

**PROCEEDINGS**

**ASC 2015**

# XII Agricultural Science Congress

## Sustainable Livelihood Security for Smallholder Farmers

**Editors**

A. K. Srivastava | T. K. Datta | K. K. Vass  
V. K. Gupta | S. Ayyappan



**National Academy of Agricultural Sciences  
New Delhi**

**2016**





# Role of Social Networks in Adoption of Technology and Empowerment of Women: Sociological Evidences from Village-Level Studies

R. Padmaja<sup>1</sup>, M. C. S. Bantilan<sup>1</sup>, D. Parthasarathy<sup>2</sup>, Avishek Bose<sup>1</sup>

<sup>1</sup> International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, Telangana, India

<sup>2</sup> Indian Institute of Technology-Bombay, Powai, Mumbai- 400076, Maharashtra, India

## Introduction and Rationale for the Study

There is abundant literature and information produced regarding social networks and the specific roles that women play in these networks and benefits they receive through them. However, much is left to be explored and understood on the role of social networks in increasing women's and men's access to resources and opportunities, and to establish means to map and measure them and how they are gendered. Another important step is to identify how social networks empower women, specifically in terms of increasing their bargaining power. Studies suggest that men and women build and utilize social networks differently, and because the multiple roles that women and women's social networks play it is important to recognize and facilitate networks that can increase household access to necessary productive resources (Flora 2001). Increased participation by women in social networks can increase access to resources such as information about employment opportunities or income during economic crisis.

Likewise, there is a vast body of literature that have considered gender issues in agricultural production and technology adoption and these are receiving importance and are being investigated with greater rigor, encompassing a multi-dimensional perspective. In India also, there a number of studies and research reports which have investigated the technology adoption process especially for agricultural technology, impacts of the green revolution, differential impacts of technology on men and women and finally welfare outcomes ( Padmaja *et al* 2006, Kolli and Bantilan 1997, Kabeer N 2001, and Kelkar G (2009) among others. Most show mixed evidence regarding the different roles men and women play in technology adoption and also the importance of communication and extension services available to men and women farmers in India. This is not an easy task, as poor and marginalized people are often difficult to reach. Rural areas in India have poor communication between government, institutions and farmers, and hence display a low uptake of new technologies.

Systems to communicate new practices and ideas are often ineffective in remote areas. In these areas, it is often informal connections between farmers and the outside world that help to promote technological change. These include relations and friends within a village, and contacts in other villages and urban areas. It is therefore important to research on the social networks in rural poor areas and make better use of the existing communication networks used by the poor. The approach of Peter Blau which considered social positions of the people as one of the core concepts of studying social structure forms the basis and motivation for this study to adopt the approach of looking at relationships and interactions by men and women in the rural setting to achieve the duals goals of 'equity' and 'efficiency' in development and sharing of technology including knowledge.

This is a sociological study focusing on social networks, to understand what formal and informal links and associations mean to the poor in rural communities in India, and how these links help them in improving themselves and their communities at large. Understanding when, why, and how social networks function best is important. A number of studies have acknowledged that technological change in the SAT is slow and less dynamic compared to the regions with better soils, water and irrigation

facilities. The harsh environment of the SAT necessitates collective action as a coping mechanism to overcome the challenges of extreme weather events, and poor resource endowments to bring about significant economic changes.

This paper draws heavily from the PhD dissertation entitled, "Mapping the social network architecture of rural communities: Gender and technological innovations in the semi-arid tropics of India" (Padmaja R, 2012) which is a much more indepth academic and research work on the topic and illustrates a new way to look at gender, technology adoption and empowerment using the network lens.

## Methodology

A mixed methods approach for data collection and analysis is adopted in this study i.e., qualitative and quantitative approaches are used and is based on the experiences of men and women from two villages Kanzara in Maharashtra state and Aurepalle in Telangana state - located in the heartland of semi-arid tropics (SAT) of India. These villages form a part of the larger longitudinal Village-level Studies (VLS) which the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is undertaking since 1975.

