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**Leveraging Social Capital to Transform Communities of Practice into Digital
Knowledge Networks: Theoretical Insights and Experiences**

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Abstract

There is a growing understanding among developmental economists that social capital is a major contributor to the factors of production that determine economic development. However, owing to the inherent ambiguities and imprecision associated with the concept, while much attention has been focused on defining social capital better and understanding its effect on economic wellbeing, the process of social capital creation and destruction remains poorly understood. There is some consensus that social capital is greater when individuals are embedded within a dense network of social ties so that cooperation can be monitored and rewarded by others, or when there is affection amongst individuals that promotes altruism and expectations of future reciprocity.

In Indian agriculture, traditionally, any change in agricultural practices is driven by consensus arrived at by a network of village elders. However, with increased mobility into urban areas as well as the increasing reach of formal institutions, these networks appear to be weakening. Using information and communication tools, we endeavor to strengthen as well as widen these communities of practice and transform them into digital knowledge networks.

The objective of this paper is two fold. First, this paper attempts to succinctly situate the concept of social capital in economic discourse and justify the author's belief that communities of practice represent a stock of social capital. Second, this paper discusses two cases, aimed at transforming communities of practice into digital knowledge networks in the domain of Indian agriculture by leveraging existing social capital. Lessons from the first initiative, named Digital Ecosystems for Agricultural Livelihood played a role in defining the actors and methodologies for the second initiative called agropedia, which is an ongoing program. The paper concludes with some initial evidence on how the transformation, which is far from complete, appears to have strengthened social capital and asserts that this could be one approach towards social capital preservation and growth.

1. Introduction

'The term social capital is here to stay ... as a useful metaphor to draw attention to those particular institutions serving economic life that might otherwise go unnoticed. Once attention is drawn to them, we need to try to understand them and find ways of improving them or building around them.' Dasgupta (1999). Deriving from this quote and the premise that social capital is being seen as a driver of economic growth (see Dinda (2008), Knowles (2005), Eiji (2008), for example), this paper forwards an approach to strengthen development projects by leveraging existing social capital in the Indian agricultural domain. Specifically, we illustrate how information and communication technology (ICT) tools can result in increasing community participation to better leverage common resources, so as to further the aggregation, creation and sharing of agricultural knowledge among the various actors. The role of ICT as only

process enhancing, a mere tool to speed up the transaction without altering the structure or nature of relationships, has changed. Social relations with the associated concepts of trust, reciprocity and cooperation, as denoted by membership in formal and informal networks used by an individual in entering both market and non market transactions (Labonne and Chase, 2008), are linked to the success of any ICT initiative. At the same time a successful ICT initiative to transform existing offline communities to vibrant online ones can foster existing social relations as well as build new relationships (Hopkins and Thomas, undated).

Before reporting on the experiences in implementing this approach, the paper situates the concept of social capital in economic discourse, attempts to understand some measures of social capital in section 2 and takes stock of the changing nature of social capital in Indian agriculture in section 3. A presentation of two live case studies, documenting our experiences in implementing ICT initiatives comprises section 4. Section 5 concludes by summarizing the implementation approach which leverages social capital and fosters it, as has evolved through our practical experiences.

2. Social Capital

Social capital is a relatively new concept in economic discourse, which attempts to bring to the fore “*intangible social dimensions to economic activity such as trust and community*” (Spies-Butcher, 2003). Its importance in understanding and promoting long term and inclusive models of local economic development has attracted the attention of policy makers and social scientists alike (Evans and Syrett, 2007). Social capital can be defined as a set of associations, both horizontal and vertical, governed by networks and norms which foster social trust and are capable of working for the mutual benefit of the group by fostering cooperation and co-ordination (Collier 1998). On an institutional level, social capital is a formation of assets that allows and facilitates certain action while it restricts others. On an individual level, it is a resource that opens up access to (embedded) assets while requiring solid action to maintain. Greve et al (2006) referring to Burt (1992) argues that “*The value of social capital depends not only on how many contacts an actor has, but also on the structure of his relations within the network*”. The processes that turn the individual social capital into institutional capital encompass the creation of normative systems, allocative mechanisms and linkages. Therefore, social capital is a broad notion of both individual and collective levels rather than a one-dimensional resource. While a comprehensive review of conceptual frameworks for and an annotated bibliography of social capital is available in Feldman and Assaf (1999), in the paragraphs that follow some of the key contributions on social capital as they relate to communities of practice and economic development are presented.

Bourdieu (1985) delineated ‘*social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition"*. Coleman (1990) defined social capital by the effect of its absence: “*...social organization constitutes social capital, facilitating the achievement of goals that could not be achieved in its absence or could be achieved only at a higher cost.*”. Bebbington (1999) posits that social capital is closely related to the notion of access. Woolcock (2001) defines social capital as the norms and networks that facilitate collective action. Further, he calls social capital a precious ‘*resource*; arising out of an individual’s kin, friend and associate ties which comprise the asset. Connections among individuals, referred to as social networks, result in norms of reciprocity and trustworthiness (Putnam, 2000). Interactions

among groups of individuals are central to Ostrom's (2000) definition of social capital. This is true of Knack and Keefer (1997) as well as the World Bank (2005).

Durlauf and Fafchamps (2004) focus on the effects of social capital when they posit that "*social capital generates positive externalities for members of a group, which are achieved through shared trust, norms and values and their consequent effects on expectations and behavior. The shared trust, norms and values, themselves arise from informal forms of organizations based on social networks and associations.*" While describing the process of formation of social capital, Lin (1999) defines social capital as "*the investment in social relations (individual level) and networks (group level) through the utilization of which the entrepreneur gains access to embedded resources and enhance returns*". Sobel (2002), who has critiqued the concept in great detail, defines it as "*circumstances in which individuals can use membership in groups and networks to secure benefits.*" It is important to note that social capital is a measure of the capacity for self-enforcement, or voluntary group enforcement as opposed to third party-enforcement. An exhaustive summary of definitions of social capital is tabulated in Knowles (2005) who extends the compilation by Durlauf and Fafchamps (2004), and likens it to informal institutions as put forward by North (1990).

Searching through definitions, some keywords appear to be particularly popular. *Norms, rules or procedures* along with *resources* and the matter of *access* emerge as the driving notions of the discourse on social capital. Scholars present *trust and reciprocity* as constitutive parts of social capital. Social capital seems to have enabling and restrictive attributes. *Networks and relationships* serve as the platforms on which every social capital exertion takes place. Thus, most definitions of social capital include the concept of trust, networks and group memberships, and a shared set of co-operative norms.

