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Gender and Social Capital Mediated Technology Adoption

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Abstract

This study explores gender-differentiated benefits from the social capital build-up in technology uptake, and the decision-making patterns of men and women with respect to production, consumption and household tasks; and allocation of resources. The background research examined women's role in developing social capital, and research developed a case study of the groundnut producing areas of Maharashtra in western India, and compared 'with' and 'without' technology situations, and 'before' and 'after' situations in relation to the package of groundnut production technology introduced in the region in 1987. The paper addresses three aspects: (1) social networks in technology adoption, (2) the gender-based activity pattern, and (3) build-up of social capital leading to improvements in the welfare of farmers and the farming community with a gender perspective.

Available evidence suggests substantial differences in networks of men and women, particularly in composition. The evidence suggests that men belong to more formal networks reflecting their employment or occupation status, while women have more informal networks that are centered on family and kin. Findings show that women who are engaged in agriculture and allied activities develop bonding social capital characterized by strong bonds such as that found among family members or among members of an ethnic group. Men who are engaged in agriculture, on the other hand, develop bridging social capital characterized by weaker, less dense but more crosscutting ties such as with farmers, acquaintances, friends from different ethnic groups and friends of friends. Women's employment opportunities significantly improved with the introduction of technology. Finally, the study concludes that while technology development and exchange can build upon social capital as a means of empowering women, much more needs to be learned about the approaches that foster build-up of social capital.

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Acronyms and abbreviations

DFID	Department for International Development, UK
FAO-RAP	Food and Agricultural Organization, Regional Office for Asia and the Pacific
GPT	groundnut production technology
GSA	Gender and Social Analysis
HC	Higher caste/forward caste
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
KVM	Krishi Vikas Mandal
LEGOFTEN	legumes on-farm testing and nursery unit
NARES	National Agricultural Research and Extension Services
NGO	non-governmental organization
NRM	natural resource management
R&D	Research and Development
SAT	semi-arid tropics
SC	scheduled castes
SHG	self-help group
ST	scheduled tribes
UNDP	United Nations Development Programme

1. Gender dimensions in technology adoption and social capital

Agricultural research during the past 30 years has been successful in boosting productivity and providing enough food to feed the world. However, the problems of poverty, food security, and natural resource degradation are persisting. People, natural resources and technology continue to be the three basics for agricultural development (Asian Productivity Organisation 2002). People who are producers however, both men and women in agricultural communities, are confronted by production challenges associated with changing population situation, a degrading natural resource base, new technologies and accelerated global economic integration. Against the backdrop of the UN Millennium goals on the reduction of poverty and hunger and the empowerment of women, it is imperative that agricultural development priorities should be directed to poverty reduction with gender equality. Hence, agricultural research objectives move beyond increasing food production to encompass goals of poverty reduction (See Box 1).

Box 1. Impact of agricultural research on poverty

Assessing the impact of agricultural research on poverty is difficult, as there are many ways in which agricultural research can have an effect (Kerr and Kolavalli 1999). Findings have highlighted the complex interactions between technologies and the vulnerability of households, their asset base, intervening institutions and livelihood strategies (Adato M and Meinzein-Dick 2002). Research results document that farmers, even communities become empowered gaining a small measure of control over their resources. The findings demonstrate to researchers and scientists the value of extending their work beyond the confines of laboratory and research station to benefit from the knowledge and experience of the men and women who are closest to the land.

In the developing world as awhole, women play the primary role in food production. Rural women, who undertake a major proportion of farm work, are responsible for family food security and home production, and are often involved in postharvest processing and marketing. However they often have lower levels of social status and economic security in the family. It is realized that, in order to raise the agricultural output and productivity on a sustainable basis in the developing countries, large-scale adoption of new technologies is very essential. Major international agencies such as the UN and the World Bank have realized that these technologies have to address to the needs of not only the male farmer in perspective but also incorporate the requirements and adaptability of women in

the farm sector. Based on the findings from global research "targeting women in agricultural technology dissemination can have a greater impact on poverty than targeting men" (IFPRI 2005).

There is increasing evidence that gender may make a difference in economic circumstances (Molinas 1998). Kabeer (1996) argues that local gender relations play a significant role in mediating the translation of economic benefits derived from technological uptake into individual well-being. Women are generally poorer than men, because they lack the range of assets and access to entitlements, which male members of their households tend to enjoy. Social capital plays an important role in influencing adoption impacts of agricultural technology, because of the ways in which social networks and social relationships facilitate and constrain technology dissemination. As a result of differing social networks and correspondingly different levels of access to information, men and women experience different economic consequences.

An examination of the magnitude and mechanisms through which different types of agricultural research benefit the poor is important to guide future research in ways that will make the greatest contribution to poverty reduction. This report synthesizes empirical results and lessons learnt from the natural resource management (NRM) innovation at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), namely, Groundnut Production Technology (GPT) with a focus on gender dimensions and build-up of social capital in technology adoption and exchange.

1.1 Gender dimensions in social analysis

Gender studies have highlighted entrenched inequalities in control over assets, gender discrimination in labor markets, and lack of voice in the power struggle in controlling resource allocation as the main reason for women's vulnerability. Gender research has also created awareness of the feminization of poverty (Jackson 1995; Kabeer 1995; Lockwood 1995) and the often-vulnerable situation of female headed or female maintained households (Buvinic 1993; Buvinic and Gupta 1994). An important dimension of vulnerability in marginal areas is a lack of power, voice and social networks that can help the poor to access resources, institutions, technology and markets. Hence this analysis places greater stress on the significance of social capital and the gender dimensions of it in technology adoption.

Women's increased access to and control over resources that translates into their empowerment, helps them deal with the impacts of environmental change, especially in poor degraded dryland areas.Women's reduced control over resources allow them limited ways of dealing with degradation, and as empowerment means

increased access to and control over resources, the latter provides a means of making up for detrimental environmental impacts (Heyzer 1995). In turn, women's efforts in combating desertification (land reclamation, reforestation and irrigation systems) lead to an increase in self-confidence as well as NRM, financial management and negotiating skills (FAO 2002).

The above discussion illustrates that women are critical to agricultural production, but their access to resources and effective technologies is often constrained by gender barriers. This can lead to detrimental effects on the design and implementation of effective agricultural development programs. Social and gender analyses in the nexus of technology can direct agriculture technology development and dissemination process to empower disenfranchised groups.

1.2 Gender and agricultural technology adoption

Over the last 25 years, studies on the role of women in agriculture contributed to a basic understanding of the increasingly complex human dimensions of food production, farm management structure, and rural development. During the 1980s, studies presented women as productive partners, by documenting women as producers of food, traders and family caretakers. Research on the subject, which continued in the 1990s, expanded the discovery process on the feminization of agriculture – their increasing recognition and empowerment in farm household decision-making process. More recent studies have shown that feminization of agriculture has intensified due to increased rural-to-urban migration, which primarily involves the male members of society. The recent argument is that gender is an essential concept for the social analysis of deprivations and in programming for eradication of poverty. In the traditional conceptualization of economic analysis and development programming, feminization of poverty is not included, and therefore these earlier analyses fail to delineate gender dimensions of rural poverty. Current debates on commercialization highlight the risks to women's traditional skills. Therefore it is important to examine the linkages among feminization of rural poverty, migration from rural areas and commercialization.

As pointed in the literature, women sometimes could not benefit from technological change because new technology was not introduced to them due to the notion that women were not really responsible for farming. Persistently, certain technologies were introduced to male farmers even though women were in reality primarily responsible for the particular crop or task affected. Apart from access to information, one other critical area that needs in-depth understanding is the control over resources. Whether technical change benefits women depends on their control over resources. Women in farm households who have control over income from land will benefit from any type of technical change in agriculture.

This is because they will reap the returns from increased productivity of both household labor and land (Quisumbing 1994).

People's access to assets, information, and new technologies thus comprises many gender aspects, affecting the value of technologies to men and women. For example, in a study by ICRISAT in Zimbabwe, men have been found to prefer improved varieties, while women seek out the open pollinated varieties. The underlying reasons for different preference is that women have less access to the credit and cash required for certified seed and fertilizer as well as their social networks to acquire open pollinated seeds.

Doss and Morris (2001) in his study on adoption of improved maize technology in Ghana basically asked the question – Why do men and women adopt agricultural technologies at different rates? Evidence from Ghana suggests that gender-linked differences in the adoption of modern maize varieties and chemical fertilizer are not attributable to inherent characteristics of the technologies themselves but instead result from gender-linked differences in access to key inputs. On the whole, these results from Ghana suggest that technology adoption decisions depend primarily on access to resources, rather than on gender *per se*. This conclusion should be interpreted with caution, however, because it does not necessarily mean that modern varieties and fertilizer are gender-neutral technologies. If adoption of modern varieties and/or fertilizer depends on the access to land, labor, or other resources, and if in a particular context men tend to have better access to these resources than women, then in such a context the technologies will not benefit men and women equally. Policy changes thus may be needed to increase women's access to the key resources; alternatively, it may be desirable to modify research efforts by deliberately targeting technologies that are particularly suited for the resources available to women. The fundamental issue is that it is important to examine both the nature of technology itself and the physical and institutional context in which the technology is implemented in order to predict whether it will be adopted successfully by women as well as men.