This paper establishes the network architecture of men and women in two villages in rural semi-arid tropics in India by mapping farmer networks within the villages and outside. Innovative quantitative and qualitative analysis of social networks is undertaken through a documentation of detailed registries of all individuals in the village as well as their immediate family and business associates, through an enhanced village censuses which captured key transactions and relationships within and outside the village.

The total population covering both the villages is 729 households with 3058 respondents interviewed. To capture social relationships, the respondent is asked for the most important people in the village/ outside the village, whom the respondent has approached for some kind of transactions or other, and the groups/organizations which are a source of information or help to him or her. The transactions are classified into three main categories: Economic transactions, Socio-cultural-political transactions, and technological transactions. In addition to mapping the network architecture, two case studies investigating how Self-Help Groups (SHGs) in Aurepalle influenced welfare outcomes, and the role of kinship networks in Kanzara for diffusion of a specific seed technology were also undertaken. The visual network maps using UCINET software and descriptive analysis of these network maps provided explanations to the questions raised above.

## Documenting the social network architecture

From the documentation and mapping of network architectures in the two study locations it was observed that the rural communities demonstrate social connectedness to a large extent. The degree of social connectedness however varies across villages, across different interactions and transactions and across groups and individuals. The density of networks also varies depending on the characteristics of the region as a result of which people develop interactions and relationships with other individuals, groups and organizations differently. In Aurepalle the economic transactions are more dense and reciprocal because of the profit making motivation of individuals and the community as a result of better access to information, knowledge and infrastructure. Formal networks are fostered and developed as they are treated as important for empowerment economic as well as social in this village. The network architecture of a few households and individuals in Aurepalle reflect the motivation of both men and women to improve their lives and hence the networks with men and women from diverse caste, class and group based associations.



In contrast, Kanzara - where caste plays an important role in society and where the pathway of development is through intensification of agriculture - shows a high degree of networking in terms of socio-cultural and technological transactions. The architecture in this case is simple and clear for Kanzara. Access to technology, new knowledge and links to markets is reaching almost all households in the village. This spread is mostly through sharing of information from one household to another either through kinship bonding and / or caste and family relationship by blood or marriage. Another interesting finding is that while out migration has broken down the network structure to some extent (Kanzara), it has created new opportunities and linkages with the external environment in Aurepalle.

Network architecture differentiated by gender: The network architectures by gender were developed using a random sample of women and men in Kanzara and Aurepalle, covering all three kinds of transactions economic, socio-cultural-political, and technological. The network analysis showed that social networks consisted mostly of dyadic and triadic relationships for both women and men (Figures 1a, 1b, 1c and 1d). However, it was found that women always had at least one male alter with whom they had a direct relationship in their networks and there are few women who act as bridges connecting the different clusters of networks. The network map of men on the other hand shows a more interlinked network and the ties are mostly with other men in the village. The map of the sample women in the village Aurepalle (Figure 1d) also presents an interesting case.

This network also reveals linkages with people/organizations both within and outside the village. However, what is interesting in this case is that there a groups/cliques of small networks among women belong to a particular social group or even a SHG. These small networks are then linked to the other

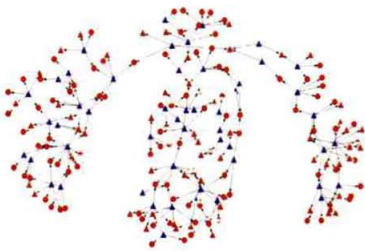


Figure 1a. Network map of sample women for all transactions, Kanzara

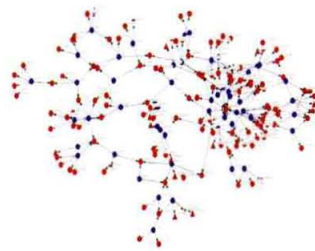


Figure 1b. Network map of sample men for all transactions, Kanzara

Legend: Circle – Men; Triangle – Women; Red color – alter; Blue color – Ego/actor

