?	00 No	01 Yes
2. Did you participate in any matsema in the previous season?	00 No	01 Yes
3. How long does it take from here to reach nearest Resource Centre?	01 less than 15 minutes 02 between 15 and 30 minutes	03 between 30 minutes and 1 hour 04 more than 1 hour
4. How often does an extension officer visit you?	01 once a week 02 at least once a month	03 very seldom 04 never
5. Do you think that the support you receive from the extension officers is useful?	00 I do not receive any support 01 I receive support but it is not helpful	02 I receive useful support

Sharecropping on Non - Household Fields

6. Specify name, if any	**Field A:**	**Field B:**	**Field C:**
7. Size of cultivated area (specify unit)	Size: Unit:	Size: Unit:	Size: Unit:
8. Own contribution	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 77 Other_____	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 77 Other_____	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 77 Other_____
9. Partner (field owner) contribution	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 06 field 77 Other_____	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 06 field 77 Other_____	01 Labour 02 cost of tractor 03 animal draught 04 seeds 05 fertilizer 06 field 77 Other_____
10. Share of the produce going to your household	00 Less than half 01 Half 02 More than half	00 Less than half 01 Half 02 More than half	00 Less than half 01 Half 02 More than half
11. Preparation of the field	01 Likoti 02 Plough with tractor 03 Plough with animals 77 Other_____	01 Likoti 02 Plough with tractor 03 Plough with animals 77 Other_____	01 Likoti 02 Plough with tractor 03 Plough with animals 77 Other_____
12.Crop planted 1	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
13. Harvested on:			
14. Total Yield (specify unit, e.g. kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:
15.Crop planted 2	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
16. Harvested on:			
17. Total Yield (specify unit, e.g. kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:
18.Crop planted 3	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
19. Harvested on:			
20. Total Yield (specify unit, e.g. kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:

2

Fields of the Household (either owned, rented or borrowed)

How many fields did you cultivate last season (either owned, rented or borrowed)? _____

21. Specify name, if any	**Field A:**	**Field B:**	**Field C:**	**Field D**	**Field E**
22. Size of cultivated area (specify unit)	Size: Unit:	Size: Unit:	Size: Unit:	Size: Unit:	Size: Unit:
23. What do you think of the fertility of this field	01 Improved 02 No change 03 Declined	01 Improved 02 No change 03 Declined	01 Improved 02 No change 03 Declined	01 Improved 02 No change 03 Declined	01 Improved 02 No change 03 Declined
24.Crop 1	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
25. Harvested on:					
26. Total Yield (unit: kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:
27. Have you sold some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes
28. Are you going to sell some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes
29.Crop 2 (if any)	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
30. Harvested on:					
31. Total Yield (unit: kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:
32. Have you sold some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes
33. Are you going to sell some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes

(Continue – crop3)	**Field A:**	**Field B:**	**Field C:**	**Field D**	**Field E**
34.Crop 3 (if any)	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 _____
35. Harvested on:					
36. Total Yield (unit: kg, bucket, 50Kg bag, 80Kg bag, etc)	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:	Yield: unit:
37. Have you sold some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes
38. Are you going to sell some of the harvest?	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes	00 No 01 Yes

(continue)	**Field A:**	**Field B:**	**Field C:**	**Field D**	**Field E**
39. Preparation of the field last year	01 Likoti 02 Plough with tractor 03 Plough/ own animals 04 Plough/ others' animals 77 _____	01 Likoti 02 Plough with tractor 03 Plough/ own animals 04 Plough/ others' animals 77 _____	01 Likoti 02 Plough with tractor 03 Plough/ own animals 04 Plough/ others' animals 77 _____	01 Likoti 02 Plough with tractor 03 Plough/ own animals 04 Plough/ others' animals 77 _____	01 Likoti 02 Plough with tractor 03 Plough/ own animals 04 Plough/ others' animals 77 _____
40. Number of people to prepare and plant the field and for how long	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY
41. How many times did you weed last season?	☐☐ TIMES	☐☐ TIMES	☐☐ TIMES	☐☐ TIMES	☐☐ TIMES
42. How did you weed?	01 Hand/Hoe 02 tractor 03 Herbicides 77 Other_____	01 Hand/Hoe 02 tractor 03 Herbicides 77 Other_____	01 Hand/Hoe 02 tractor 03 Herbicides 77 Other_____	01 Hand/Hoe 02 tractor 03 Herbicides 77 Other_____	01 Hand/Hoe 02 tractor 03 Herbicides 77 Other_____
43. On average, every time, number of people to weed and for how long	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY	☐☐ PEOPLE for ☐☐ DAYS ☐☐ HOURS PER DAY