2.1 Social Capital and Economic Performance

Woolcock and Narayan (1999) identify four distinct approaches to understanding the role of social capital as it pertains to economic development, as represented in Table 1. They conclude that the synergy view, with its emphasis on incorporating different levels and dimensions, and its recognition of the positive and negative outcomes that social capital can generate, has the greatest empirical support relating social capital and economic growth. Existence of social capital results in the resolution of collective action problems, without recourse to government intervention, a greater likelihood of revolving credit schemes being successful, less time spent monitoring workers, greater innovation, and a greater number of transactions taking place (Knowles, 2005). However, there are also arguments to suggest that social capital can act as a brake on economic development. For example, some sets of norms discourage the introduction of new techniques and ideas. Beugelsdijk and Smulders (2004) conclude that for Europe, bonding social capital results in reduced bridging social capital which in turn reduces regional output growth. It is quite possible that farmers may be reluctant to introduce new techniques that would improve productivity, because this would go against the established way of doing things. For example, Rogers (1983) discusses the example of a Peruvian village whose inhabitants largely refuse to boil their drinking water because, according to local custom, only the sick are permitted to drink boiled water. Social networks, such as guilds, cartels, the mafia, political organizations and lobbying groups may provide benefits for members, but this can often come at the expense of non members (Ogilvie, 2004).

Table 1. Four Views of Social Capital. (Source: Woolcock and Narayan, 1999)

Perspective	Key Actors	Policy Prescriptions
<i>Communitarian View:</i> Local associations	Community groups, Voluntary sector	Small is beautiful' Recognize social assets of the poor
<i>Networks View:</i> Intra ('bonding') and inter ('bridging') community ties	Entrepreneurs, Business groups, Information brokers'	Decentralization Creation of enterprise zones 'Bridging' social divides
<i>Institutional View:</i> Political & legal institutions	Private and public sector	Grant civil and political liberties Transparency, accountability
<i>Synergy View:</i> Community networks and state-society relations	Community groups, civil society, firms and states	Co-production, complementarity, Participation, linkages Scaling up' local organizations

Nevertheless, researchers have shown statistical associations between high levels of social capital and a range of benefits, including the development of pluralist democracy, improved physical health, self-rated happiness, public safety and enhanced economic performance and efficiency. The degree of social capital promotes efficiency improvement and capital accumulation at the same time, in contrast to human capital only enhancing efficiency improvement (Eiji, 2008). For a firm, while existence of social capital improves the learning effect in developing stages, human capital drives learning in later stages of maturity and social capital could have detrimental impact. The more people interact with each other, the better the information they will have about each other, improving the flow of information about best practice techniques, making the introduction of new technologies more likely, and hence increasing the level of productivity. Networks and membership of groups may also help overcome the impediments to information flows due to social divergence.

Some of these associations are merely correlational, while others are almost certainly causal (Johnson et al., 2005). A high degree of trust (worthiness) is required to ensure that members do not free ride, and individuals who are well networked will have good information about other potential members of the scheme (Narayan and Pritchett, 1999). Community-based institutions may also be formed to manage common property resources. In a low-trust environment, entrepreneurs will assume that workers will shirk unless closely supervised, so to reduce this risk supervisors will be hired, reducing productivity. Paldam and Svendsen (2000) argue that a lack of social capital prevents small firms growing into large firms in many parts of Africa for this very reason. With regards to transaction costs, Fafchamps and Minten (2002) argue that when trust is present agents can “*lower their guard and economize on transaction costs such as the need to inspect quality before buying, or the need to organize payment in cash at the time of delivery.*” They go on to argue that trust “*enables agents to place and take orders, pay by check, use invoicing, provide trade credit, and offer warranty*”, noting that these features of markets are taken for granted in developed countries, but are often lacking in developing countries. Fafchamps and Minten (1999), in their research about Madagascar traders, measure the direct benefits of social capital in terms of value added and in total sales of traders; screening in the labor and credit markets, reduction of the search costs for market opportunities, improvement of the diffusion of information on innovations as well as on bad payers or cheaters and finally the reduction of risk. Moreover, Tsai and Ghoshal (1998) derive the conclusion that intra-firm social capital

facilitates the creation of value by spreading techniques and enabling innovation. Wallis et al.(2004) summarize the impact of social capital by stating that “(it) *makes a measurable contribution to economic performance and human wellbeing, particularly in developing countries.*”

The most significant outcome of social capital utilization is the access to an aggregation of embedded resources. In an entrepreneurial environment, Portes (1998) presents examples of such embedded resources related to economic activity; such as access to credit, obtaining valued credentials etc. The arguments discussed so far tend to suggest that social capital will affect the accumulation of *other* factors of production, or affect the level of total factor productivity, rather than social capital being a new factor of production in its own right. It can leverage physical and human capital and reduce transaction and monitoring costs. For example, if social capital leads to the establishment of informal credit markets, this will facilitate the accumulation of physical and human capital. When social capital helps resolve collective action problems, efficiency is increased. If social capital reduces transaction and monitoring costs, or leads to the introduction of new technologies, this will increase the level of total factor productivity.

2.2 Communities of Practice

Economists view the community both as something that can be explained by economic phenomena and as an explanation for economic outcomes; that is, the community itself can be the object of interest, or the nature of community can help to explain other objects of interest (Johnson et al, 2005). Social capital is used as a measure of strength and weaknesses of the community. The construction of communities or social networks, defined as “*each one’s reticulations, and the fabrication of institutionalized group relations*” need various investments of economic and cultural capital (Portes, 1998) as well as time and skills (Lin, 1999). Social networks result in reciprocity expectations and the group enforcement of norms that guarantee that the investments bring back returns (Coleman, 1988). Social networks are usually formed among people in proximity of each other who share commonalities of interest (Hopkins and Thomas, undated). In the context of agriculture, such networks, communities of practice are among the farming community, trading community etc, with livelihood comprising the common interest.