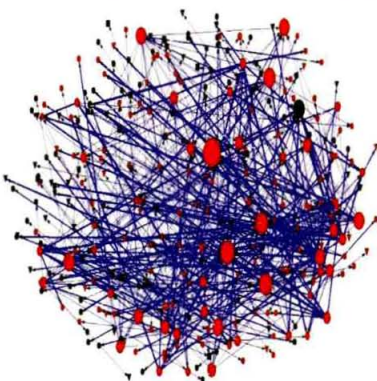


Figure 1c. Network map of sample men for all transactions, Aurepalle

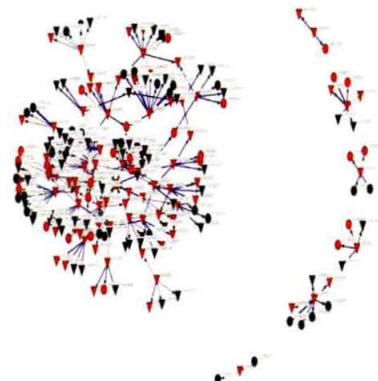


Figure 1d. Network map of sample women for all transactions, Aurepalle



facilities. The harsh environment of the SAT necessitates collective action as a coping mechanism to overcome the challenges of extreme weather events, and poor resource endowments to bring about significant economic changes.

This paper draws heavily from the PhD dissertation entitled, “Mapping the social network architecture of rural communities: Gender and technological innovations in the semi-arid tropics of India” (Padmaja R, 2012) which is a much more indepth academic and research work on the topic and illustrates a new way to look at gender, technology adoption and empowerment using the network lens.

## Methodology

A mixed methods approach for data collection and analysis is adopted in this study i.e., qualitative and quantitative approaches are used and is based on the experiences of men and women from two villages Kanzara in Maharashtra state and Aurepalle in Telangana state - located in the heartland of semi-arid tropics (SAT) of India. These villages form a part of the larger longitudinal Village-level Studies (VLS) which the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is undertaking since 1975.

This paper establishes the network architecture of men and women in two villages in rural semi-arid tropics in India by mapping farmer networks within the villages and outside. Innovative quantitative and qualitative analysis of social networks is undertaken through a documentation of detailed registries of all individuals in the village as well as their immediate family and business associates, through an enhanced village censuses which captured key transactions and relationships within and outside the village.

The total population covering both the villages is 729 households with 3058 respondents interviewed. To capture social relationships, the respondent is asked for the most important people in the village/ outside the village, whom the respondent has approached for some kind of transactions or other, and the groups/organizations which are a source of information or help to him or her. The transactions are classified into three main categories: Economic transactions, Socio-cultural-political transactions, and technological transactions. In addition to mapping the network architecture, two case studies investigating how Self-Help Groups (SHGs) in Aurepalle influenced welfare outcomes, and the role of kinship networks in Kanzara for diffusion of a specific seed technology were also undertaken. The visual network maps using UCINET software and descriptive analysis of these network maps provided explanations to the questions raised above.

## Documenting the social network architecture

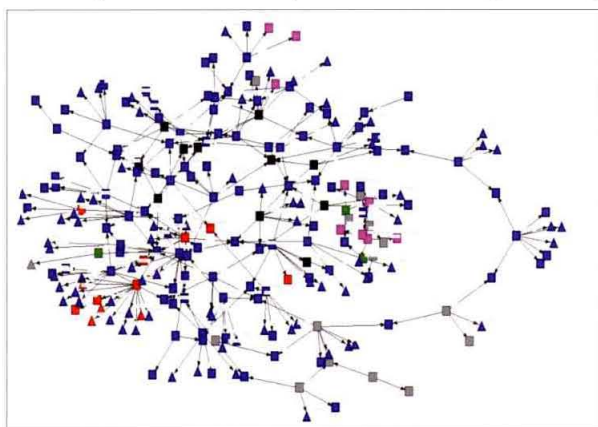
From the documentation and mapping of network architectures in the two study locations it was observed that the rural communities demonstrate social connectedness to a large extent. The degree of social connectedness however varies across villages, across different interactions and transactions and across groups and individuals. The density of networks also varies depending on the characteristics of the region as a result of which people develop interactions and relationships with other individuals, groups and organizations differently. In Aurepalle the economic transactions are more dense and reciprocal because of the profit making motivation of individuals and the community as a result of better access to information, knowledge and infrastructure. Formal networks are fostered and developed as they are treated as important for empowerment economic as well as social in this village. The network architecture of a few households and individuals in Aurepalle reflect the motivation of both men and women to improve their lives and hence the networks with men and women from diverse caste, class and group based associations.