(continue)	Field A:	Field B:	Field C:	Field D	Field E
44. Do you have any winter crop planted on this field?	00 No (GO TO 51) 01 Yes	00 No (GO TO 51) 01 Yes	00 No (GO TO 51) 01 Yes	00 No (GO TO 51) 01 Yes	00 No (GO TO 51) 01 Yes
45. If yes, please specify (more than one answer allowed)	01 Wheat 02 Barley 03 Peas 04 Oats 77 ____	01 Wheat 02 Barley 03 Peas 04 Oats 77 ____	01 Wheat 02 Barley 03 Peas 04 Oats 77 ____	01 Wheat 02 Barley 03 Peas 04 Oats 77 ____	01 Wheat 02 Barley 03 Peas 04 Oats 77 ____
46. What is the purpose of planting winter crops? (more than one answer allowed)	01 Harvest grain/peas 02 Harvest for animal feed 03 Leave it as cover crops 04 Let animal graze in the field	01 Harvest grain/peas 02 Harvest for animal feed 03 Leave it as cover crops 04 Let animal graze in the field	01 Harvest grain/peas 02 Harvest for animal feed 03 Leave it as cover crops 04 Let animal graze in the field	01 Harvest grain/peas 02 Harvest for animal feed 03 Leave it as cover crops 04 Let animal graze in the field	01 Harvest grain/peas 02 Harvest for animal feed 03 Leave it as cover crops 04 Let animal graze in the field
47. What crop/s are you going to plant ON THIS FIELD NEXT SEASON? (MORE THAN ONE ANSWER ALLOWED)	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 ____ 88 Don't' know yet	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 ____ 88 Don't' know yet	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 ____ 88 Don't' know yet	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 ____ 88 Don't' know yet	01 Maize 02 Beans 03 Sorghum 04 Sunflower 77 ____ 88 Don't' know yet
48. How are you preparing the field for next sowing?	01 Likoti 02 Plough with tractor 03 Plough with own animals 04 Plough/ others' animals	01 Likoti 02 Plough with tractor 03 Plough with own animals 04 Plough/ others' animals	01 Likoti 02 Plough with tractor 03 Plough with own animals 04 Plough/ others' animals	01 Likoti 02 Plough with tractor 03 Plough with own animals 04 Plough/ others' animals	01 Likoti 02 Plough with tractor 03 Plough with own animals 04 Plough/ others' animals

2. Nutrition and access to food

1. Which is the MOST IMPORTANT source of food for the household (HH)? (ONLY ONE ANSWER ALLOWED)	01 Own production 02 Purchase 03 Private gifts 04 Food aid, from ____ 05 Food for labour, from ____
2. Which is the SECOND MOST IMPORTANT source of food for the household (HH)? (ONLY ONE ANSWER ALLOWED)	01 Own production 02 Purchase 03 Private gifts 04 Food aid, from ____ 05 Food for labour, from ____
3. How much does the household spend for food items on average every month?	Maloti ☐☐☐
4. Do you eat your the production from your own fields all year round?	01 Yes 00 No (GO TO 6)
4.1 If not, could you specify which are the months in which the HH can NOT feed itself with its own production?	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
5. Considering both own production and the purchased food, does the HH face shortages in food any time during the year?	01 Yes 00 No (GO TO 7)
5.1 If yes, Indicate the months during which the household faces shortages in food	JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
6. How many meals did the children (below 5 years) eat yesterday?	Number of meals ☐☐ 99 no children (GO TO 10)
7. Has any child (below 5 years) suffered from one of these diseases in the last two weeks?	01 Diarrhoea 02 Cough 03 Fever 00 None of the previous
8. How many meals did the adults and the children older than 5 years eat yesterday?	Number of meals ☐☐ **Pay attention**: If yesterday was not a "normal day" (HH participated in a ceremony or in a feast) ask about the day before yesterday