Kolli and Bantilan (1997) studied the gender-related impacts of a crop and resource management technology package in Maharashtra, India. The study indicated that to ensure effective and committed involvement of men and women in agriculture, views and perceptions of both men and women of the farming communities needed to be incorporated during technology generation and development. A research and development (R&D) agenda that incorporates analysis of gender-disaggregated farmer perspectives is likely to lead to a more appropriate and acceptable technology that will gain further and wider adoption.

The complex nature of gender and poverty notwithstanding, female-headed households may exhibit pronounced preferences to invest in household wellbeing.

Certainly, studies from a diverse range of countries indicate that women and men's relative control over resources has significant and often gender differentiated impacts on household consumption and expenditures (Haddad et al. 1997).

In conclusion as global research experience demonstrates, gender is a critical variable in the social analysis of technology promotion and in the constraints and success of technology adoption.

1.3 Social capital and gender concerns

1.3.1 Understanding social capital

Social capital concerns the norms and values people hold; that result in, and are the result of, collective and socially negotiated ties and relationships (see Box 2). It is integrally related to other forms of capital, such as human (skills and qualifications), economic (wealth), cultural (modes of thinking) and symbolic (prestige and personal qualities). For example, economic capital augments social capital, and cultural capital can be readily translated into human and social capitals. In terms of social capital, where people share a sense of identity, hold similar values, trust each other and reciprocally do things for each other, then this is felt to have an impact on the social, political and economic nature of the society in which we live. Over

Box 2. Types of Social Capital

Social capital is not considered as a single entity, rather it is multidimensional. There are three broad types of social capital.

Bonding Social Capital: This form refers to connections to ordinary people, for example, classmates, colleagues and other peers. In the Indian village situation, this could be people belonging to same caste and religion.

Bridging Social Capital: This refers to connections to people who are not from the same region. They include people in the phone and email lists whom a person does not contact regularly but are nonetheless crucial for professional life. In an Indian village situation, it could be the schoolteacher or the local NGO personnel and other government officials such as a mail carrier.

Linking Social Capital: This pertains to contacts or networks with the people in power, whether they are in politically or financially influential positions. A person's prestige, ability to get things done, and professional advancement often depend on ties to these elites. In an Indian village situation, a backward caste member who is closer to a forward caste member would be favored in terms of access to information and other benefits.

the recent years, the concept of social capital has gained importance in policy studies, in the development sector. There are many definitions, controversies over the definitions and ways of explaining this concept. But to be broadly understood, social capital stands as a network of people or institutions across geographical areas, social strata and disciplines. Social capital is often argued to be a concept that itself bridges disciplinary boundaries, allowing people steeped in anthropological, economic, political science, psychological and sociological traditions to talk to each other (Schuller et al. 2000; Woolcock 2001), and across conceptual areas.

The most narrow concept of social capital is associated with Putnam (Putnam 1993). He views it as a set of "horizontal associations" between people: social capital consists of social networks ("networks of civic engagement") and associated norms that have an effect on the productivity of the community. The key feature of social capital in this definition is that it facilitates coordination and cooperation for the mutual benefit of the members of the association (Putnam 1993). The work of Putnam (1993, 1995, 2000; Leigh and Putnam 2002) lays emphasis on the trust and reciprocity between people that facilitates collective action in terms of economic and political development at regional and national levels.

A second and broader concept of social capital was put forth by Coleman (1988a; 1988b), who defines social capital as "a variety of different entities, with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors – whether personal or corporate actors – within the structure". This broadens the concept to include vertical as well as horizontal associations, and also the behavior among other entities such as firms. Vertical associations are characterized by hierarchical relationships and an unequal power distribution among members. James Coleman's work (1988a; 1988b; 1990; 1991) sees social capital as inherent in the structure of family relationships, particularly intergenerationally. He is concerned with explaining how children's educational achievement is driven by parental investment, which then radiates out to the community in the form of the generational passing-on of cohesive social and moral norms of trust and co-operation, and sanction, and producing economic efficiency. (See also Amato 1998; Furstenburg and Hughes 1995; Parcel and Menaghan 1993).

A third and an encompassing view of social capital includes the social and political environment that enables norms to develop and shapes the social structure. In addition to the largely informal, and often local, horizontal and hierarchical relationships of the first two concepts, this view also includes the more formalized institutional relationships and structures, such as government, the political regime, the rule of law, the court system, and civil and political liberties. This focus on institutions draws on North (1990) and Olson (1982), who have argued that

such institutions have an important effect on the rate and pattern of economic development.

Another school of thought around social capital concentrates on social capital as a set of resources that are linked to membership of a particular social group. The emphasis is on the social networks that provide access to that group's resources; with the outcome being enhanced economic rewards and social power. For example, Bourdieu (1986; Bourdieu and Wacquant 1992) focuses on family and group relationships. He sees social capital as the resources that are generated through these. In particular, Bourdieu (1986) and Allatt (1993) see a family as the means by which a range of capital assets is transmitted over time, across generations. Bourdieu emphasizes the way that social capital is constructed and maintained in the interaction between individual agency and a society stratified by social and economic inequalities. His focus on class relations of privilege has been extended by feminists to analyze gendered divisions (for example, Reay 2000; Skeggs 1997). Other theorists and researchers focus more on social capital as a resource that arises out of people's family relationships and that enables them to increase their human capital, which then enables them to gain greater economic rewards.

Summarizing, it can be said that social capital has an impact on basically everything about the lives of poor households and it is an important component of managing risk and opportunity, survival and mobility. While using our understanding of social capital as a form of networks of people which the rural households turn to in terms of vulnerabilities, an overview of the different indicators of social capital used by social and development practitioners is presented in Appendix 1.

1.3.2 Gender concerns in social capital

The contributions of social capital to agriculture in particular and rural development in general are well documented in a number of studies. Assumptions are that build-up of social capital promotes collective action, cooperation, knowledge sharing and adoption of new technologies. It is also hypothesized that social capital can facilitate the linkage of farmers to markets – both input markets and product markets. Findings from Parthasarathy and Chopde (2000) indicate that social capital contributes to increased productivity and risk management capacity of farmers in marginal environments such as the semi-arid tropics (SAT). They also suggest that social capital is associated with better common property management.

In keeping with the primacy of gender in socio-economic development issues, the gender-related dimension of social capital is one of the emerging themes. Of major importance in this regard is whether gender constitutes a principal determinant

in the accumulation of social capital, and if so, what are the differences observed between men and women in respect to this attribute. The family as the main source of economic and social welfare has been identified as the primary institution for the generation of social capital for the larger society. Women as primary caregivers are seen playing a critical role in the process of social capital formation.

The relationship between social capital and gender has been investigated in a number of studies included in the Social Capital Initiative (SCI) of the World Bank and the Local Level Institution Studies (LLIS). Several themes emerge from this research. First, social capital and social networks are an important means by which women gain access to resources and economic opportunities. Second, development projects can affect the strength and reach of women's networks, though not always positively. Finally, the SCI research suggests that development projects might have a better chance of succeeding if women's networks and social capital is specifically included.

2. Mediating forces of gender and social capital in technology adoption

2.1 Conceptual framework for gender, technology and livelihoods

2.1.1 Poverty alleviation through technological interventions based on the principle of sustainable livelihoods

Millennium Development Goal One on eradication of extreme hunger and poverty reinforces the need for agricultural research for improving livelihood and poverty reduction in rural sector. The reports of assessment on poverty and hunger also illustrate that the rural communities and the land dependent people are highly represented among the deprived populations. Hence the role of science and technology to improve productivity in all sectors including agriculture and rural economies gains great importance in achieving the Millennium Development Goal One.

Figure 1 provides the conceptual framework for technology intervention and poverty alleviation linkages. Technological innovation leads to introduction of technology for the benefit of the poor farm households. The adoption of a technology takes place in the context of individual farm households. The decision for adopting a new technology is based upon the necessity of the technology and mainly the accessibility of the technology by the poor farmer. The enabling factors for a farmer to adopt a technology are as follows:

- Assets
- Access
- Human Capital
- Social Capital
- Migration (Sometimes migration also brings in knowledge of new technology)

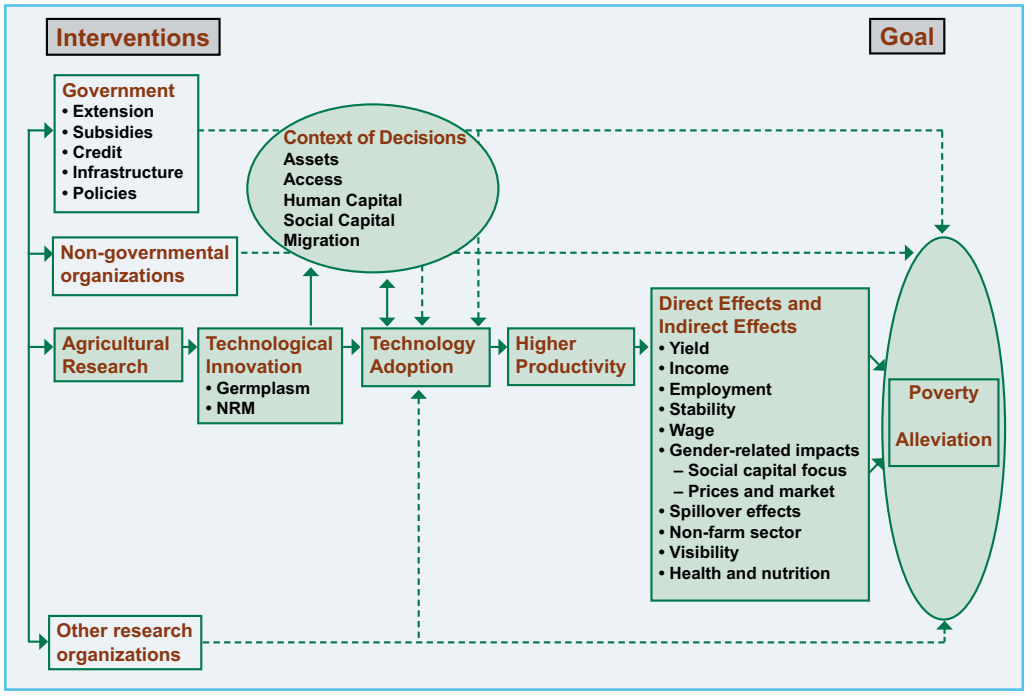

Figure 1. Technology intervention-poverty alleviation linkages: A conceptual framework.