A community of practice comprises members and the links between different members and different groups in a community, forged through various media, whether digital or in person. The community grows as there are more reciprocal interactions among the members, and as some members form link nodes to other communities of practice. In the rural context, an instance of formation of such link nodes could be marital connections in geographically disparate villages. Since such interactions lead to reduced transaction costs for economic activity, social capital is enhanced both by the deepening of the network (bonding social capital¹) and widening (bridging social capital¹). However, communities with too many reciprocal ties as compared to ties with other communities of practice run the risk of group-think (Dasgupta, 2003), which then has a negative impact on development, and would represent a reduction of social capital. Several factors have led to a destruction of social capital including neoliberal ideology, unchecked markets, unemployment and technological change (Leicht, 1999). With human resources becoming increasingly mobile, maintaining social capital, embodied in communities of practice or social networks is becoming increasingly challenging. One way to overcome the challenge is to create virtual links for communities of practice in addition to the face-to-face mode of communication that they

are used to. If this process is implemented in a manner so as to not disturb the existing social capital, then at the very least, networked communities of practice could use the greater reach of the ICT initiative to reach out to other communities of practice and enhance their weak links if not deepen their existing links. We refer to these networked communities of practice as digital knowledge communities, alluding to the knowledge capital that is embedded in these communities.

There is little clear theory on how individuals or communities get more social capital. Although there are suggestions that communities need to build or re-build their social capital, but there are few concrete suggestions for how to enhance it (Clair, 2005). Paldam and Svendsen (2000) summarize some lessons related to building social capital. Bottom-up trust building communities of practice, formed voluntarily based on risk sharing, tend to grow slowly, but have a longer life as compared to top-down third party-enforced communities of practice. These can be built quickly, but tend to have a short life. Whether communities of practice are successful or not varies from location to location, sometimes because of initial differences in social capital.

2.3 Building Digital Knowledge Communities

While trying to build digital knowledge communities, social capital is of interest in the way in which it affects information flows and cooperation within a group and how it affects economic transactions. The '*embeddness*' of economic transactions in social networks was first discussed by Granovetter (1983). He noted that economists abstract social ties away from transactions and assume social order as given, when in reality social order depends on trust, and trust can exist only in the presence of the ties which economists have assumed away. The key to utilizing social capital is to make it a part of the system rather than try to formalize it. The process of social arrangement, or else social interaction, moves under the effect of (1) necessities or bargains imposed by threats and opportunities of the external environment and (2) the internal dynamics of the social group (or social environment) to which the agent belongs. This process creates social capital, which can be quantified through the economic benefits that the relational aspects offer.

When understanding how ICT can be integrated in the development projects, it is reasonable to expect that outcomes are dependent on "*social contexts of design, implementation and use*" (Rosenbaum, 1999). Studies have shown that outcomes of ICT implementation and use in different real world settings, be it in an organization or an educational community, are difficult to predict or replicate, and that the "*contextually dependent nature of ICT's suggests that similar ICT's can have different outcomes in different situations*" (Kling, et al, 1998). We interpret this social context as related to the nature and strength of ties in a social network, and the effects it has on various market and non-market transactions. Thus, the benefits intended by ICT interventions for a community are moderated by the existent social capital in the community and whether the intervention is built on this capital or independent of it. This explains the failure of most ICT interventions to correct social exclusion in the rural communities in India, as in the case of IVRP or ARISNET. (Rajagopalan and Sarkar, 2008a, Sreenivasulu and Nandwana, 2001). In the case of eChoupal, caste barriers prevented lower caste farmers from participating in the network (Bhatnagar and Schwabe, 2000). Social capital can be used to explain this failure in terms of the various groups that are embedded in the community, and the network ties and norms, or the social enforceable behavior that they are governed by. Specific norms within the group, (not permitting different castes to mingle socially, for example) can nullify the benefits of enhanced availability of

information. Improving access to information can thus end up not significantly empowering marginalized members of society

There is a large body of literature that posits that connecting communities using ICT lead to a reduction in social capital (Grootaert, 1999). The general argument in those papers runs as follows. Given the positive role of weak ties on enhancing economic growth, and the propensity of ICT to promote these ties, the proliferation of weak ties moves the individual out of the ambit of his immediate social group and alienates him from his surroundings. Also, when dealing with members outside one's community, the basis for trust is reduced, and the effectiveness of social capital does not translate directly online. At the same time there are papers which admit finding a link between social capital and economic development, but question the direction of causality (Miguel et al (2003), Knack and Keefer (1997), Zak and Knack (2001)). Others suggest that interventions results in bonding social capital being replaced by bridging social capital¹ (see Labonne and Chase, 2008, for example, on evidence from a large scale intervention program in the Phillipines). Yet other papers report the positive impact of ICT based interventions on social capital (Baliamoune-lutz, 2005, Leicht, 1999). What is clear from most of these papers is that the success of an initiative is highly context dependent, and the ability to align the initiative with existing social capital, which itself is an elusive concept. Before moving on to sharing some experiences of the IITK team, I now discuss the context in which their ICT interventions took place.

3. Indian Agriculture

Agriculture directly and indirectly continues to be the occupation and way of life for more than half of India's population. Ensuring a thriving agricultural economy is critical for India's global competitiveness to be "inclusive". A globally competitive Indian economy must be based on a knowledge driven transformation of Indian agriculture because in many ways Indian agriculture has already reached the physical limits of land and water (Rai, 2006). Further sustainable enhancements in production must enhance productivity and biological yields on existing land with similar physical inputs. This necessitates a tremendous thrust to revamp India's agricultural extension services.

This would require a dynamic ICT infrastructure that will ensure quick dissemination of technical information from the agricultural research system to the farmers. The one-way route of the conventional Indian agricultural extension system already suffers from maladies such as remarkably low uptake of information because of time lags and provision of generic information for specific problems. There is a need for rapid transformation of this extension system to a real time and adaptive knowledge exchange network. This network needs to build real time feedback routes from the 'fields to the laboratory' and can derive necessary traction from other industrial and business knowledge management technologies and processes like user to user exchange, expert to expert exchange and KM oriented standards for information storage, retrieval and aggregation with analytics.

With increased mobility into urban areas as well as the increasing reach of formal institutions, informal networks among the farmers appear to be weakening. It is also well

¹ Woolcock (2001) defines bonding social capital as links with family, friends and neighbors, bridging social capital as ties that are slightly more distant, such as with workmates and acquaintances, and linking social capital as the ability to benefit from ties with those outside one's immediate group of contacts

documented that social capital, which has interpersonal complementarities, falls sharply with physical distance (Glaeser et al, 2000). Thus, existing informal institutions need immediate strengthening. Considering that there are nearly 700,000 villages (farming-hubs) in India or, at a more aggregate level, 6000 administrative blocks with more than 100 million potential farmer/trader/agro-industry users of such a knowledge-network, it is surprising that this domain does not attract as yet, sufficient attention. Collaborative research attention from information science, social science, knowledge management professionals and academicians is an urgent need to understand the effective path towards autopoietic knowledge networks and the proclivity of users to become co-creators.