cliques through bridging women members, again these are individual who hold high informal power either through their participation in SHGs or linkages with other individual who hold informal power. The map also shows a few cliques which are not connected to the bigger network. This indicates that inspite of the village progressing through diversification of livelihood sources as well as access to development programs by the government, support of the local leaders and access to nearby towns, some sections of the village, especially women are not totally included in the mainstream development. This calls for further inquiry and a more indepth understanding of the causes for such exclusions.

### Kinship Networks in the Spread of an Agricultural Innovation in Kanzara

Following the attack of Fusarium wilt (a disease which affects legume crops ) for consequent years in the early eighties, farmers of Kanzara were incurring losses especially low yields and were not able to meet their consumption requirements (Bantilan and Joshi, 1996). ICRISAT (in collaboration with ICAR) introduced a wilt resistant variety of pigeonpea (ICP 8863) through the LEGOFTEN program in Karnataka in 1987, where the incidence of wilt was high. Wilt is also endemic in parts of Maharashtra, Andhra Pradesh, and Madhya Pradesh. However, since ICP 8863 has not been officially released except in Karnataka, efforts to popularize its use received no support from the formal seed sector or from extension agencies in the other states. A group of farmers who were risk takers and who were responsible for bringing into the village new innovations in agriculture by being the initial adopters, approached ICRISAT and requested for a wilt resistant variety of pigeonpea during the late eighties. ICRISAT distributed 5 kgs of seed among 5 farmers of the village during 1987-1992. Within a span of 5 years this variety spread throughout the district even in the absence of the state government getting engaged in the multiplication of the seed. The variety and the seed spread were through kinship relations (either by blood or marriage), caste group affiliations, friends and acquaintances alone. The variety still dominates pigeonpea production even till 2009. This is well documented by Parthasarathy and Chopde (2000) as a case study on the adoption and impact of wilt resistant cultivar of pigeonpea (ICP 8863) in Maharashtra.

Responding to the informal request of the early adopters of Kanzara, seeds of this cultivar were given on an experimental basis to five farmers in Kanzara. However, ICRISAT did not provide these farmers any other support except the seeds and also did not promise any monetary remuneration in case the variety failed and the farmers incurred losses. This condition was acceptable to the farmers and they were happy to experimnt and take risk with the small quantity of the seeds they got. Finding success in the first year it was planted and harvested, the farmers shared it with few friends and kin members within and outside the village. The variety spread through the women lineage, distribution to the daughter's marital family as well as to the sons who are living in the same village or in the neighbouring villages. This cycle continued over the next two to three years and the spread of the seed happened not only in the village, but also Akola district and the neighboring districts of Buldhana, Yeotmal, Amravathi



*Legend: Square – in the village; Triangle – outside the village; Color: blue – Upper Caste; red – Nomadic Tribe; Black – OBC; Grey – SC; Green – ST; Pink – Muslim;*

*Figure 2. Network map of sample households in Kanzara who are adopting ICP 8863 variety of pigeonpea.*



and Wardha. Over the next few years, as demand for the seed increased, neither the public sector nor the private sector offered to produce and distribute the seed, and the government of Maharashtra paid little heed to the demand for the cultivar, as well as to the drastic fall in yields as a result of wilt. Thus farmers in Kanzara and later those in the Vidharbha region undertook production and distribution through kin and community networks. The initial spread occurred from the five farmers who were originally given seeds, to farmers in neighboring districts of the Vidharbha region through informal networks. Farmers shared and sold seeds among themselves, resulting in widespread adoption of the technology by the year 1995.