9. Ask about different foods that the members of the household ate in the past three days. READ ALOUD EACH CATEGORY TO MAKE SURE NOTHING WAS FORGOTTEN. DO NOT LEAVE FIELDS BLANK	a. Yesterday			b. 2 days ago			c. 3 days ago		
Maize (papa)	Y	N	DK	Y	N	DK	Y	N	DK
Sorghum	Y	N	DK	Y	N	DK	Y	N	DK
Rice, Pasta	Y	N	DK	Y	N	DK	Y	N	DK
Bread	Y	N	DK	Y	N	DK	Y	N	DK
Potatoes	Y	N	DK	Y	N	DK	Y	N	DK
Vegetables, leaves	Y	N	DK	Y	N	DK	Y	N	DK
Milk (fresh, sour)	Y	N	DK	Y	N	DK	Y	N	DK
Beans, Peas	Y	N	DK	Y	N	DK	Y	N	DK
Beef, red meat	Y	N	DK	Y	N	DK	Y	N	DK
Poultry	Y	N	DK	Y	N	DK	Y	N	DK
Pork	Y	N	DK	Y	N	DK	Y	N	DK
Fish	Y	N	DK	Y	N	DK	Y	N	DK
Eggs	Y	N	DK	Y	N	DK	Y	N	DK
Fruits	Y	N	DK	Y	N	DK	Y	N	DK
Sugar, sugar products	Y	N	DK	Y	N	DK	Y	N	DK
Oils, fat, butter	Y	N	DK	Y	N	DK	Y	N	DK

3. Household vulnerability and Community Cohesion

1. Has this household ever received donations of food? (DO NOT INCLUDE PRIVATE DONATIONS AND FOOD FOR LABOUR)	01 ☐ Yes	00 ☐ No (GO TO 2)
1.1 If yes, how long have you received donations of food? **(INDICATE MONTH AND YEAR)**	From	To
2. Has any member of this household ever participated in a food for labour programme organized by the government, NGOs or other development organizations? **(DO NOT INCLUDE MATSEMA)**	01 ☐ Yes	00 ☐ No (GO TO 4)
3.1 If yes, how long has he/she been participating in a food for labour programme? DO NOT INCLUDE MATSEMA - **(INDICATE MONTH AND YEAR)**	From	To
3. Has the HH asked any credit in the last year, if yes, to whom?	00 ☐ No credit asked (GO TO 5) 01 ☐ Bank 02 ☐ Credit Union/saving association	03 ☐ Relative 04 ☐ Friend 05 ☐ Other _____
3.1 Has the HH asked and obtained any credit in the last year, from whom?	00 ☐ No credit received, despite asking 01 ☐ Bank 02 ☐ Credit Union/saving association	03 ☐ Relative 04 ☐ Friend 05 ☐ Other _____
4. Generally speaking, how would you define the relations between people within your community?	01 ☐ Extremely bad 02 ☐ Bad 03 ☐ Neither bad nor good	04 ☐ Good 05 ☐ Very good
5. Generally speaking, would you say that most people in your community can be trusted, or that you can't be too trustful when dealing with other people?	01 ☐ Most people can be trusted 02 ☐ You can't be too trustful	

6. How much do you trust the people in the following categories? (TICK ONE ANSWER FOR EACH CATEGORY)

		01) To a very small extent	02) To a small extent	03) Neither small nor great extent	04) To a great extent	05)To a very great extent
A	Local government officials	☐	☐	☐	☐	☐
B	The chief	☐	☐	☐	☐	☐
C	Agricultural Extension Officer	☐	☐	☐	☐	☐
D	Police	☐	☐	☐	☐	☐
E	People from neighbouring villages	☐	☐	☐	☐	☐
F	Staff of NGOs and other development organizations	☐	☐	☐	☐	☐

7. Does the Household give help to other households, or receive help from other households on a voluntary basis, in any of the following ways? **(TICK ONLY IF YES)**

	10.1 GIVES HELP	10.2 RECEIVES HELP
a. Child care	☐	☐
b. Caring for the sick people/home based care	☐	☐
c. Fuel collection	☐	☐
d. Food	☐	☐
e. Keeping livestock	☐	☐
f. Small business (ex. Crafts, brewing, etc.)	☐	☐
g. Other (specify: _____)	☐	☐
h. Other (specify: _____)	☐	☐

8. What kind of associations/groups/committees exist in your community? Please tick the corresponding box for those existing (USE "OTHER" CATEGORY IF NECESSARY), specifying if there is any specific rule/condition to become a member (belong to the same clan/family, pay a fee, go to the same church, etc) and if any member of your HH belongs to it. Be careful not to mention the same association in more than one category:

	ASSOCIATION/GROUP/COMMITTEE (USE "OTHER" CATEGORY IF NECESSARY)	10.1 Tick	10.2 Is there any specific rule/condition to become a member? (belong to the same clan, pay a fee, go to the same church, etc)		Do you or any member of the HH belong to it?	
A	Conservation Agriculture Association (temo e baballa mobu)	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
B	Livestock Group	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
C	Farmers' association/group	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
D	Support Group	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
E	Grocery Association	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
F	Burial Association	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
G	Credit association/Trust Fund	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
H	Religious, specify: _____	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
I	Youth Group	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
J	Sports Group	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
K	Other (specify: _____)	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No
L	Other (specify: _____)	☐	01 ☐ Yes	00 ☐ No	01 ☐ Yes	00 ☐ No

COMMENTS

ANNEX III Methodological note on the wellbeing indexes

Three indexes have been built in order to compare the wellbeing status of the conventional and the CA farmers as well as to evaluate the distribution of welfare within the sample: an Asset Index, a Capabilities Index and an Outcome. The *assets index* measures the endowment with productive assets, which includes animals, land and agricultural production means and other tools. The index can be considered as a proxy of the wealth of the households, even though it does not include other economic resources and monetary earnings. The *capabilities index* is built on variables such as the availability of a salary and other formal income sources, the ownership of a tractor, the capability to hire workers through *matsema* (collective wok), the presence of disabled members in the household and the household dependency ratio, and it measures the household capability to generate welfare. The *outcome index* measures the household capabilities in terms of consumption, and takes in account the heating method, the dietary diversity (through the food consumption score, FCS) and other consumption assets such as gas stove, radio and television.

Each index is built synthesizing a number of variables available from the questionnaires. The variables are weighted by giving different scores to the values, being a higher score associated to a better condition expressed by that variable in terms of asset, capabilities and outcomes.

Table 3 Variables used to calculate the Asset Index and relative scores associated to different values

Variable	Value	Score	Value	Score	Value	Score	Value	Score	Max Score
Number of small stock (units)	0 - 5	0	6 - 9	1	10 - 24	2	=>25	3	3
Number of sheep/goats (units)	0	0	1 - 5	1	6 - 15	2	=>16	3	3
Number of cattle (units)	0	0	1 - 2	1	3 - 5	2	=>6	3	3
Number of pigs (units)	0	0	1	1	2	2	=>3	3	3
Number of donkeys (units)	0	0	=>1	0.66					0.66
Number of horses (units)	0	0	=>1	1					1
Number of productive assets (units) *	0 - 1	0	2 - 4	1	5 - 9	2	=>10	3	3
Own ox cart (dummy)	no	0	yes	1					1
Own land/land and cattle (dummy)	no	0	Only land	0.5	land + cattle	1			1

* Productive assets can include: sickle, hoe, garden tools, axe, saw, plough, planter, cultivator

Table 4 Variables used to calculate the Capabilities Index and relative scores associated to different values

Variable	Value	Score	Value	Score	Value	Score	Value	Score	Max Score
Pension, salary or remittances as first source of income	None	0	Pens	1	Salar or Remitt	2			2
Own tractor (dummy)	No	0	yes	1					1
Held matsema (dummy) *	No	0	yes	1					1
Disabled member in the household (dummy)	Yes	0	no	0.5					0.5
Dependency ratio (DR)**	=>4	0	1.5=<DR<4	0.5	1=<DR<1.5	1	DR<1	2	2

* Initially a higher importance was given to *matsema* and, compared to the asset index, the capability index appeared more normally distributed within both sub-samples. Lowering the weight associated to *matsema*, the distribution of the capability index becomes more similar to that of the assets index, possibly indicating a higher adherence to the reality.

** DR = the ratio of household members more than 60 years old and less than 18 to the 19 - 59 years old members

Table 5 Variables used to calculate the Outcome Index and relative scores associated to different values

Variable	Value	Score	Value	Score	Value	Score	Max Score
Heating method	No	0	with coal or paraffin	0,5	with gas or electricity	1	1
Food Consumption Score (FCS)*	FCS<10	0	10=<FCS<22	1	FCS>=22	2	2
Own gas stove (dummy)	No	0	yes	1			1
Number of radio (units)	0	0	1	0.33	=>2	0.66	0.66
Own television (dummy)	No	0	yes	1			1

* The food consumption score measures the diversity of household diet over three days, whereby each food is allocated a score based on its contribution to the diet. Each food type consumed is allocated a score based on its nutrient density.