A new agricultural technology is introduced for farmers to harvest better yields with less resource inputs. So the end result would be higher productivity, with both direct and indirect effects. The direct effects of the new technology would be (a) Increase in yield; (b) Increase in income; (c) Increase in employment (due to the need for labor in the farms); (d) Stability of employment; and (e) Increase in wages. The indirect effects would be (a) Equal opportunities for women to participate in the labor force (gender impacts); (b) Increased collective action (social capital, which in itself forms a criterion for adoption of the technology); (c) Prices and market; (d) Spillover effects; (e) Visibility; and (f) Improved health and nutrition.

2.1.2 Gender and Social Analysis Framework

Many development projects have failed because they have not taken into account the complex social relationships – based on gender bias, power and status – within communities and households. Gender and social analysis (GSA) takes apart familiar conceptual units such as the community, the household, and the family. It looks at relationships and distribution and control of resources within them. This learning can be used to design and deliver higher quality projects and empower marginalized social groups.

The framework used for GSA is presented in Figure 2. The framework developed by the World Bank was adapted for this study. The five key entry points of analyses are

- social diversity and gender;
- institutions, norms and customs;
- stakeholders;

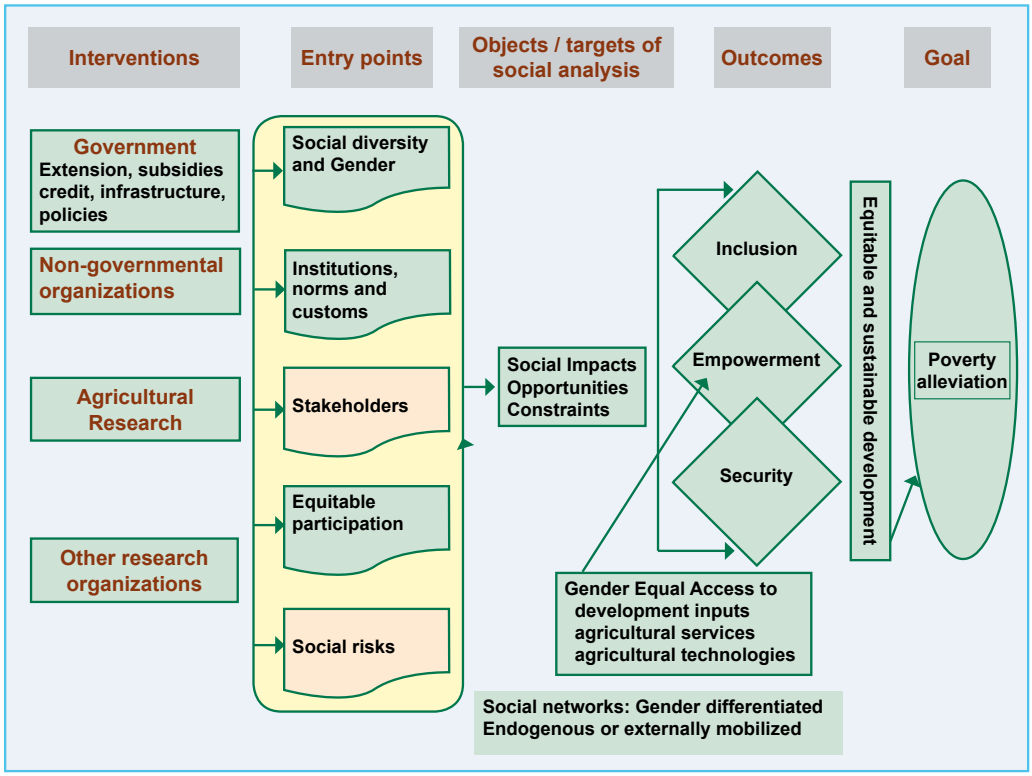

Figure 2. A framework for gender and social analysis.
(Source: Adapted from the World Bank Social Analysis sourcebook).

- equitable participation; and
- social risk.

Social diversity and gender. Social analysis examines how people are organized into different social groups, based on the status ascribed to them at birth – according to their ethnicity, clan, gender, locality, language, class, or some other marker/ status/identity they have achieved or chosen – civil servant, agricultural laborer, local leader, etc.

Institutions, norms and customs. Social groups relate to each other in different ways. Some cooperate, while others compete. Still others may be in conflict. Social analysis examines the groups' characteristics, intra-group and inter-group relationships, and the relationships of those groups with public and private (eg, market) institutions.

It also examines the norms, values, and behavior that have been institutionalized through those relationships. In so doing, social analysis helps us understand the socio-cultural context in which the development interventions take place. Such an analytical process will uncover not only formal organizations and networks, but also the rules – formal and informal – that influence behaviors within those organizations.

Stakeholders. The interests of various groups in the development process are the subjects of stakeholder analysis. Questions are cast in a way that helps to clarify social dynamics – What divisions exist in a society, and which of those divisions really counts in the context of a particular development intervention. Stakeholder analysis examines the characteristics and interests of the vulnerable and the poor as well as those of other stakeholders. In looking at social differentiation, social analysis examines not just where boundaries lie but also how permeable they are

Equitable participation. Social analysis identifies the assets poor people own or control, including the physical and financial capital they are able to mobilize. It also examines their capabilities – in the form of their own human capital (health, education, skills, and experience) and their social capital (organizational networks and relationships).

Social risks. Project interventions that change the terms for provision of goods and services may increase efficiency but also inadvertently increase vulnerability to exogenous factors such as an imperfect market or fluctuations in global market prices. Social analysis examines these risks and explores how the project might address them so as to achieve its development objectives.

Together the entry points help project planners understand how the pieces of the social puzzle fit together, and how to design operations, monitoring systems and evaluations that will maximize the outcome of development objectives and the social development outcomes from interventions.

Social analysis will help in designing a social development strategy into the research paradigm. This is done so by examining the social opportunities, constraints and impacts from the intervention. The outcomes are achieved by measures that (a) increase access of the poor to markets and public services, (b) increase the social and economic assets and capabilities of people, especially the vulnerable and the poor, (c) mitigate adverse impacts and address social tensions and conflict, and (d) increase the accountability of public institutions to citizens. A social development strategy would thus help to increase benefits to the poor and reduce social and political risks that could undermine the gains of development thereby increasing the sustainability of projects. This as a whole leads to equitable and sustainable development paving the way for poverty alleviation.

3. The Case Study process

3.1 Technology selection

ICRISAT carries out research with its partners in the NARES to develop technological innovations in the areas of genetic enhancement and natural resources management. Pilot studies carried out earlier have clearly established linkages between social capital and technology adoption, and their impact on outcomes, especially in terms of poverty reduction. Based on a pilot study, the ICRISAT GPT has been selected as the focus technology for this study. The GPT was specifically developed for cultivation of groundnuts in dry areas, especially to promote cultivation in summer using an improved package of practices, including improved cultivars, and soil, water, and nutrient management options. Appendix 2 provides a history of GPT. Findings from the pilot survey indicated that the GPT would be a good case to understand the technology adoption–poverty alleviation linkage, and at the same time assist researchers to explore the role of intervening factors in the adoption and impact of complex technologies in difficult environments. In view of the earlier gender analysis conducted on this technology, it was also concurred that GPT would provide a good case of the gender implications and impacts of a NRM technology.

3.2 Site selection

The present study was carried out in two villages – Umra (experimental village) and Ashta (control village) in the state of Maharashtra, India, where the technology had been introduced at almost the same time in 1987.

This study addressed the following questions:

- How does technology adoption lead to improvements in welfare – income, yield, social indicators – for diverse groups differentiated by gender, class, and ethnicity?
- What are the differential effects of the adoption of GPT on men and women in terms of social capital build up?

3.3 Sample selection

In order to facilitate sample selection, a household census was undertaken in both the study villages. Since the main emphasis was to observe the differential effects of technology, ie, gender dimensions in technology adoption with special emphasis on social capital, it was decided to divide the population into two groups. The two groups identified were namely male headed households (MHH) and female headed households (FHH).

The grouping is as follows:

- Female-headed households (includes adopters, non-adopters, tribals, non-tribals, all farm sizes)
- Male-headed households. This group was further stratified into four sub-groups namely
  - Landless households
  - Non-tribals, adopting GPT
  - Tribals, adopting GPT
  - Non-adopters irrespective of social group

Stratified random sampling was adopted to select the sample households for the questionnaire surveys as well as for focus group meetings. The sampling design is tabulated below in Table 1.