A descriptive analysis of kinship networks in the spread of an agricultural innovation in Kanzara is based on qualitative data collected mainly through face to face interviews with early innovators and adopters, key respondent interviews, and random interviews with small groups of people. This case study provides an excellent illustration of how farmers use their social capital through village, caste, community and kinship networks to produce and distribute a seed technology not only within the village but also to Akola and the neighboring districts of Buldhana, Yeotmal and Wardha in Maharashtra. The social networks especially kinship networks, played a crucial role in diffusing the technology, and in the production and distribution of seeds. This spread shows how even in the absence of an apathetic and inefficient bureaucracy and an uninterested seed sector, technology adoption and diffusion can take place through networks of kin, relatives and friends.

Complementing the descriptive analysis with a documentation of the network architecture of farmers who are adopting this pigeonpea cultivar, identifying some actors from whom they received either seeds, or advice, or knowledge about this cultivar. This network map (figure 2 ) is drawn using the responses of the sample households belonging to the ICRISAT VLS. From the map it can be clearly seen that the exchange of new knowledge is through the same caste group. Farmers belonging to the upper caste continue to play a key role in the spread of the technology either within the village or even outside the villages.

This case demonstrates that once a technology is accepted and adopted by a group of farmers, other farmers observe its performance and then approach the early adopter for knowledge, information as well as sources from where resources and inputs can be accessed from for this technology. The social networks based on caste prove to be one of the channels through which the technology spreads in the initial years. The failure of the government to provide the farmers with necessary inputs as well as knowledge prompts farmers to turn to their kin networks and networks based on caste for the necessary knowledge. These networks based on kin also interact with other networks and the spread of information and knowledge continues. This was how this variety spread to the entire village. But the point to be noted is that the early adopters used their social capital outside the kinship networks to get access to this new seed technology. These focal points/nodes/groups of individuals are therefore the change agents in this case.

### **Self-Help Groups as a Vehicle for Empowering Women in Aurepalle**

In the cultural context of India, most rural women are credit constrained, with limited decision making and bargaining power within the household, and have limited access to the labour market. Some argue that women are amongst the poorest of the poor and the most vulnerable of the underprivileged and thus helping them should be a priority. Hence providing microfinance to these

rural women through the mechanism of Self Help Groups has been hailed for its positive economic impact and the empowerment of women. The concept of empowerment has different dimensions of



interpretation. Empowerment refers to increasing the spiritual, political, social or economic strength of individuals and communities. The empowerment approach also focuses on mobilizing the self-help efforts of the poor and enables one to gain power, authority and influence over others, institutions or society.

Looking at the issue of empowerment from a network perspective, in Aurepalle, the formation and functioning of the women SHGs have resulted in women:-

- Having decision-making power of one's own
- Having access to information and resources for taking proper decisions
- Having a range of options from which to make choices
- Ability to exercise assertiveness in collective decision making
- Having positive thinking on the ability to make change
- Ability to learn skills for improving one's personal or group power
- Ability to change others' perceptions by democratic means
- Involving in the growth process and changes that is never ending and self-initiated
- Increasing one's positive self-image and overcoming stigma
- Increasing one's ability in discreet thinking to sort out right and wrong

For the women in Aurepalle, empowerment is to allow them to gain knowledge, skill-sets and attitude needed to cope with the changing external environment and the circumstances in which they live. The first and foremost benefit was the ability to come together and form a network which has a multiplier effect more women are able to come together and collectively engage in economic and socio-cultural and political activities. SHGs have also economically empowered poor rural women to gain economic strength as a group as well as reduce transaction costs for borrowers and lenders. In Aurepalle, SHGs have become a dominant, important and effective means for empowering women.