The scores have been attributed (i.e. each variable has been weighted) on the basis of the existing literature on livelihoods strategies in Lesotho, in particular taking in account some previous analysis carried out by IFAD, CARE and Sechaba Consultants. The score obtained for each variable is divided by the maximum score obtainable for the same variable and multiplied by 100, in order to normalize the new values associated to each variable. The normalized scores are synthesised in the index through a weighted average as follows:

$$\text{INDEX} = \sqrt[\alpha]{\frac{1}{\text{n}}\sum_{i=1}^{n} x_i^{\alpha}}$$

where:

$x_i = i$ - variable

n = number of variables

$\alpha = 2$

The index – ranging from 0 to 100 – is calculated for each respondent farmer/household.

Example: Calculating the Capabilities Index for the household YZ:

Variable	Value	Score	Normalized Score (0-100)
Pension, salary or remittances as first source of income	Pension	1	(1/2)*100 = 50
Own tractor	No	0	(0/1)*100 = 0
Held matsema	Yes	1	(1/1)*100 = 100
Disabled member in the household	No	0,5	(0.5/1)*100 = 50
Dependency ratio (DR)	2	0,5	(0.5/2)*100 = 25

$$\text{CAPABILITIES INDEX of YZ} = \sqrt{\frac{50^2 + 0^2 + 100^2 + 50^2 + 25^2}{5}} = 55{,}9$$

The wellbeing status can be evaluated through the three indexes for each household and ranked in order to compare different farmers or gender categories. By dividing the distributions into quintiles it is possible to rank the households wellbeing status and categorize them as very poor, poor, moderate, better off and rich, as it was presented in paragraph 4.1.4 (figures 4.5, 4.6 and 4.7). Generally speaking, all farmers categories show a poor welfare status also reflected in the outcome index. The CA farmers show a higher degree of vulnerability especially in relation to the endowment of productive assets, while the differences with the conventional sample diminish in relation to other capability factors, although still present. In both sub-samples, the FHH as a whole show a lower welfare status, even though the differences are accentuated amongst the CA farmers.

The table below reports the average values for the three indexes, reflecting the results obtained with the frequency distribution. The CA sample, and especially the female headed households, report lower average values of all indexes. In particular, the CA female headed households are the worst endowed with productive assets, with an average asset index well below the sample average.

Table 6 Average values and standard deviation of the wellbeing indexes, by farmer category and gender

Indicator		CV FHH	CV MHH	CV	CA FHH	CA MHH	CA	Total
Assets Index	Average	37.3	41.4	39.9	31.6	36.4	34.6	37.1
	St. Dev.	17.3	18.0	17.9	14.5	16.3	15.9	17.1
Capabilities Index	Average	47.0	48.5	47.9	44.0	46.6	45.6	46.7
	St. Dev.	19.4	18.5	18.9	18.1	17.1	17.5	18.2
Outcome Index	Average	41.2	46.0	44.2	39.2	43.1	41.6	42.9
	St. Dev.	17.8	18.7	18.5	18.5	18.5	18.6	18.6

ANNEX IV List of interviews and workshops held with relevant stakeholders

Beyond the open and the semi-structured interviews listed below, also a number of informal meetings with farmers and local CA promoters revealed to be particularly relevant to the field research. Among the most helpful, it is worthy to mention those with Koili, Joshua, Sello in Tebellong, with Isaac in Tsoelike and with Refiloehape in Ha Mamathe. Further interesting inputs came from the constant interaction with Rev. August Basson (Growing Nations), Mr. Richard Fowler (ARC South Africa), Rev. Pete West and Rev. John Mokoena (Dihlabeng Church and Rehobothe Church in Botha Bothe).