3.4 Data collection techniques and tools

Focus group meetings and PRA techniques were utilized to gain insights on the key issues underlying gender dimensions in technology adoption and build-up of social capital and finally tracking the linkage to poverty reduction. Existing benchmark data was used to establish the basis for monitoring changes and impacts. This will enable us to throw light on the actual process by which technology adoption resulted in poverty alleviation, and focus on the issues of gender, empowerment, social capital and exclusion/inclusion. In tracking the benefit flows from technology adoption, it is necessary to establish relationships between different factors and

Table 1. Sample selection, Umra and Ashta villages, Maharashtra, 2003.

Sl.No	Group	Sample size	
		Umra*	Ashta**
1	Female-headed households (includes adopters, non-adopters, tribals, non-tribals, and landless female headed households)	13 (13)	11 (11)
2.1	Landless male-headed households	14 (47)	16 (107)
2.2	Adopters, non-tribals, all farm sizes	14 (50)	3 (23)
2.3	Adopters, tribals, all farm sizes	8 (14)	4 (4)
2.4	Non-adopters irrespective of social groups and farm size	12 (45)	20 (139)
	Total	61 (169)	54 (289)

Note: Figures in parenthesis indicate the total number of households
* 30% of the population was taken as the sample
** 15% of the population was taken as the sample

interventions, which are likely to affect the flow of benefits as well as the groups who may benefit. The tools used for data collection were as follows: a structured interview schedule; GSA tools; focus group meetings; and interviews with key informants.

4. Major findings of the study

4.1 Findings based on quantitative and qualitative data

1. Village profiles. The participation in growing groundnuts by smallholder farmers in Umra as compared to Ashta speaks for itself, when it comes to explaining the role played by the dominance of group action or collective action. Umra has 66% of the smallholder farmers growing groundnut with a 100% adoption of GPT among them, while in Ashta there is an absolute zero percent of smallholder farmers who grow groundnut and adopt GPT (Table 2). One can therefore infer that groundnut is a cash crop in the village of Ashta, and there is a low group action. The cash crop remains with those who have cash, that is the large and medium size landowners; and the poor farmers have no opportunity to invest in groundnut. However, in Umra, as observed by these results and confirmed by the focus group meetings, there is a strong social capital, which enables even the smallholders to adopt.

Table 2. Village profiles – Umra and Ashta, Maharashtra, 2002–03.

Sl. No	Characteristics		Umra	Ashta
1.	No. of households and percentage to total number of households	Farm households	114 (67%)	170 (60%)
		Agricultural labor households	48 (28%)	100 (35%)
		Others	8 (5%)	14 (5%)
		Total no. of households	170	284
2.	Percentage of farm households by land holding size	Smallholder farmers	40 (35%)	69 (41%)
		Medium-scale farmers	35 (31%)	61 (36%)
		Large-scale farmers	39 (34%)	40 (23%)
		Total	114	170
3.	Percentage of farm households growing groundnut	Smallholder farmers	12 (18%)	0 (0%)
		Medium-scale farmers	23 (34%)	14 (47%)
		Large-scale farmers	32 (48%)	16 (53%)
		Total	67 (59%)	30 (18%)
4.	Percentage of farm households growing groundnut in summer	Smallholder farmers	8 (66%)	0
		Medium-scale farmers	12 (52%)	14 (100%)
		Large-scale farmers	24 (75%)	16 (100%)
		Total	44 (66%)	30 (100%)
5.	Percentage of groundnut growing households adopting GPT	Smallholder farmers	12 (100%)	0
		Medium-scale farmers	23 (100%)	9 (64%)
		Large-scale farmers	32 (100%)	14 (88%)
		Total	67	23 (77%)
6.	Percentage of groundnut growing households adopting GPT selected as sample	Smallholder farmers	5 (42%)	0
		Medium-scale farmers	8 (35%)	5 (56%)
		Large-scale farmers	11 (34%)	6 (43%)
		Total	24 (36%)	11(48%)
7.	Percentage of landless labour selected as sample		14 (29%)	16 (16%)

Note: Figures in parenthesis indicate the number of households.
Large farm size: 6 acres and above; Medium farm size: 3.1 to 6 acres; Small farm size 0.1 to 3 acres.

When compared with the benchmark data (1992–93), there is an increase in the number of farm households even though the total number of households is the same (Table 3). This implies that there is an upward mobility in terms of land ownership. Focus group meetings corroborated this finding and also indicated that increase in employment opportunities due to GPT adoption has led to many of the labor households acquiring land.

Table 3. Comparative tabulation of Umra 1992 Vs Umra 2002–03.

Variable	Umra 1992–93	Umra 2002–03
Number of Farm Households	92 (54%)	114 (67%)
Number of Female Headed Households	17 (10%)	13 (8%)
Number of Groundnut growing households	50 (54%)	67 (59%)
Number of Technology Adopters	40 (80%)	67 (100%)
Agricultural labor Households	66 (39%)	48 (28%)
Total number of Households	170	170

Source: Gender analysis surveys, 1993–94.
Gender and social analysis surveys, 2003.

Figures 3 and 4 represent the social maps of the two villages developed by the local people themselves. Through these maps the location of households within the community, social resources, relationships between the community and the resources of individuals within the community is clearly understood.

2. Adoption of different components of GPT. Table 4 shows the differences in the adoption of different components of technology (benchmark and current

Table 4. Adoption of components of groundnut production technology in Umra and Ashta, Maharashtra, 2002–2003.

	Percent of households adopting		
Component	Umra (n=23) 1992–93	Umra (n=67) 2002–03	Ashta (n=23) 2002–03
*ICRISAT cultivars	100%	0%	0%
Soil preparation (Broad-bed and Furrow system)	90%	86%	73%
Seed treatment	85%	88%	87%
Dibbling	95%	74%	90%
Gypsum application	35%	78%	53%
Micro nutrients application	75%	89%	80%
Sprinkler irrigation system	95%	91%	80%
Seed management	95%	22%	20%

* ICRISAT variety no longer used due to non-availability and its long duration. (TAG 24 and TAG 26 used since 4-5 years)
Total number of groundnut growers; Ashta: 30; Umra: 67
Total number of GPT Adopters: Ashta: 23; Umra: 67

Figure 3. Social map, Umra village, Maharashtra, India.

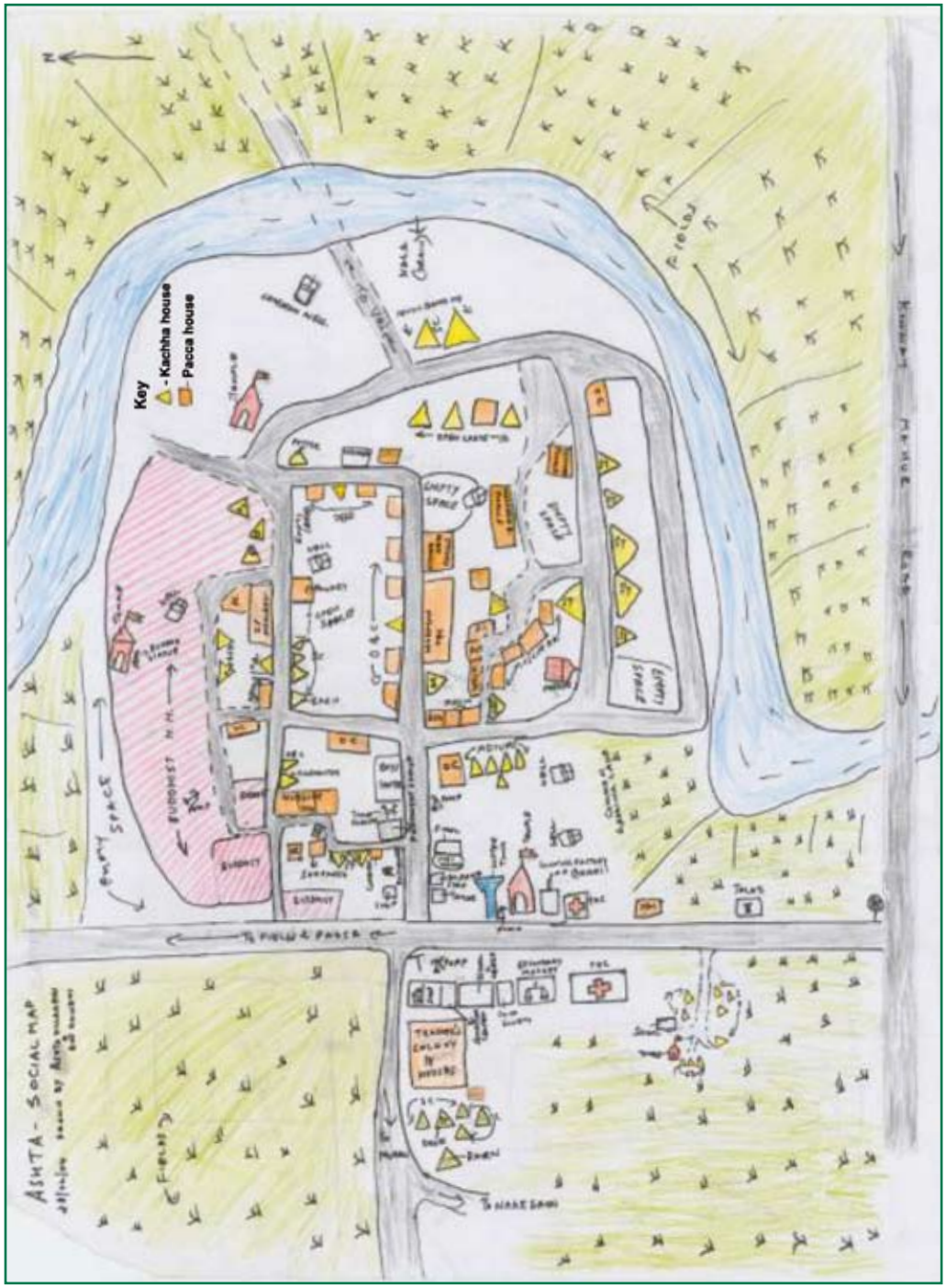

Figure 4. Social map, Ashta village, Maharashtra, India.