Micro-financing by the SHGs has given the women in the village and their families a new gateway to create new livelihoods and a source of credit in case of emergency need. It has also created a foundation for the women in the village to be more empowered, take part in the decision making process in the household, contribute to the income stream in the household and put their talents to work in the mode of a livelihood. The women of Aurepalle are very dynamic and tacitly knowledgeable. The women have mostly invested in their children's education or on income generating activities. Few were interested in purchasing jewellery or using the funds for consumption purposes. Due to the loan installment being very small and a manageable amount every month, the probability of loan default was very low. Also since the groups are formed cohesively on personal relationships the members of the group ensured that each member is keeping accordingly to the repayment requirements. Therefore the groups efficiently function in terms of credit worthiness.

This case study is a good example to demonstrate how membership into SHGs has actually helped them to increase their transactions with other actors as well as groups in the village. Aurepalle village has many case studies which prove that the SHG network has bought about broader level

changes at the individual, household and community level as well. Some of the broader level changes bought about by the SHGs especially for women include increase in confidence levels of women; entrepreneurship skills (diversification of livelihood sources moving from the traditional to the more contemporary small businesses, managing milk collection centres by women, blending traditional crafts to modern uses) as well as negotiating with government officials, and additional funds for community





development. To quantify this statement is beyond the domains of this paper but the descriptions and anecdotes prove this point to a great extent.

## Conclusions

This study makes an explicit use of social network analysis methodology in order to provide empirical support to diffusion of innovation theories from a social networks perspective. It examines social relationships of households and individuals at a micro- and macro-level through an analysis of whole networks of communities or groups.

The vagaries of weather and the frequent dry spells and drought episodes in the semi-arid tropics mandate collective action and behavior as a coping mechanism to tide over these negative events. The remoteness of the villages, poorly developed communication channels in many areas in the SAT, and disincentives for government staff to reach these hitherto marginalized areas create a necessity for people in these regions to build networks of practice for sustainability, as well as to improve their incomes and standard of living. The very nature of the region plays an important role in influencing formation of networks both informal and formal. This unfavorable setting necessitates people to develop informal networks based on caste, class, kin, occupation and location to get access to resources, services and information. As opined by Munshi (2004) information flows less smoothly in a heterogeneous population. The role of social networks in terms of caste, kinship or even class in spread of information therefore becomes more important in the SAT.

There is very limited literature on the role of social networks in improving technology uptake in the SAT. In the absence of government support through agricultural extension, an avenue for new knowledge and information is through social networks of men and women. The two case studies from Kanzara and Aurepalle clearly bring out that formal and informal social networks that already exist can be tapped for this diffusion, new networks can also be built for specific purposes. The findings also lead us to the conclusion that men and women access and use networks differently. Therefore mapping the social network architecture of men and women in rural communities helps us to identify entry points for innovation and also identify gaps and weak links, and how these can be filled and strengthened so that the spread of an innovation is faster and reaches all sections of the community.

Qualitative insights from this study suggest that actors men and women compare themselves and their options to those in structurally similar positions, and the ability to choose different options is patterned by the social structure to which they belong. Women in the two study villages evaluated their options vis-à-vis the alternatives of similarly situated others in the social network. This explains the differences in the position of women across the two villages. In Aurepalle, women emulated other women holding an advantaged position in the social network (the SHGs) and therefore were empowered. In contrast, women of Kanzara were rooted in kinship ties and relations and hence not

able to come out of that structure and convert their constraints to opportunities. These two case studies throw some light on how norms and feelings of relative deprivation or advantage evolve based on the structure to which men or women belong to. From an everyday perspective, gender roles and responsibilities continue to be traditional and dichotomized. Women in both villages continually strive to engineer a fit between the imperatives of change be it technological, social or policy-related and their divergent life circumstances

From a broader development perspective, the findings of the study suggest that policy interventions and government support must target areas where the network linkages are weak or missing or lacking. This study clearly brings out that in some village the rural communities have strong bonding capital (e.g.



kinship) but have limited bridging capital with the external environment. The interventions and support should be geared at building or facilitating such connections and networks. Especially from a gender perspective, these kinds of linkages and networks with the external community either within the village or outside the village for women can help in restructuring the social fabric and empowering women through a self actualization process.