Date	Place	Name	Role/Organization
30/01/2006	Tebellong	Workshop with CA Trainers from Tebellong and Tsoelike	Growing Nations Project
02/02/2006	DAO Qacha's Nek	District Agricultural Officer Field Services Officer	District Agricultural Office (DAO) Qacha's Nek
03/02/2006	DAO Qacha's Nek	Ms Ntseliseng	Crop Officer - DAO Qacha's Nek
06/02/2006	Thaba Kholo	Workshop with CA Trainers from Makhoakhoeng	Dihlabeng Church Project
09/02/2006	Cana	Church Minister of Cana	Church Minister of Cana
10/02/2006	Maseru	Pastor James Qhobela	AFM - Botha Bothe
02/08/2006	DAO Qacha's Nek	Mr Lesesa Morojele	Nutrition Officer DAO Qacha's Nek
02/08/2006	DAO Qacha's Nek	Ms Ntseliseng	Crop Officer DAO Qacha's Nek
02/08/2006	Tsoelike Auplaas	Pastor Ranthimo	Growing Nations Project
03/08/2006	Liphakoeng	Ms. Mamakhaola Makhaola	Chief of Tebellong area
03/08/2006	Ha Stelling	Mr. Tsiliso Makakane	Chief of Ha Stelling
04/08/2006	Ha Mosue	Mr. Isaac Sehahle	Chief of Ha Mosue
07/08/2006	Thaba Kholo	Workshop with CA Trainers from Makhoakhoeng	Dihlabeng Church Project
17/08/2006	Ha Paramente	Ms. Jeremia Matela	Chief of Ha Paramente
18/08/2006	Thaba Kholo	Pastor John Mokoena	Rehobothe Church
18/08/2006	Makhunoane	Mr. Herbert Matela	Acting Head Chief of Makhoakhoeng area
18/08/2006	Ha Moloi	Mr. Matela Matela	Chief of Ha Moloi

ANNEX V Multiple Correspondence Analysis run with the Social Capital related variables

Analysis of Indicator Matrix

Axis	Inertia	Proportion	Cumulative	Histogram
1	0,2343	0,0717	0,0717	******************************
2	0,2036	0,0623	0,1341	*************************
3	0,1731	0,0530	0,1871	**********************
4	0,1603	0,0491	0,2361	********************
5	0,1504	0,0460	0,2822	*******************
6	0,1224	0,0375	0,3196	***************
7	0,1115	0,0341	0,3538	**************
8	0,1053	0,0322	0,3860	*************
9	0,1006	0,0308	0,4168	************
10	0,0966	0,0296	0,4464	************
11	0,0943	0,0289	0,4752	************
12	0,0917	0,0281	0,5033	**********
13	0,0868	0,0266	0,5299	**********
14	0,0836	0,0256	0,5555	*********
15	0,0804	0,0246	0,5801	*********
16	0,0796	0,0244	0,6044	*********
17	0,0746	0,0228	0,6272	********
18	0,0694	0,0213	0,6485	********
19	0,0678	0,0208	0,6693	********
20	0,0622	0,0190	0,6883	*******
21	0,0620	0,0190	0,7073	*******
22	0,0568	0,0174	0,7247	*******
23	0,0565	0,0173	0,7420	*******
24	0,0540	0,0165	0,7585	******
25	0,0535	0,0164	0,7749	******
26	0,0515	0,0158	0,7906	******
27	0,0482	0,0148	0,8054	******
28	0,0466	0,0143	0,8196	*****
29	0,0463	0,0142	0,8338	*****
30	0,0425	0,0130	0,8468	*****
31	0,0415	0,0127	0,8595	*****
32	0,0375	0,0115	0,8710	****
33	0,0363	0,0111	0,8821	****
34	0,0355	0,0109	0,8930	****
35	0,0346	0,0106	0,9036	****
36	0,0327	0,0100	0,9136	****
37	0,0304	0,0093	0,9229	***
38	0,0300	0,0092	0,9321	***
39	0,0287	0,0088	0,9409	***
40	0,0272	0,0083	0,9492	***
41	0,0248	0,0076	0,9568	***
42	0,0220	0,0067	0,9635	**
43	0,0207	0,0063	0,9699	**