However an over emphasis on technology may drag us back to the pitfalls of modernization theory (Schech, 2002). The primary concern of 'modernization theory' in terms of 'imparting knowledge' and 'transfer of technology' from 'us' to 'them' may soon corrupt an agricultural knowledge network and seek undue resources to remain sustainable. Pilot ICT initiatives that aim to create their own parallel infrastructure to overcome the problems of the existing agricultural network have also experienced problems of high resource intensity and sustainability.

Around 2003, the project team at IIT Kanpur conceived and developed the "*Digital Mandi*", with funding from Media lab Asia. This was a trading platform to enable farmers to circumvent village mahajans and get fair prices for their produce. Moreover, such a mandi had the potential to eliminate geographical barriers, as well as insure the farmers using sophisticated instruments such as futures contracts. The intent was to involve banking and para-banking institutions in the endeavour so as to also address the liquidity crunch that farmers usually face. Despite being released with great fanfare² the project failed to take off and attain a critical mass of users. The reasons for the failure could be that perhaps the concept was too new at that time, or perhaps, the *digital mandi* platform was an additional institutional arrangement introduced into the villagers existing social and institutional framework, and the alignment was not synchronized.

4. Experiences

Given the failure of several well meaning ICT based initiatives in agriculture, we propose adopting a more community centric design for developing an Information System for rural communities. Working in a manner that enhances social capital, rather than undermining it can ensure that users "buy in" to the concept, which improves project sustainability. Moreover continued involvement and use leads to the evolution of a more complex and multi functional ICT enabled socio-technical system. The digital ecosystem (DE) is one such paradigm (Dini and Nachira, 2005).

A DE for a social system needs to deal with heterogeneity and greater variations in actor's abilities and resources to participate in the network. As seen in the case of rural ICT deployment, differences in participants are induced by social and economic factors (caste, income group), level of education and exposure and so on. The vision of a DE as network that finally evolves into an "*agent-based, loosely coupled, domain-specific and demand driven interactive communities which offer cost-effective digital services and value-creating activities that attract agents to participate and benefit from it*", (Dini

² <http://www.iitk.ac.in/news/digitalmandi/>

and Nachira, 2005) makes it capable of accommodating these variations by encouraging the co-existence of different species. This description also underscores the critical importance of participation to the success of a DE – in terms of growth, sustainability and inclusion. It is essential that rather than make recipients of assistance dependent on the provider, the providers should create the right digital environment where recipients can exercise their choice on the nature and extent of assistance they require. A big asset of a DE, in this context, is that it is intrinsically designed to be self sustaining. A DE functions independent of the entry or exit of individual actors. This is achieved by functioning as a platform fostering various economic (business) and social networks involving a multiplicity of actors engaged in dynamic and amorphous interactions. There is no single entity guiding or directing activities and information flows. Instead, all actors share the responsibility of running the network, by sharing information, resources and interacting with others, making the system robust and less resource intensive. What follows is a brief exposition of two experiences of ICT interventions for rural development which have consciously adopted a community centric approach so as to keep social capital intact.

4.1 Digital Ecosystems for Agriculture and Rural Livelihood – A Knowledge Network

Conceived by the IITK team and funded by Media Lab Asia, Digital Ecosystems for Agriculture and Rural Livelihood (DEAL)³ is an ICT enhanced network built on an existing framework of tele-centers in rural institutes, village schools, village level agriculture extension centers (KVKs) and other deployment partners. This framework enhances the coherence and inter-operability of digital content created by different stake holders and thus supports efficient and effective archiving and reuse of knowledge in the domain of Indian agriculture & rural livelihood development

The project aims to create a digital social network by the diffusion of knowledge in the agriculture domain. The stages of the project therefore involved developing a network, transforming it into communities of practice and then to a digital knowledge network. The focus is on understanding the underlying trajectory through which a group of actors transforms from a Community of Practice to a self sustaining digital community. The moderating node in this system is the OPAALS laboratory at IIT Kanpur providing the collaboration and collation technology platform, skills and resources to assist knowledge flows through the network. The presence of Government agencies helps build trust. Agricultural experts and educational institutions are responsible for verification of content generated. Actors (nodes) involved in the project can be seen in associated papers⁴.

Field deployment of the DEAL project was between December 2006 and June 2007. Following this, a study was conducted at the 4 partner KVKs in September 2007 to assess the effect DEAL has had on information flows. A total of 20 agricultural scientists from across KVKs and 5 project team members from IIT Kanpur were interviewed. We elicited responses from actors how exposure and use of different facets of the DEAL project altered their relationships with existing nodes, or if there was a deletion / addition of new nodes. Each KVK scientist was asked to describe the existing links each KVK had with different actors in the extension system, and how they viewed the potential of DEAL in enhancing their access to information flows in the network. The questions about DEAL were open ended and unbiased, and respondents were encouraged to give

³ <http://opaals.iitk.ac.in/deal/>

⁴ Please refer Rajagopalan and Sarkar (2008b) for more details

their honest impressions and opinions about the project, its strengths and weaknesses, the potential for forming new associations, the benefits thereof and lacunae in implementation.

Table 2 lists key members who are part of the network (actors), both before and after the DEAL intervention with their respective role. An exhaustive list of all actors involved is too long wended and does not provide significant additional information.

Table 2 Key Actors in the DEAL Network

ACRONYM	ACTOR DESCRIPTION
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Services
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IIPR	Indian Institute of Pulses research
NSI	National sugar Institute
CSA	Chandra Shekar Azad Agricultural University
NDU	Educational Institution
ZCU	Zonal Co-ordination Body
KVK	Krishi Vigyan Kendra
KVK(P)	KVK at Pratapgar
KVK(D)	KVK at Dileepnagar
KVK(R)	KVK at Rae Barelli
KVK(K)	KVK at Kannauj
SAC(P)	Scientific Advisory Committee
IITK	Indian Institute of Technology Kanpur
PNU	Pant Nagar Agricultural University
KV	Kisan Vidyalyaya
NBFGR	National Bureau of Fish Genetic Resources

The following network diagram, prepared in NetDraw^{5.3}, represents the ties that were present before the implementation of DEAL. The thicknesses of lines are representative of the extent of interaction (strong or weak ties) between the actors. For example, the link between agricultural experts within the same KVK, or between a farmer and his respective KVK are examples of strong ties, while links between KVKs and NGOs are examples of weak ties. In the course of the analysis, we refer to pre-existing, structure based links that individual nodes supply information to or draw information from (or both), as 'strong ties'. By this definition, all links sanctioned by the structural framework of the agricultural extension system are denoted as strong links, and is termed as linking social capital (Woolcock, 2001). However, in practice, most of these channels are too infrequently used by the nodes to be significant. To tighten our definition of strong ties, the agricultural scientists at each KVK were asked to indicate which of the available structural links were mandatory. Apart from that, they were asked to list the nodes in the said network that they had received information inputs from. In theory, all KVKs can, by the extension structure, seek the help or advice of any national research or educational institute that are in the same zone, through the Zonal co-ordination unit. Thus, the potential for extended links is inherent in the system, but without frequent use these

^{5.3} Software from Analytic Technologies

remain links only on paper. Similarly, there exist links between the KVKs and educational institutes like PNU and NDU, but these links are more or less dormant.