study) by sample households in Umra. The benchmark data reveals adoption of components ranging from 35 to 100%. It can be deduced from the table that farm households were essentially interested in ICRISAT seed first, and in order to achieve maximum productivity, adopted the other components of the package to varying levels depending upon their resources. Adoption was high for most other components (85 to 95%) except for gypsum and micronutrient use in the early 1990s. Informal discussions with farmers revealed that non-availability of gypsum and micronutrients were the main reason for their comparatively lower level of adoption. The generation of good quality seed material from the crop, by selection and segregation, for re-use or sale, emerged as an important activity related to the technology package. Thus, this new practice did have gender implications: a new demand was made on women's time allocation – for shelling groundnut pods at home.

The recent data however depicts a different picture. The most striking observation is the zero percent adoption of ICRISAT seed. Two reasons were cited for this: (a) non-availability of seed at the required time; and (b) the longer duration of ICRISAT varieties. Farmers now prefer the improved variety TAG 24 or TAG 26, which are easily available in the market and fits into their cropping pattern very well in terms of crop duration. A majority of the farmers stated that if ICRISAT varieties were made available to them, they would adopt them 100%, especially during the summer.

Another observation is the increase in gypsum adoption. Gypsum is a valuable micronutrient not just for GPT but for other crops as well. The results have shown that social capital played a key role in acquiring this valuable chemical. In Ashta, though groundnut is grown by the rich farmers, their usage of Gypsum is low, because they approach the markets individually where gypsum is available in a very limited way. The little that they use is most of the time bought from Umra farmers. The farmers of Umra on the other hand buy Gypsum collectively, by going as a group to buy it from Rashtriya Chemical Fertilizers (RCF). This gives them a group status, which enables better bargaining power and also quick acquisition of Gypsum.

There is however a decrease in the dibbling method of sowing. Since this method of sowing is tedious, time consuming and back breaking, there were serious complaints by women labor even though it was an important source of additional employment. The men and women farmers got together to discuss this and approached a tool manufacturing firm (through the farmers group), discussed their problem, and after many permutations and combinations came up with an improvised seed drill machine that gave results very near to the dibbling method. This can be used even with the Broad-bed and Furrow (BBF) maker. However, many farmers continue to use the dibbling method of sowing during summer groundnut cultivation

whereas for *kharif* (rainy) and *rabi* (postrainy) groundnut, the seed drill is used. Similarly the use of BBF is also on the decline for summer groundnut cultivation but on the rise for *kharif* groundnut and other crops (chickpea, vegetables) in the postrainy season. Seed management is also showing a downward trend since improved varieties of seed used presently are easily available.

3. Gender disaggregated activity pattern. An analysis of activity patterns is helpful in understanding 'who does what' within a household. With the help of such an analysis, one can assess whether there is a gender-based division of labor. In the context of a technology intervention such as GPT, a comparison of 'with' and 'without' technology situations helps us to understand whether this intervention led to shifts in the gender division of labor, and which activities were most affected. Tables 5 and 6 show the activity pattern of men and women in groundnut production as well as other crops in Umra and Ashta villages.

Results from an earlier survey revealed that the introduction of the new package of groundnut crop production technology resulted in greater gender specificity of the activity pattern (Kolli and Bantilan 1997). Operations hitherto performed jointly have been given increased exclusivity. A reversal in this trend was observed in the present study, especially among smallholder and medium-scale farmer categories who are now also adopting this technology. This trend is a positive one as it reduces inactive periods during the crop tenure among both women and men. A consolidation of activities within the existing gender based division of labor is also observed. The new activities required by the introduction of the technology package were again shared by men and women based on the principles that governed the gender division of labor. An operations-wise labor use analysis, indicated that there has been an increase in the requirement of labor time allocated to production functions of cropping activities due to adoption of the new technology. There is increase in time allocated by both men and women in crop activities other than groundnut also.

4. Decision making on resources and benefits from groundnut crop. Women did not have any exclusive involvement in taking decisions on the use of resources required for crop production activities in either village, except for a lone case in Umra, 2003 (see Table 7). Men, however, reported an almost hundred percent involvement in decision-making either exclusively or jointly with women in both villages. This suggests a total dominance in decision-making of the male member of the farm household with respect to the utilization of resources. Joint decision making by women has increased over time.

In Umra, a number of smallholder farmers grow groundnut and also adopt technology whereas in Ashta, large-scale farmers take up GPT. Hence in the decision making process, most of the key decisions relating to production of groundnut in Umra are joint decisions while it is lower in Ashta. There is however

Table 5. Activity pattern for groundnut crop.

	Umra (% participation) 2002-03			Ashta (% participation) 2002-03		
	Male	Female	Joint	Male	Female	Joint
Field cleaning	10	33	57	8	38	54
Clod crushing	75	25	0	67	33	0
Ploughing	100	0	0	100	0	0
Harrowing	100	0	0	100	0	0
Prep of BBF/ridges and furrow	85	15	0	36	55	9
Trans of organic manure	78	4	17	58	17	25
Appln of organic manure	64	9	27			
Chemical fertilizer (basal)	8	77	15	0	67	33
Chemical fertilizer (top dressing)	13	73	13	0	100	0
Seed treatment	50	17	33			
Sowing/dibbling	4	92	4	0	100	0
Seed drill/resowing	78	11	11	100	0	0
Irrigation (Sprinkler)	88	0	12	58	8	33
Hoeing	81	14	5	100	0	0
Hand weeding	0	100	0	6	94	0
Appln of gypsum, borax, zinc, etc.	47	42	11	44	56	0
Spraying of pesticides	92	0	8	93	7	0
Packing and transport	65	0	35	63	13	25
Marketing	95	5	0	87	7	7
Purchasing inputs	95	5	0	92	8	0
Transport of fodder	78	4	17	69	8	23
Fodder collection from field	36	8	56	15	15	69
Stacking of fodder	57	5	38	33	0	67
Shelling pods and sorting kernels for seed	13	27	60	17	0	83

Table 6. Activity pattern for other crops.

Activity	Umra (% participation) 2002-03			Ashta (% participation) 2002-03		
	Male	Female	Joint	Male	Female	Joint
Field cleaning	7	30	63	8	44	48
Clod crushing	100	0	0	40	40	20
Ploughing	100	0	0	97	0	3
Harrowing	100	0	0	97	0	3
Prep of BBF/ridges and furrow	92	8	0	67	0	33
Trans of organic manure	84	11	5	60	25	15
Appln of organic manure	80	10	10	74	21	5
Chemical fertilizer (basal)	6	82	12	3	74	23
Chemical fertilizer (top dressing)	6	82	12	6	81	13
Seed treatment	74	11	15	57	14	29
Sowing/dibbling	4	84	12	0	83	17
Seed drill/resowing	76	6	18	93	0	7
Irrigation (Sprinkler/traditional method)	93	0	7	100	0	0
Hoeing	81	19	0	95	5	0
Hand weeding	3	95	3	6	81	13
Plant protection	86	0	14	73	7	20
Harvesting	3	41	56	3	31	66
Drying/cleaning	11	33	56	22	22	56
Winnowing/threshing	11	33	56	22	22	56
Packing and transport	73	3	23	70	0	30
Marketing	93	0	7	96	4	0
Purchasing inputs	96	0	4	97	3	0
Transport of fodder	83	4	13	68	4	28

Table 7. Decision making on resources required for groundnut production, Maharashtra.

	Umra 1992-93 (n=24)			Umra 2002-2003 (n=24)			Ashta (n=11)		
	Decisions made			Decisions made			Decisions made		
	Excl. Male	Excl. Female	Joint	Excl. Male	Excl. Female	Joint	Excl. Male	Excl. Female	Joint
Cash	50	0	50	13	4	83	27	0	73
Credit	27	0	73	8	4	63	18	0	73
Seed	45	0	55	33	4	63	0	0	9
FYM	75	0	25	8	4	38	0	0	55
Special Chemicals (gypsum/ micronutrients)	86	0	14	33	4	63	27	0	55
Pesticides	76	4	20	4	0	0	0	0	0
Sprinkler sets	53	0	47	21	4	42	27	0	9
Tools and implements	81	0	19	21	4	50	18	0	45
Network	-	-	-	45	4	51	27	0	9

Note: **Exclusive Male**: Decision taken exclusively by male members of the household
Exclusive Female: Decision taken exclusively by female members of the household
Joint: Decision taken by men along with women members of the household

an exception in the case of credit where the joint decision-making is marginally higher. This may be due to the fact that the groundnut growers and adopters in Ashta are large- and medium-scale farmers where the women in these households generally do not have control over 'on-farm' activities but may have a considerable amount of say in 'money matters'.