Column Contributions – Component 1

						Component 1	
ID	Name	Qual	Mass	Inert	Coord	Corr	Contr
1	Associations_0	0,038	0,003	0,020	0,752	0,025	0,007
2	Associations_01-02	0,081	0,029	0,012	-0,258	0,050	0,008
3	Associations_03-04	0,047	0,027	0,012	0,027	0,000	0,000
4	Associations_05-06	0,033	0,006	0,019	0,574	0,033	0,008
5	Associations_07-08	0,008	0,002	0,020	0,508	0,008	0,002
6	Church Attend_Never/Rarely	0,001	0,014	0,016	0,020	0,000	0,000
7	Church Attend_Often	0,107	0,034	0,010	-0,281	0,081	0,011
8	Church Attend_Sometimes	0,136	0,018	0,015	0,503	0,096	0,020
9	Pitso Attend_Always	0,124	0,035	0,010	0,157	0,027	0,004
10	Pitso Attend_Never	0,037	0,003	0,019	-0,800	0,032	0,009
11	Pitso Attend_Sometimes	0,088	0,029	0,012	-0,103	0,008	0,001
12	Theft_Never	0,012	0,022	0,014	-0,114	0,006	0,001
13	Theft_Sometimes	0,006	0,027	0,012	-0,030	0,001	0,000
14	Theft_Very often	0,013	0,017	0,015	0,193	0,013	0,003
15	Trust Commun_Distrustful	0,529	0,023	0,013	0,791	0,321	0,060
16	Trust Commun_Trustful	0,529	0,044	0,007	-0,405	0,321	0,031
17	Relations Commun_Bad	0,065	0,007	0,018	-0,239	0,007	0,002
18	Relations Commun_Extrem Bad	0,002	0,002	0,020	0,212	0,001	0,000
19	Relations Commun_Good	0,335	0,029	0,012	-0,423	0,134	0,022
20	ions Commun_Neither bad or good	0,345	0,022	0,014	0,819	0,320	0,062
21	Relations Commun_Very good	0,104	0,007	0,018	-0,583	0,043	0,011
22	Evalu Coll Work_Negative	0,052	0,013	0,016	0,029	0,000	0,000
23	Evalu Coll Work_Positive	0,052	0,053	0,004	-0,007	0,000	0,000
24	Help Exchange_High	0,187	0,013	0,017	-0,887	0,185	0,043
25	Help Exchange_Medium	0,211	0,051	0,005	0,253	0,211	0,014
26	Help Exchange_None	0,020	0,003	0,020	-0,595	0,016	0,004
27	Rules_Lack community cohesion	0,026	0,011	0,017	-0,356	0,024	0,006
28	Respect Rules_No rule	0,017	0,008	0,018	0,174	0,004	0,001
29	Respect Rules_Other/DK	0,037	0,002	0,020	-0,649	0,014	0,004
30	Respect Rules_Respect rules	0,138	0,023	0,013	0,285	0,042	0,008
31	espect Rules_Respect traditions	0,025	0,006	0,018	-0,361	0,014	0,004
32	Respect Rules_Weak authorities	0,067	0,017	0,015	-0,029	0,000	0,000
33	Gov Off_High	0,211	0,010	0,017	-0,223	0,008	0,002
34	Gov Off_Low	0,163	0,010	0,017	0,836	0,122	0,029
35	Gov Off_Moderate	0,093	0,014	0,016	0,048	0,001	0,000
36	Gov Off_Very high	0,314	0,011	0,017	-1,199	0,282	0,067
37	Gov Off_Very low	0,130	0,023	0,013	0,280	0,040	0,008
38	Chief_High	0,374	0,022	0,014	0,513	0,129	0,025
39	Chief_Low	0,017	0,002	0,020	0,781	0,017	0,005
40	Chief_Moderate	0,002	0,003	0,019	0,208	0,002	0,001
41	Chief_Very high	0,309	0,037	0,009	-0,311	0,118	0,015
42	Chief_Very low	0,023	0,003	0,019	-0,584	0,017	0,005
43	Ext Officer_High	0,165	0,011	0,017	0,155	0,005	0,001
44	Ext Officer_Low	0,370	0,011	0,017	1,175	0,260	0,062
45	Ext Officer_Moderate	0,095	0,010	0,017	0,118	0,003	0,001
46	Ext Officer_Very high	0,444	0,016	0,016	-1,075	0,350	0,077
47	Ext Officer_Very low	0,002	0,019	0,015	0,068	0,002	0,000
48	Police_High	0,410	0,018	0,015	-0,056	0,001	0,000
49	Police_Low	0,414	0,010	0,017	1,397	0,354	0,085
50	Police_Moderate	0,025	0,008	0,018	0,421	0,025	0,006
51	Police_Very high	0,415	0,018	0,015	-0,914	0,317	0,065
52	Police_Very low	0,024	0,012	0,017	0,007	0,000	0,000
53	Neighb Villages_DK	0,051	0,003	0,020	1,003	0,044	0,012
54	Neighb Villages_High	0,186	0,020	0,014	0,657	0,182	0,036
55	Neighb Villages_Low	0,034	0,011	0,017	0,028	0,000	0,000
56	Neighb Villages_Moderate	0,051	0,011	0,017	-0,285	0,016	0,004
57	Neighb Villages_Very high	0,326	0,009	0,018	-0,930	0,138	0,034
58	Neighb Villages_Very low	0,037	0,013	0,016	-0,341	0,028	0,006
59	Dev Org_DK	0,018	0,001	0,020	0,774	0,010	0,003
60	Dev Org_High	0,327	0,014	0,016	-0,095	0,002	0,001
61	Dev Org_Low	0,176	0,014	0,016	0,709	0,135	0,030
62	Dev Org_Moderate	0,053	0,011	0,017	-0,001	0,000	0,000
63	Dev Org_Very high	0,464	0,012	0,017	-1,184	0,297	0,070
64	Dev Org_Very low	0,070	0,015	0,016	0,284	0,024	0,005