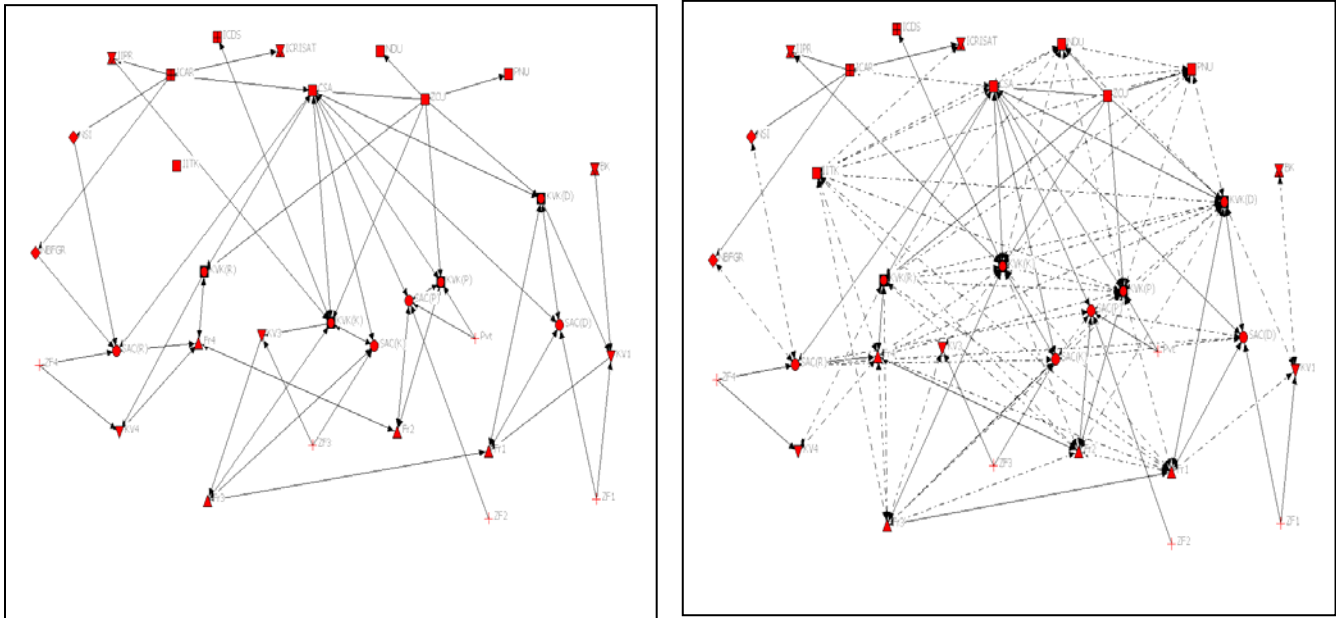


Fig.1: Network Ties before and after implementation of the DEAL initiative

The network shows information flows within and across the community. Here, the community is understood in terms of the village unit. So, within community linkages are those between actors in the same village – for example, between the farmer of a village and the respective village KVK, while across-group links includes links between actors from different villages. In the above network diagrams, we have represented the different flows of agricultural information and the interrelations, both formal and informal. Formal links are characteristic of the reporting relationship between actors, for instance, in the case of a KVK and a ZCU (Zonal Co-ordination Unit), and informal links are characteristic of the social relations between actors, like relations between farmers of adjoining villages.

We can characterize the reporting relationships between members into different layers, administrative, academic and functional. One observation here from the network diagram representing the pre-DEAL scenario is that while there are well established and clearly defined relationships between members from different layers, there are very few formal ties between members of the same layer. For example, the relationship between the ZCU and a KVK, or between a KVK and farmer is close and well directed, but there exist no direct links between the 4 KVKs. Communication is routed through the ZCU, and is conducted face to face at periodic zonal meetings.

After the implementation of the DEAL project, IITK is the only completely new actor introduced into the framework. Its integration into the network is represented by the arrows between it and other nodes, signifying an increase in information flows. The dotted lines represent ties that have been formed due to content co-creation and sharing by partners facilitated by IITK through DEAL, while the solid lines represent the preexisting network ties. By implication, ties formed through DEAL are mostly weak

links (voluntary interaction). These are voluntary clusters of members who are from different groups. Linking together all the actors in dynamic relationships helps retain both strong and weak ties.