The trends of access and control of benefits with regard to groundnut crop in both Umra and Ashta, reveal that in Umra, women have a say in both farm and domestic activities, whereas in Ashta the joint decisions are more only in the domestic sphere.

5. Emergence of group action in Umra. GPT adopters in Umra revealed that collective action and social capital were instrumental in high adoption level of the technology in the village. A few farmers from the large landholding class, with little or no education, initially adopted the technology after it was introduced to them. Initially adoption of the technology was very poor and also there was partial adoption of the technology package. Since the farmers did not have the knowledge to use different components of the technology in the right way, it resulted in more harm than good. For example initially they did not even know how to assemble the sprinkler sets and use water optimally. The small group of adopters was almost on the verge of discarding the technology. It was at that time that a farmers' mela (fair) was organized at the nearby Mahur town. The group of initial adopters together with some other farmers mostly from the medium land holding class went as a group to this fair, participated in the discussions, sought clarifications and accepted the challenge to use the technology. The challenge was taken up by a medium land holding, educated farmer. The Krishi Vikas Mandal (KVM) was formed during this time. Several other farmers joined in this process, and they were very successful since then in using and benefiting from the technology. A striking feature is that it was only when the farmers came together as a group did they realize the potential of the technology package and its benefits. Their success motivated other farmers in the village to adopt the technology. This initial group became the think tank of the village and soon every farmer in the village started coming to them for advice not only on the use of GPT but on all problems related to farming in general.

This successful KVM headed by an effective leader then started innovating on its own with the success of GPT adoption. They started experimenting with implements prescribed for GPT, for other crops namely the BBF and sprinkler system of irrigation. Several modifications were made in the use of the BBF based on the crops for which it is used and the type of irrigation followed. They explored other changes in the cropping system. For example instead of two crops a year earlier they now have three crops a year. They are also growing a wider variety of crops right from food grains to vegetables to green gram and groundnut.

This collective action does not end at the village itself. Smallholder farmers from nearby hamlets (esp, Ashta Toliram tanda) are also approaching this group for advice. Interviews revealed that some farmers who were under heavy debts became debt free due to GPT adoption and working with the group.

The group has become more enterprising with its success. They would now like to explore the use of mulching for groundnut crop and are planning to visit one very successful farmer in Kolhapur district in Maharashtra. They have come to know of this farmer through their associations with other farmers from other villages.

How and why do households form, join and sustain informal and formal groups?

While the KVM is the nodal agency for procuring and sharing inputs, information gaining as well as information sharing, and problem solving related to agriculture, collective action /group action was restricted only to male farmers. There were no women members in the KVM. But spillover effect of this group action was observed among women and they began to form themselves into groups (initially pooja mandal, and later SHGs learning from the experience of the farmers group). Female-headed households also had access to the new technology, tools, inputs and information through male relatives. Our discussions with farmers both men and women revealed that gender may not be a mediating factor for technology adoption. Yet the ability to mobilize themselves leads beneficial impacts for women and their empowerments gains in many ways as indicated below:

- Increase in employment opportunities especially for women, in particular even during the lean season (summer)
- Ability to join the SHGs (since they were earning more money they did not have to depend on male members for contributions to the SHG);
- Increased decision making on participation in SHGs,
- Vocational training courses (tailoring);
- Decision regarding education of children,
- Decision regarding uses of increased income, and dietary habits.

The loan obtained from the contributions of women in the SHG was used in the following order of priority – agriculture, education of children, healthcare, secondary occupations (poultry farming, livestock) and consumption (household durables, repair of homes, jewellery and clothes).

In contrast to Umra, the adoption of GPT is very low in Ashta. One important constraint expressed by them was the lack of knowledge/information about the technology. Though the technology was introduced at around the same time as in Umra by the same group, adoption was low because only a few farmers took up

the technology. They do not have information about the use of BBF. As there was no collective action, the cultivators never tried to get the necessary information from the Umra farmers. Lack of collective action led to non-availability of gypsum and micronutrients, which was another reason for the poor adoption.

Generally speaking Ashta portrays a better picture than Umra in terms of housing and other amenities because of the political connections associated with this village. This village gets a number of welfare schemes run by the government. However benefits of the schemes do not reach actual intended beneficiaries. Large land holding farmers in this village held some political posts or the other in the past and they always try to recall the times when they were the sarpanch (leaders) or etc. Because of this situation there is a lack of trust among the farmers and hence they were very unsuccessful in forming a farmers group. The quality and type of leadership are very significant in the mobilization of social capital. There are too many leaders in this village and hence reaching a consensus is very difficult. In spite of knowing the advantages of collective action (they admitted that Umra is becoming prosperous because of this collective action), farmers and / or the laborers are unable to mobilize themselves into a group and work collectively due to this lack of trust and social hierarchy.

6. Voices of women. Ashta village portrayed a high level of gender discrimination. Most female-headed households belonged to the labor class or had low incomes. Women in this village were unhappy and bitter with the situation. Since women do not have employment all round the year, they are unable to feed their families and hence the food security of the family is at stake. Domestic violence is on the rise as women cannot afford to pay for their husbands' liquor and other vices. Women of this village revealed that they have little or no say in decision-making – either at the household level or the farm. They do not have any voice (meaning there is no value for their feelings) and they are helpless. They are badly in need of more employment so that they can feed their children with the money left after entertaining the demands of men. There was poor attendance and participation in the focus group meetings.

In Umra, when the GPT was introduced groundnut being a 'women's crop' women labor were automatically absorbed into the action. Since they did most of the work in the farms they became aware of the technology, so much so that female-headed households in the village started adopting the technology and began to reap the benefits. The focus group meetings and key informant interviews in Umra revealed that women gained more confidence and had a voice in the village then they had prior to the introduction of the technology. In fact one of the woman respondents said in the social analysis exercise, which determined who according to the farmers was 'rich' in the village, that "whoever has adopted ICRISAT technology was rich".

4.2 Analysis of findings in the context of the conceptual framework

Why should we consider gender dimensions in social capital?

Gender is a social construct superimposing cultural significance onto sexual identity. As the main source of economic and social welfare for its members, the family is the first building block in the generation of social capital for the larger society. Many studies now show that social networks, norms and trust that comprise social capital are important determinants of development outcomes. These informal networks and social relationships are particularly important for women. In almost all societies, women are less likely to belong to formal organizations. They are consequently more likely to rely on kin and social networks for access to resources. Because men and women belong to different social networks, the economic and social consequences of technological choices and developmental interventions impact their social networks and associations in different ways. Traditionally, women are responsible for household welfare and child rearing. Reliance on informal exchange networks is necessary among women and their households to share resources, stabilize incomes, and reduce risks. For women in female-headed households networks are also important for their economic activities. This is especially important because many women are not involved in the formal sectors and as a result are often locked out of information channels, which may help them to survive or even to thrive.

Analysis of qualitative data confirms the well-known tendency for participation in different types of groups to be strongly sex-segregated horizontally, such that membership in most groups and organizations is disproportionately male while others are located more within the female sphere. Almost all groups in Umra were 100% segregated by male and female and the gender gaps were fairly strong. This finding is not particularly surprising, as it confirms popular assumptions, but still it does suggest the need for considerable caution in estimating overall patterns of social capital, since the type of group studied may either exacerbate or underestimate the extent of any gender differences. It also confirms the conventional wisdom, and suggests that studies of social capital need to take explicit account of gender, rather than assuming that this is a gender-neutral phenomenon. Thus, in seeking to explain gender gaps in formal group membership, as the literature suggests, this largely reflects the way in which women and men differ in their informal social networks. Time spent with family members and immediate relatives are more common among women, and this does not necessarily lead people to join formal organizations and community groups. On the one hand gender-related bonding groups, where women talk to women and men talk to men, did have positive

spin-offs for individuals, for groups, and for society. But at the same time gender-based bonding also had negative externalities. It isolated women from opportunities in the outside world, reinforced their role in the homestead and made women more dependent on male relatives for various needs.

Gender dimensions in build-up of social capital

Several studies have found that men and women's personal networks differ in composition, although they are similar in size. Men's networks tend to be more formal since men are more often involved in formal employment. Male networks include more co-workers and fewer kin than women's networks (Moore 1990). This was very true in Umra where the farmers' group (KVM) was a formal organization, whereas women's networks tended to be informal (pooja group, mutual finance group [Chit fund group], the mahila mandal, etc) and include more kin relative to male networks. (SHGs have members across kin groups). In Umra, women were becoming more accustomed to formal groups as a result of their spouses' participation in the formal KVM. Contrary to the findings by Werbner in 1991, it was found that women who were working on the farm as family labor or as paid labor were more aggressive in coming together as a group and discussing their problems and trying to find some solutions to their problems. They are more apt than men to develop friendship networks. Women in this village also are involved in decisions on how the family spends the extra income as a result of GPT adoption – whether to put it back in the farm, or to purchase consumption goods, and this is an integral part of social networking.

Women from low-income group were the one who had the strongest kin and community ties in both Umra and Ashta. Group formation in SHGs did appear to strengthen women's negotiating position; participating women frequently reported a change in their role in household decision-making especially in Umra. Several strategies can be suggested to increase the effectiveness of group action for women. Horizontal networks must be developed, and focus placed on the diversification of skills. This is seen to be emerging in Umra (introduction of vocational training classes for women such as tailoring). Ties between women at different levels of the production and marketing chain should be emphasized, improving the flow of technology and market information and aiding women in entering markets dominated by men.