Column contributions – Component 2

		Component 2		
ID	Name	Coord	Corr	Contr
1	Associations_0	-0,537	0,013	0,004
2	Associations_01-02	-0,205	0,031	0,006
3	Associations_03-04	0,260	0,046	0,009
4	Associations_05-06	0,042	0,000	0,000
5	Associations_07-08	0,030	0,000	0,000
6	Church Attend_Never/Rarely	0,040	0,000	0,000
7	Church Attend_Often	0,158	0,026	0,004
8	Church Attend_Sometimes	-0,323	0,040	0,009
9	Pitso Attend_Always	0,297	0,097	0,015
10	Pitso Attend_Never	-0,325	0,005	0,002
11	Pitso Attend_Sometimes	-0,327	0,080	0,015
12	Theft_Never	0,105	0,006	0,001
13	Theft_Sometimes	-0,088	0,005	0,001
14	Theft_Very often	0,003	0,000	0,000
15	Trust Commun_Distrustful	0,638	0,208	0,045
16	Trust Commun_Trustful	-0,327	0,208	0,023
17	Relations Commun_Bad	0,700	0,058	0,017
18	Relations Commun_Extrem Bad	-0,127	0,001	0,000
19	Relations Commun_Good	-0,517	0,201	0,038
20	ions Commun_Neither bad or good	0,229	0,025	0,006
21	Relations Commun_Very good	0,699	0,061	0,018
22	Evalu Coll Work_Negative	0,452	0,051	0,013
23	Evalu Coll Work_Positive	-0,114	0,051	0,003
24	Help Exchange_High	0,082	0,002	0,000
25	Help Exchange_Medium	-0,003	0,000	0,000
26	Help Exchange_None	-0,313	0,004	0,001
27	Rules_Lack community cohesion	-0,100	0,002	0,001
28	Respect Rules_No rule	0,299	0,013	0,004
29	Respect Rules_Other/DK	-0,839	0,023	0,007
30	Respect Rules_Respect rules	0,435	0,097	0,021
31	espect Rules_Respect traditions	-0,328	0,011	0,003
32	Respect Rules_Weak authorities	-0,448	0,066	0,016
33	Gov Off_High	-1,104	0,203	0,057
34	Gov Off_Low	0,487	0,041	0,012
35	Gov Off_Moderate	-0,595	0,092	0,024
36	Gov Off_Very high	0,404	0,032	0,009
37	Gov Off_Very low	0,419	0,090	0,019
38	Chief_High	-0,709	0,246	0,054
39	Chief_Low	-0,004	0,000	0,000
40	Chief_Moderate	-0,016	0,000	0,000
41	Chief_Very high	0,394	0,190	0,028
42	Chief_Very low	0,348	0,006	0,002
43	Ext Officer_High	-0,887	0,161	0,044
44	Ext Officer_Low	0,763	0,110	0,030
45	Ext Officer_Moderate	-0,713	0,092	0,026
46	Ext Officer_Very high	0,555	0,093	0,023
47	Ext Officer_Very low	0,033	0,000	0,000
48	Police_High	-1,037	0,408	0,097
49	Police_Low	0,576	0,060	0,017
50	Police_Moderate	-0,005	0,000	0,000
51	Police_Very high	0,507	0,097	0,023
52	Police_Very low	0,333	0,024	0,006
53	Neighb Villages_DK	-0,393	0,007	0,002
54	Neighb Villages_High	-0,107	0,005	0,001
55	Neighb Villages_Low	-0,415	0,034	0,009
56	Neighb Villages_Moderate	-0,421	0,035	0,010
57	Neighb Villages_Very high	1,085	0,188	0,053
58	Neighb Villages_Very low	0,185	0,008	0,002
59	Dev Org_DK	-0,706	0,008	0,003
60	Dev Org_High	-1,099	0,324	0,084
61	Dev Org_Low	0,389	0,041	0,010
62	Dev Org_Moderate	-0,531	0,053	0,015
63	Dev Org_Very high	0,890	0,167	0,045
64	Dev Org_Very low	0,398	0,047	0,012

Column Plot