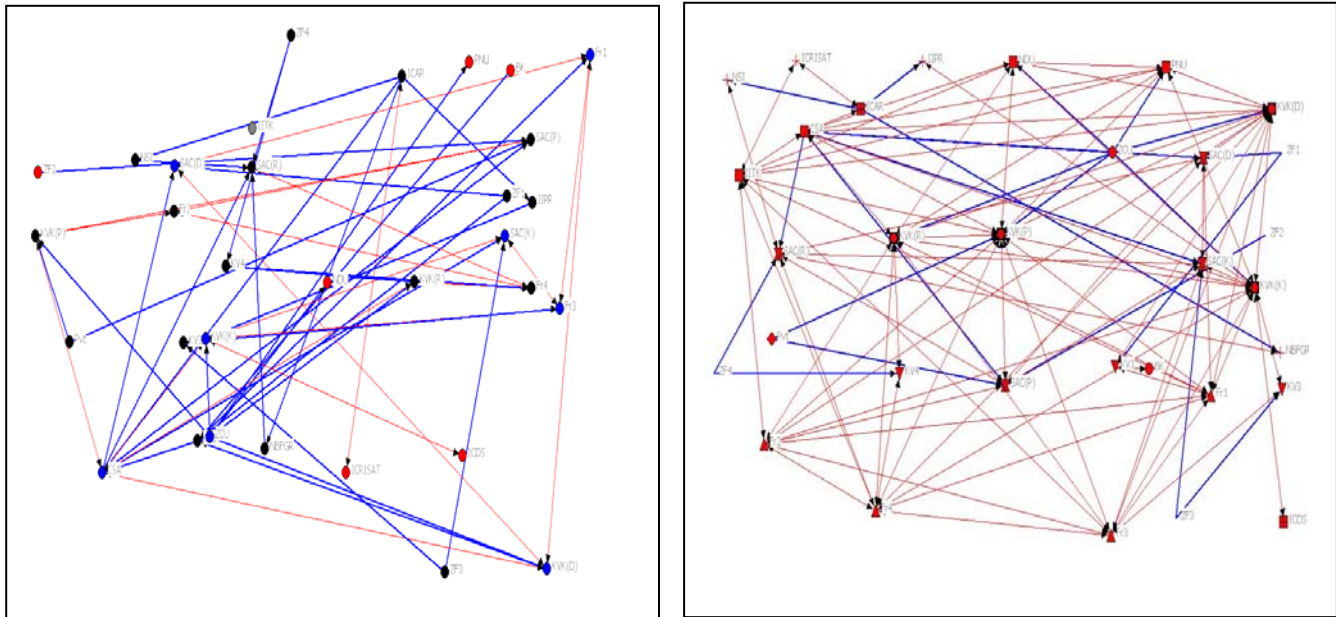


Fig.2: Reciprocal Ties before and after implementation of the DEAL initiative

Salient results⁶ from our data from 25 interviewees using analytical tools provided by Ucinet⁷ indicate that the total number of ties within this network increased from 77 to 183, and no old ties were displaced. This is also clear from Figure 1. No old actors in the network were deleted after implementing the DEAL initiative, while only one completely new node (IITK, the implementer) was added. Several weak links were introduced between existing nodes, signifying greater interaction (and hence innovation), and a deepening of community relations. A quantitative indicator of this increased interaction is the group reciprocity measure increasing from 0.3585 to 0.7745 from the pre DEAL to the post DEAL scenario. Thus, we can conclude that the ICT intervention has led to the enhancement of social capital (Granovetter, 1983, Coleman, 1988). Figure 2 depicts the state of reciprocal ties between members across different layers. The red lines denote reciprocal ties and the blue lines the non reciprocal ties.

As already discussed, in the pre-DEAL scenario, except for the informal links between farmers of neighboring villages, the other links are structurally determined. There are very few reciprocal ties between members of the same layer, for instance, the links between PNU and IIPR are both indirect and non-reciprocal. This lack of reciprocity across layers reflects the top-down nature of the reporting ties between actors from different layers, like in the relationship between the ZCU and a KVK. While a top-down approach is time and cost effective for information dissemination, in an extension setup it causes the network to become more centralized. However, studies in network architecture have shown that a centralized network is ineffective for knowledge sharing

⁶ Details of study available at IITK Deal site

(Fahey and Prusak, 1998; Markus, 2001) as it is resource intensive, error prone and more crucially, does not potentially encourage re-deployment of the stored content.

In the Indian context, with the Government reducing public investment in agricultural extension as well as privatizing its input system, there is a need to make extension and the overall technology transfer system more demand-driven and responsive to farmer needs. To achieve this, a more bottom-up approach is needed which empowers farmers and allows them to more effectively articulate their problems and needs to the research-extension system. The DE design of the system places special emphasis on voluntary participation, and as more members access the network, the number of mutual and voluntary ties increases, increasing reciprocity. After the implementation of DEAL, there is an increase in reciprocal ties (red lines), with a simultaneous decrease in the number of non reciprocal ties (blue lines). Increased reciprocity has a positive impact on content creation, while increased collaboration between members further enhances reciprocity.

Next, the impact of implementing DEAL on information flows within groups and between groups is explored. Unlike conventional ICT interventions, which adopt either a top-down or bottom-up approach, DEAL uses a community centric 'social capital aligned' approach, focusing on increasing ties between members in the same layer, while also building links across the different layers. Figure 3 illustrates the links within and between groups in before and after the implementation of the DEAL initiative. The blue lines represent ties within groups and the red show ties between groups

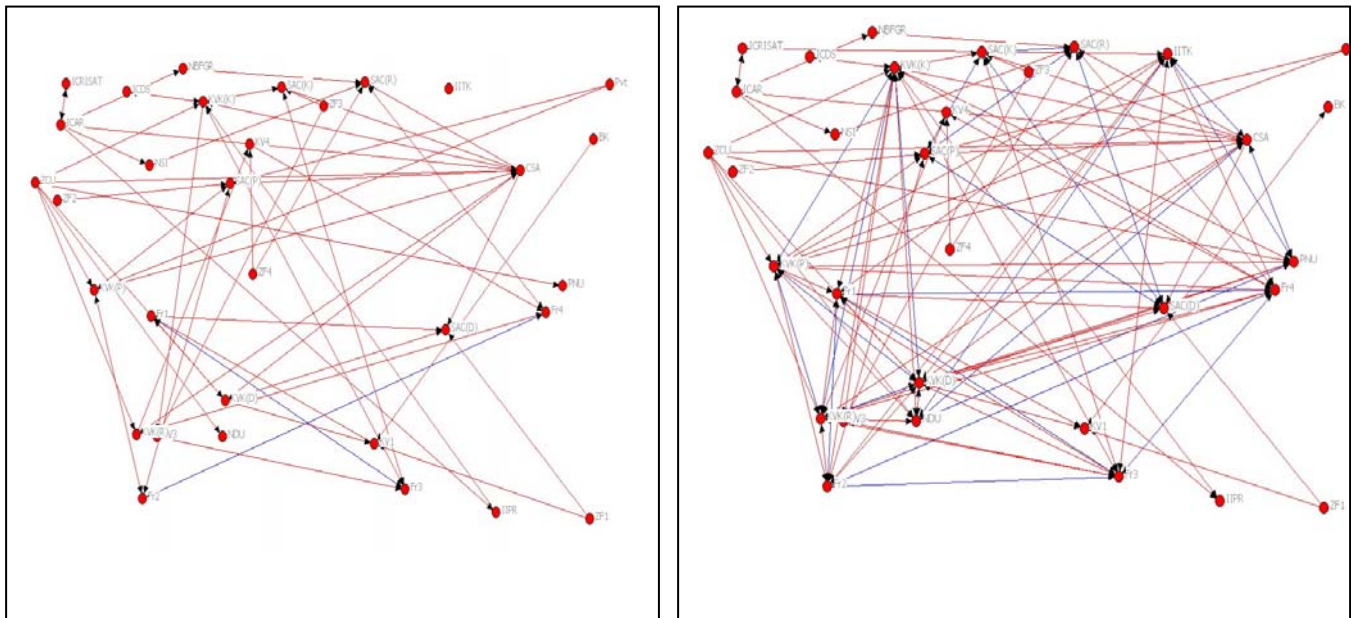


Fig.3 Links within and between groups before and after implementation of the DEAL initiative

In the pre DEAL scenario, as the interviews revealed, there are very few direct informal links between individual KVKs. Majority of the relationships that a node (actor) has is with members from the same geographic community, but has very few ties with other members having the same role in the network, impeding horizontal information flows.