Results also indicated that social networks to access resources such as sprinkler sets, BBF markers, etc, is particularly important for female-headed households, which can be marginalized in their access to collective action and social networks. We find evidence in Ashta, female-headed households are less likely to participate in collective activities. A significant relationship between being a female-headed

household and the number of times a household participated in collective action during the year was observed. This suggests that female-headed households may be especially disadvantaged in their access to economic opportunities.

The social networks provided different advantages and demanded particular contributions from both women and men who were members of the groups. In Umra, women were excluded from powerful networks, eg, the KVM, and the gram *panchayat* (village council) meetings at the village level. A woman's access to social capital networks outside the household depended greatly on whether other household members, particularly her husband, mediated her linkages. The relative power of males in the GPT adopted households increased as a result of increased incomes. As argued by Pantoja (2000), these changes, together with an absence of economic opportunities for women, weaken women's positions within the household and limit their access to resources. Such a process was especially so in the upper class (large landholding) families in Umra and Ashta.

But in Umra, GPT and SHG formation increased women's access to extra-household networks, irrespective of class and caste. Umra women had access to other groups – the mutual finance group (chit fund), the religious group, etc, but these were of limited economic value. This was not so in Ashta. The only visible groups in Ashta comprised of women were the women SHGs, many of which had ceased operating. Women did not have access to any other networks be it formal or informal.

The focus group meetings also revealed that social cohesion is the most critical input to collective action and improved agricultural outcomes, and those women and women's groups were also an important source of social cohesion. Women spend time together in common work areas and belong to traditional associations and networks that cross the lines of conflict in some fractured communities. It is suggested that where the potential of women's networks is recognized and capitalized upon, development is more likely to become a reality.

Role of social networks in empowering women

Role of individuals: Although networks may indeed empower women and help build and maintain social capital, the characteristics of individuals also play a role. Research from Umra suggests that it is women participating in multiple networks (mutual finance, vocational training, religious groups) who are likely to be empowered and thereby seek greater decision-making roles. Other individual characteristics of such women include a good reputation in their communities and competence in their work. Leaders and catalysts thus play a significant role in enabling group action and obtaining benefits through such action.

Family and kinship ties: Family and kinship ties can generate social capital and empowerment. Marital status is an important factor in shaping participation. The Umra study showed that married women are likely to be in positions of decision making and take an active role in collective decision making meetings because they are better trusted and respected. They are also able to indirectly influence higher-level decisions through their husbands and their own kinship networks. Due to their married status they gain access to additional networks that enable them to generate expanded social capital.

Social networks often operate along gender lines, although literature tends to treat them as gender-neutral institutions. While they may indeed empower women, there are also indications that networks reflect the gendered nature of power relations between men and women. As was seen in Umra, women and men frequently belong to different networks, and many women's programs are set up or operate through women-only groups. While these groups can be important for ensuring women's participation and building their self-confidence, such networks often cannot command and exercise as much authority as men's networks. Under these circumstances, strategies of empowering women through social networks may further isolate them from mainstream decision making processes.

Also, networking requires time, especially when formal group meetings are required. Women in poor households face particularly serious time constraints because of their various livelihood activities and childcare responsibilities. Furthermore, women with little education may feel they will be perceived as "ignorant" or having nothing to contribute, or they may feel they will not be listened to and that it is therefore not worth their time and effort to participate.

The social facilitation process: case of Umra village

The social facilitation was caused by two factors, the major cause being abject poverty, which facilitated the villagers of Umra to come together or perish due to poverty. Secondly, after the *Kisan mela* (farmers fair) Umra was the village that immediately took up the technology, though there were a number of people from other villages present. It was very obvious that all the others in the neighboring villages were observing them. This enabled them to come together and work for the overall betterment of the entire village, which enabled Umra to be a model village where GPT flourished and so did the farmers' economic status. Further, the coming together of villagers was not restricted to men alone, it included women too. Groundnut being a 'woman's crop' and GPT being labor intensive, paved the way for the participation of women. As revealed in focus group meetings, women felt that they became bolder and were able to speak out more than they used to after the introduction of GPT compared to earlier times.

Group dynamics in technology adoption

Farmer's groups are the basis for any interaction with a development agency be it an NGO or an international agricultural research institution such as ICRISAT. Knowledge is increasingly seen as a common good, shared by a limited group to whom it is relevant. This applies particularly in the varied and difficult environments, which characterize most rural development situations, where social and environmental conditions are not uniform, so standard packages of technical knowledge rarely apply. Research is not, in this situation, a public good able to benefit a large number of farmers, and indirectly consumers; it is more like a common good. It is now recognized that in these typical differentiated contexts, it is farmers themselves who are actively generating new knowledge all the time, and effective research must be a partnership of some kind between farmers and researchers. Recognition that there are (perhaps informal) groups already in existence, or social networks which operate effectively, is usually a good starting point. This may be combined with or checked against an analytical approach to identify common interests around which a group can exist. The GPT has had such a kind of impact in Umra village. The introduction of technology motivated the villagers to come together as a group of ten, and then the membership rose to twenty-five. The dynamics that worked in Umra, and which did not work in Ashta, is based on a realization by both the landowner and the labor community about the common good. Umra was under extreme poverty when the technology was introduced and every individual's participation was required. Thus the laborers were given more importance. Though they were not officially members of the group, they played a key role in the adoption process and hence new skills and knowledge were developed. Here the initiative of the group's president was a strong factor in sustaining social capital in Umra village.

The group dynamics that were observed in Umra implies that in a changing social context, people are building alternative forms of social networks, identifying with each other in different ways, and developing trust and reciprocity on this basis. The increasing nuclear families and increasing labour market participation of women may be a basis for this alternative resourcing of social capital. Further, the study also points out that traditional forms of social capital could stifle innovation, be divisive and oppressive, and maintain inequalities (Molyneux 2001, Levi 1996, Schuller et al. 2000). Sharing knowledge and resources across class and caste levels was possible through the KVM formation as it broke the barriers of gender, ethnicity, or social class.

Implications for practice and research

From the literature it can be observed that debates about and approaches to social capital make a distinction between social capital as a resource and the outcomes of

access to or exclusion from that resource. Put in other words, social capital is not the outcomes themselves, but the process that produces those outcomes. Research into the issue, however, has tended to focus on the outcomes of social capital, for individuals or for particular communities, regions or nations. As Portes (1998) and Durlauf (1999) argue, treating outcomes of social capital as its indicator will necessarily find social capital to be related to those outcomes. There has been far less attention to the content and process of how social capital operates, and the area remains reliant on quantitative approaches (Devine and Roberts 2003; van Deth 2003).

This study uses qualitative information to look into the nature of gender and generational relationships within families and communities. This may aid decision-makers and practitioners who develop outreach initiatives that attempt to create social change at family and local levels. As Schuller (2001) points out, the concept of social capital may well be useful in bringing issues of complex social lives, quality of relationships and a long term view to policy-making.

5. Conclusions, recommendations and future directions

Significant lessons are highlighted from the comparative analysis of the sample villages in this study. Firstly, the build-up and institutionalization of social capital was instrumental in high adoption of GPT. Social capital facilitated or played a mediating role in technology adoption. The social capital that was built up for this technology is used for procuring inputs for crop production, access to resources, marketing, knowledge sharing and dissemination, learning, diversification of agriculture, and empowerment of both men and women farmers.

Secondly, the social networks developed either through formal organizations, kinship groups, neighborhoods networks, work groups, or informal interactions and these elements, are critical for social capital. Social networks facilitated communication, coordination, and the provision of information or knowledge regarding agricultural production, income generation, skill enhancement and food security of the family. They created obligations and expectations of reciprocity among their members. Trust, shared understanding and common knowledge generated social capital and hence it can be said that social networks facilitate collective action and institutional effectiveness.

Thirdly, focus group meetings and informal discussions with farmers (both men and women) in the two comparative villages revealed that in the case of exchange of technology the issue of leadership is equally important as that of the structure and composition of networks. The field visit observations highlighted the fact

that networking for the transfer of technology requires not only leadership but knowledge as well. The president of the farmers association in Umra is not a wealthy farmer but comes from a dominant caste group in the village. Eventhough he is not a wealthy farmer he is respected by one and all in the village. It is this access to knowledge, willingness to share knowledge and guide people, and his management skills, which primarily determined his leadership status. Rich farmers may not be interested in seeing middle rank farmers in their village become richer, as was observed in Ashta. Moreover they may not want to do collaborative negotiations to get disparate groups to work cooperatively.

And lastly, findings from the surveys and discussions with different groups show that women of Umra drew upon a range of social networks for reasons of personal and family benefits. The Umra case illustrates that women's groups can be vehicles for both individual and collective women's empowerment in decision making which was not so in the case of Ashta. Some women were occupying important positions in some groups and were involved in collective decision-making meetings. They were trusted and listened to by others. This suggests that networks indeed do generate social capital for individuals, leading to more participation and trust, and creating a "benefit circle" of participation.

Including women in the decision making at the family level and at the community and village level leads to their empowerment. Holistic knowledge regarding farming practices expands choice. In a sense, exclusion of women from discussions related to family agriculture can be thought of as losing out on available talent. It can also be argued that increases in local power may not automatically transfer into power for women if and when the "hidden" transfer of welfare responsibilities to community organizations and households is left unexamined, and for as long as women's community participation is perceived as "outside" the planning and development process.