## Acknowledgments

The authors wish to acknowledge the assistance of the Senior Field Supervisors and the field investigators support - VK Chopde, Y Mohan Rao, K Ramana Reddy, N Ramakrishna, Ranganath, Anand Dhumale and Likitkhar for collecting the data. Dilip, Balaswamy and Ravi garu, Dhanyavadamlu for providing the data. Thanks to Arun Kiran and Sudha also for providing the historical VLS data. ICRISAT for providing financial assistance to undertake this field work in the two study villages.

## References

- Bantilan, MCS and Joshi PK (1996): Returns to Research and Diffusion Investments on Wilt Resistance in Pigeonpea, Impact Series 1, International Crops Research Institute for the Semi-Arid Tropics, 36 pp.
- Conley, TG and Udry, CR (2010): 'Learning about a New Technology: Pineapple in Ghana', *American Economic Review*, Vol 100, No 1, pp 35–69
- Doss, CR (2005): 'Analyzing Technology Adoption using Microstudies: Limitations, Challenges, and Opportunities for improvement', *Agricultural Economics*, Vol 34, pp 207-219.
- Flora, CB (2001): "Shifting Agroecosystems and Communities." Pp. 5-14 in *Interactions Between Agroecosystems and Rural Communities*. C. Flora (ed.) Boca Raton: CRC Press. Pp 5-14, <http://www.ag.iastate.edu/centers/rdev/pubs/chapter2.pdf>
- Granovetter, M (1973): 'The Strength of Weak Ties' *American Journal of Sociology*, Vol 78, No 6, pp 1360-1380.
- Hays, S (1994): 'Structure and Agency and the Sticky Problem of Culture', *Sociological Theory*, Vol 12, No 1, pp 57-72
- Kabeer, N (2001): "Resources, agency, achievements: reflections on the measurement of women's empowerment", in *Discussing Women's Empowerment Theory and Practice*, SIDA Studies No. 3.
- Kelkar, G (2009): Gender And Productive Assets: Implications Of National Rural Employment Guarantee For Women's Agency And Productivity. Paper presented at the FAO-IFAD-ILO Workshop on Gaps, trends and current research in gender dimensions of agricultural and rural employment: differentiated pathways out of poverty Rome, 31 March - 2 April 2009, pp 32
- Kolli, R.D. and Bantilan, C. (1997): 'Gender related impacts of agriculture technologies: identification of indicators from a case study', *Gender, Technology and Development*, Vol 1, No 3, pp 371–93.
- Munshi, K (2004): ' Social Learning in a Heterogeneous Population: Technology Diffusion in the Indian Green Revolution', *Journal of Development Economics*, Vol 73, No 1, pp 185-215.
- Padmaja R. (2012). Mapping the social network architecture of rural communities: Gender and technological innovations in the semi-arid tropics of India. PhD dissertation accepted by the Indian Institute of Technology-Bombay.
- Padmaja R, Bantilan MCS, Parthasarathy D and Gandhi BVJ (2006): 'Gender and social capital mediated technology uptake', Impact series 12. International Crops Research Institute for the Semi- Arid Tropics, pp 54.
- Parthasarathy D, Thekkekara TF, Poonacha V (Eds.) ( 2011): 'Women's Self Help Groups Restructuring Socio-Economic Development,' Dominant Publishers And Distributors Pvt Ltd, New Delhi, 191 Pages
- Parthasarathy D and Chopde, VK (2000): 'Building Social Capital: Collective action, Adoption of Agricultural Innovations, and Poverty Reduction in the Indian Semi-Arid Tropics. Paper presented at the Global Development Network, Japan, 2000, pp 20
- Sewell Jr, WH (1992): 'A Theory of Structure: Duality, Agency, and Transformation,' *The American Journal of Sociology*, Vol 98, No 1, pp 1-29
- Walker, TS and Ryan, JG (1990): *Village and Household Economics in India's Semi-Arid Tropics*, John Hopkins University Press, Baltimore.