Thus, the local social capital stays locked into the local loop keeping it out of the network.

After the implementation of the DEAL initiative, it is evident that there are now several weak links between different nodes, which are at the same horizontal level. For example, DEAL had provided a platform for different KVKs to share their extension experiences with each other through hosting a website for each of them. Horizontal ties between farmers from disperse geographical areas are enhanced through the use of multiple communication media. The “kissan blog”, a mechanism through which farmers can record their experience in audio mode and share it with all the nodes in the network, resulted in building new horizontal ties. Such novel mechanisms for sharing agricultural experiences strengthen existing strong ties while building weak ties across geographically dispersed communities. This is a distinguishing feature of a digital ecosystem as creating these ties would ultimately lead to the creation of shared norms and values.

Early results seem to indicate support for this approach at a conceptual level, though more field reviews are needed to confirm these results. Criticisms against DEAL include lack of access to computers and internet connectivity, inability to use the machines and/or portal and very bookish (as opposed to practice oriented) content. This is because most of the content was created at IITK, because of the inability of most other actors to add content.

4.2 agropedia – A Dynamic Knowledge Repository of “all things agriculture”

agropedia is an Agriculture Knowledge Repository of universal Meta models and localized content for a variety of users with appropriate interfaces, built in collaborative mode in multiple languages. Conceptualized by IITK, and funded by the National Agricultural Innovation Project⁸, agropedia aims to develop a comprehensive digital content framework, platform, and tools in support of agricultural extension and outreach. It aspires to be a one stop shop for any information, pedagogic or practical knowledge related to extension services in Indian agriculture – an audiovisual encyclopedia, to enchant, educate and transform the process of digital content creation and organization completely. Rather than target the farmer, who does not have access to as much ICT, may not be inclined to harness knowledge through unfamiliar media, and would trust the local seed seller more, agropedia aims at empowering the agents involved in extension, including the local seed seller, who, as a result could share more pertinent practices with the farmer. At the same time, the user can gain peer recognition by engaging in dialogue with other such users from geographically disparate regions, resulting in a win win situation for all. Horizontal networks established and strengthened as a result will ensure the retention and broad basing of social capital, which in turn would render no actor indispensable and the system would continue to function efficiently even if some of the nodes drop out.

There are three dimensions along which agropedia is being developed. The knowledge model dimension provides a mechanism to represent the domain knowledge in a manner that the computer can understand. Having such a domain model, it is possible to attach semantic attributes to all the material in agropedia, which facilitates indexing, semantic searching, as well as can support a host of decision support applications. The

⁸ <http://www.naip.icar.org.in/>

other two dimensions are the content dimension and social networking dimension, both of which depend on the standardized framework that the knowledge model dimension provides for structuring knowledge nuggets. Figure 4 provides a birds-eye view of agropedia.

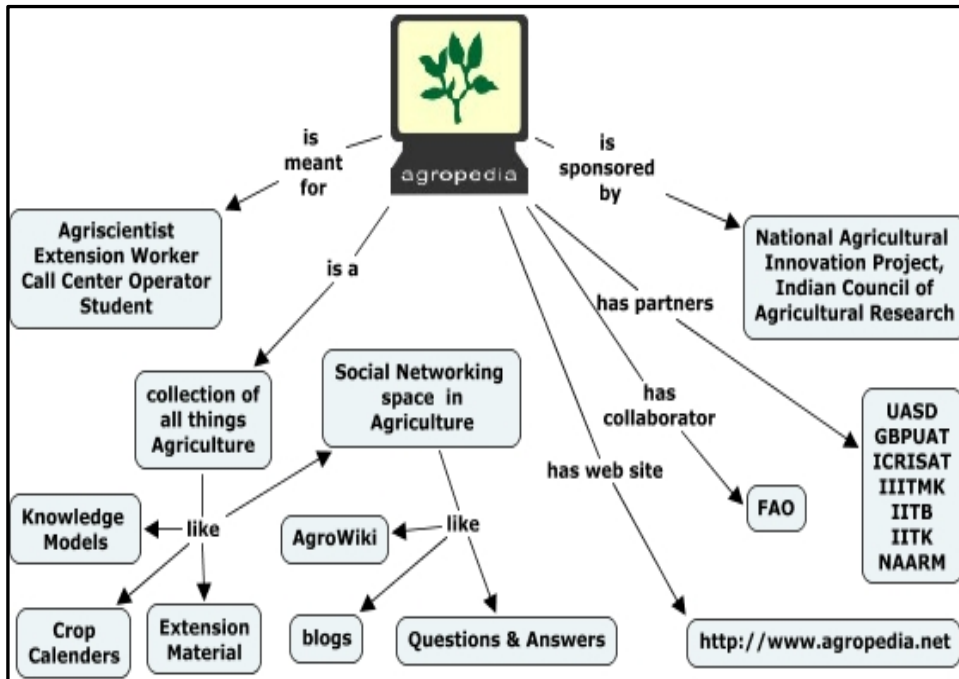


Figure 4 – A Concept Map of Agropedia

Using state of the art practices and techniques of the semantic web, agropedia is a platform where both specialists in the agriculture research and education domain and students and others interested in agriculture can make lasting contributions to the vast knowledge base. The specialists have a choice to contribute towards the *gyan-dhara* (certified content) or participate in the interaction space to contribute to *janagyan* (emergent knowledge). While *gyan-dhara* is related to the content dimension discussed earlier and can be populated only by other consortium partners⁹, knowledge is captured in the social networking dimension by leveraging social capital, which is *janagyan* or emergent knowledge. Here, users co create content through their participation in the agrowiki, agro-blog, agro-forum and agro-chat like interaction spaces. By involving all possible stake holders in positions of responsibility, identifying the information flows that would benefit them and giving currency to these flows creates avenues for collaboration between members and encourages participation. Thus, the users of agropedia are the architects of the knowledge, which is the lifeblood of agropedia, and they do this through an easy to use, entertaining and intellectually stimulating web interface.

agropedia is an ongoing initiative. The knowledge models and the technology platform for content addition and social networking were released on January 14, 2009. Till date, more than 12 workshops have been conducted across the country, many of them with over half the time being devoted to hands-on training, to 'socialise' agropedia. As on 20th February, 2009 there are around 200 pages on content (*gyandhara*), 32 blog

⁹ See www.agropedia.net for details on the consortium implementing this project

entries, and several wiki pages created. The agroforum and agrochat features are yet to become functional.