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Appendices

Appendix 1. Indicators of Social Capital

Bourdieu defines social capital as "the aggregate of the actual or potential resources which are linked to a posession of a durable network of more or less institutionalized relationships of mutual acquaintances and recognition."

The following indicators have all been used in many empirical studies. Indicators of horizontal associations take a micro-perspective and typically have been collected for analysis within a country. The other sets of indicators have been calculated at the national level and have been used in cross-country research.

Horizontal associations

Number and type of associations or local institutions; Extent of membership; Extent of participatory decision making; Extent of kin homogeneity within the association; Extent of income and occupation homogeneity within the association; Extent of trust in village members and households; Extent of trust in government.

Civil and political society

Index of civil liberties (Gastil, Freedom House); Percentage of population facing political discrimination; Index of the intensity of political discrimination; Percentage of population facing economic discrimination; Index of the intensity of economic discrimination; Percentage of population involved in separatist movements; Gastil's index of political rights; Freedom House index of political freedoms.

Social integration

Indicator of social mobility; Measure of the strength of "social tensions"; Ethnolinguistic fragmentation; Riots and protest demonstrations; Strikes; Homicide rates; Suicide rates.

Legal and governance aspects

Quality of bureaucracy; Independence of court system; Expropriation and nationalization risk; Extent of trust in trade unions; Perception of extent of community organization; Reliance on networks of support; Percentage of household income from remittances; Percentage of household expenditure for gifts and transfers; Old-age dependency ratio; Index of democracy; Index of corruption; Index of government inefficiency; Strength of democratic institutions; Measure of "human liberty"; Measure of political stability; Degree of decentralization of

government; Voter turnout; Political assassinations; Constitutional government changes; Coups; Other crime rates; Prisoners per 100,000 people; Illegitimacy rates; Percentage of single-parent homes; Divorce rate; Youth unemployment rate; Repudiation of contracts by government; Contract enforceability; Contract-intensive money (currency).

Appendix 2. History of Groundnut Production Technology (GPT)

The development of GPT in India evolved with the need to enhance groundnut production and yield to meet the rising demand in the country and to reduce the import of edible oils. In 1986, the Government of India introduced a massive program known as the 'Oilseed Technology Mission', allocating more resources to research and technology transfer activities, and offering remunerative prices to oilseed producers, among other measures. ICRISAT, through its Legume On-Farm Nursery Network (LEGOFTEN) was an active partner with the Ministry of Agriculture and the NARS in identifying appropriate technology options for increased groundnut production and transferring these during the period 1987-91. LEGOFTEN yielded desirable results. The area under groundnut expanded from 6.84 million ha in 1987/88 to 8.67 million ha in 1991/92, and production increased from 5.88 million tons in 1987/88 to 7.07 million tons in 1991/92 (Government of India 1993). Production of other oilseeds also substantially increased during the late 1980s.

After reviewing all available and relevant research information and carefully identifying production constraints in the major oilseed-producing regions in India, a technology package was integrated at ICRISAT. This package was thoroughly discussed with the NARS and State Departments of Agriculture. Since a particular technological package performed well in one type of environment and poorly in another, a unique technology package was suggested for each location after characterizing soil, climate, nutrients, water, pests, and diseases. Several on-farm trials and demonstrations were conducted in eight Indian states, covering Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, and Uttar Pradesh. These on-farm trials were launched under LEGOFTEN. During the on-farm trials, the suggested technology options for different locations were regularly monitored, adjusted, and refined to meet local requirements. For example, when the crop showed symptoms of iron deficiency, the application of ferrous sulphate was specifically recommended, and added to the technology package.

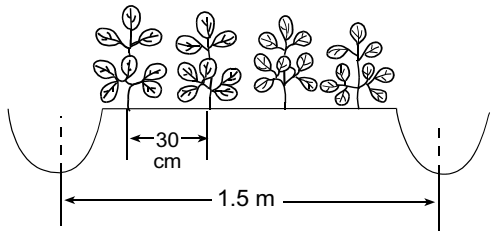
The GPT encompasses several components related to soil, nutrient, crop, water, and pest management. The components of the GPT can broadly be divided into:

- land management: preparation of Broad-bed and Furrows (BBF) for groundnut production;
- nutrient management: efficient application of macro- and micro-nutrients;

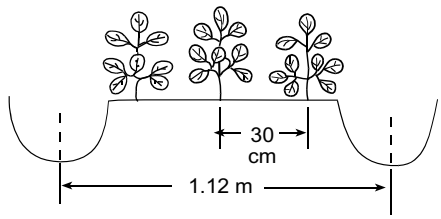
- improved varieties: high-yielding variety seeds, seed rate and seed dressing/ treatment;
- insect and pest management: effective control of insects, diseases, and weeds; and
- water management: Use of sprinkler sets to improve efficiency of irrigation.

Four components of the GPT package were in use by the farmers before the package was introduced: These included (i) improved varieties, (ii) single super phosphate, (iii) seed dressing, and (iv) seed drying. Other components have been developed through NARS R&D, and ICRISAT's Groundnut Improvement Program. ICRISAT's Resource Management and Farming Systems Programs had research data on the land management and configuration system. This area had been extensively researched by ICRISAT scientists since the mid-1970s, so understandably, ICRISAT was interested in the performance of these components. This collaboration with Indian NARS and the Ministry of Agriculture in the technology transfer program provided an opportunity to confirm the suitability and viability of the concept in farmers' fields.

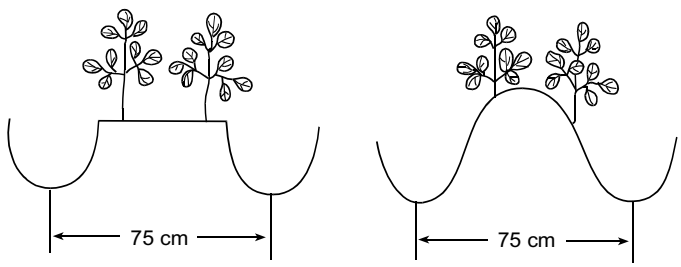
The Broad-bed and Furrow system was viewed as an important component of the GPT. It is prepared by opening a furrow 30 cm wide and 22.5 cm deep at 1.5-m intervals to sow four rows of groundnut with a distance of 30 cm between rows. This specific land preparation system is known as BBF. Over a period of time, the concept of BBF was modified to suit the requirements of the farmers into narrow-bed and furrow, a bed of 75 cm, and ridge and furrow systems (Figure 1). Traditionally, farmers use 1-2 harrowings to sow groundnut on flat land. The advantages of raising the bed and forming furrows were to (i) reduce soil erosion, (ii) provide surface drainage, (iii) concentrate organic matter and fertilizer application, and (iv) reduce soil compaction around plants. It was initially designed for the micro-watershed of the Vertisol technology to achieve optimal use of land and water resources in rainfed agriculture. On nutrient management, GPT suggested a balanced and efficient use of macro- and micro-nutrients to control nutrient mining from the soil. These included use of ammonium sulphate, single super sulphate, gypsum, zinc sulphate, and ferrous sulphate. These were recommended after nutrient deficiencies were detected in groundnut-growing regions. The application of macro-nutrients – ammonium sulphate and single super phosphate – had been previously recommended, and was adopted by farmers even before the GPT was packaged. This recommendation was essential because these fertilizers supply nitrogen, phosphorous, sulphur, and calcium, that are essential for the groundnut crop. Gypsum was recommended as a source of calcium to improve pod development. Zinc sulphate and ferrous sulphate were recommended to overcome zinc and iron deficiencies.



1. Broadbed-and-furrow: ideal for rainy and postrainy seasons, under sprinkler in all soils



2. Bed and furrow: ideal for rainy and postrainy seasons under furrow irrigation in sandy loam soils



3. Narrow bed or ridge and furrow: ideal for postrainy seasons under furrow irrigation in black and lateritic red soils

Figure 1. Broad-bed and furrow method (BBF) of groundnut cultivation.

Potdar and Anders (1995) reported that iron chlorosis led to groundnut yield reductions of 32% for pod, 18% for fodder, and 25% for total dry matter production. Therefore, the use of ferrous sulphate was considered important to increase groundnut yields.

Leaf spot, rust, collar rot, and bud necrosis are common diseases of groundnut. The yield losses due to these diseases were estimated to be 20–25%. Similarly, 15–20% yield losses were caused by insects (Pawar et al. 1993). Collar rot and other seedling diseases are also common in groundnut crops. Very few farmers treat their seed with fungicides. Fungicidal seed treatment was incorporated into GPT package. Similarly, herbicides and pesticides recommended by ICRISAT and NARS, to control weeds and pests before the GPT was developed were also included in the package.

Water management is another important component of the GPT as irrigation water is scarce in the SAT. Irrigation-use efficiency increases with the use of furrows compared to irrigation on flat land. Sprinkler irrigation was included in the GPT to enhance irrigation water-use efficiency.

Varieties developed at ICRISAT were recommended as part of the GPT. Generally, farmers were adopting either local or improved varieties released in the mid-1970s. ICRISAT varieties were high-yielding and less susceptible to pests and diseases. Most of the above components of the GPT package were not new; they were known and independently recommended earlier by various research institutions, including ICRISAT. Ironically, their adoption at farm level was limited, and the most often cited constraints were inadequate information and insufficient resources.

Source: ICRISAT Impact Series no. 2 (Joshi and Bantilan 1998).

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The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

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