The interest in agropedia is evident from its media coverage in Science and Development Network¹⁰, Guardian¹¹ and Outlook¹². More specific results about interest in agropedia, as mined by google analytics are as represented in figure 5.

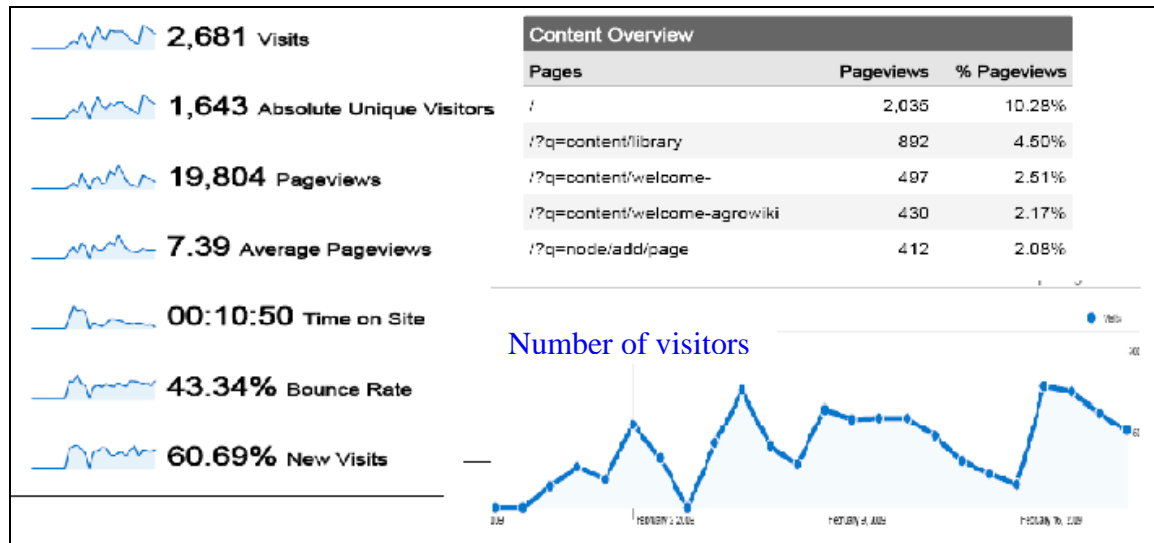


Figure 5 – Some Statistics on agropedia, as reported by Google analytics as on 21st February 2009

5. Conclusion

From the experience of the digital mandi to DEAL (section 4.1) and agropedia (section 4.2), there is a clear evolutionary path that emerges, as illustrated in Table 3. Our experience so far has resulted in the development of one approach to preserve, create and leverage social capital using ICT to further agricultural knowledge. The process is community centric, and attempts to incorporate past experiences as well theoretical insights gained from literature.

In this paper, I started by situating social capital and community networks in the economic discourse and then went on to share some experiences where social capital has been leveraged to build online community networks. The necessary and sufficient conditions to ensure the sustainability of online community networks include adequate infrastructure and embeddedness of the intervention in existing social structures, which result in the creation of new norms and networks.

Social capital is defined as the density of trust (Paldam and Svendsen, 2000). I reinterpret Putnam to propose that the growth of social capital can be derived from the pattern and intensity of networks among actors within a single community of practice which is not geographically bound. Using that premise, I demonstrated that the

¹⁰ http://www.scidev.net/en/news/india-debuts-agricultural-wikipedia-.html?utm_source=link&utm_medium=rss&utm_campaign=en_news

¹¹ <http://www.guardian.co.uk/environment/2009/jan/22/network-india-agricultural-wikipedia>

¹² <http://www.outlookindia.com/full.asp?fodname=20090223&fname=Farmers+%28F%29&sid=1>

approach followed by the IITK team to build digital knowledge communities is indeed a social capital enhancing mechanism.

Table 3 – Milestones along The path to agropedia

Year	Initiative	Comments
2003	Digital Mandi – A trading Platform for agricultural Produce	Unsuccessful – an idea whose time had not come
2005	DEAL – Digital Ecosystems for Agriculture and Rural Livelihood An ICT enabled platform for content on multiple dimensions of agriculture and livelihood, created by communities of practice in agriculture including the farmers. Literacy independent ICT tools were developed including audio blogs and innovative user interfaces	Very successful, as long as the central node, IITK, is in the picture. Sustainability remains a concern in the backdrop of limited capacity and delays in infrastructure provision
2007	agropedia – a knowledge platform for agricultural knowledge, that not only incorporates the content dimension from DEAL, but adds two orthogonal dimensions. Standardized knowledge models (using global standards) are developed to index and add semantic attributes to the content, and a domain specific social networking site is created to promote the addition of social content, building on the success of web 2.0	The initiative is still being rolled out. Till date, it's knowledge models and social spaces have appealed to domain specialists worldwide (ref), as well as in India Sustainability issues are addressed through (a) setting up self sustaining social spaces, (b) using the existing social capital to deliver the service and (c) limit the reach of the project to extension scientists who have access to relatively better infrastructure

However, change in social capital is a slow and dynamic process, and a lot depends on whether there is a central node championing the ICT intervention. Also, to evaluate if the ties between members in a community of practice have a long term effect and what their impact will be on the existing social capital, in terms of evolution of new norms for interactions or change in network structure, we need to continue observation into atleast a few more time periods. Over time, new norms and networks are expected to emerge within the digital knowledge network which could lead to very different economic outcomes. Since social change is an evolutionary phenomenon requiring time in the order of decades to manifest significantly, this is an area for further investigation.

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