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Radhika Rajagopalan
OPAALS, Indian Institute of Technology, Kanpur, India

Runa Sarkar
Department of Industrial and Management Engineering, Indian Institute of Technology, Kanpur, India

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IT, SOCIAL CAPITAL AND THE DIGITAL ECOSYSTEM: A NEW APPROACH TO ONLINE CONTENT CO-CREATION

Radhika Rajagopalan*
Runa Sarkar**

Abstract

In this paper, we explore how the dynamics of knowledge transfer within a community depends on social capital and how the synergies generated by social capital can positively impact the co-ordination between member-nodes. This could lead to the evolution of a more complex and multi functional ICT enabled socio-technical system capable of enhanced co-creation of knowledge. In this context, we present the Digital Ecosystem (DE) concept as a prototype for a sustainable knowledge synthesizing network. A Digital ecosystem describes an ICT enabled network that displays associative and autopieotic properties. In other words, not only is a so defined network capable of self sustenance, but also of expansion through heightened inclusion (i.e., increasing heterogeneity in the network composition) and growth (i.e., increase in the size and scope of the network).

In simple terms, a DE is a web of interconnected and interdependent ICT enabled users who transact in the digital mode resulting in synergistic benefits for all. The strength of this system is that it enables a resilient, multi- user exchange relationship capable of adjusting to change. The sustenance of a DE depends on co-operation between member-nodes of the network. This closely reflects the social capital embedded in community relationships. We then look at the evolution of norms and extended social ties within a DE and the effect on content co-creation. Finally, we outline the case of the DEAL (Digital ecosystem for Agriculture and Livelihood) project as an illustration of the digital ecosystem model outlined in the paper, in terms of its projected content creation, validation and sharing systems.

INTRODUCTION

Today's world is driven by information and success depends not only on

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**Project Associate, OPAALS, Indian Institute of Technology, Kanpur*
***Assistant Professor, Department of Industrial and Management Engineering, Indian Institute of Technology, Kanpur*

finding and using information, but on doing so fast. Agriculture, manufacturing, and business- all are now wired. Technology is no longer an end in itself, but the means to achieving greater economic success and social connection. Information and communication technology (ICT) provides a delivery system flexible enough to accommodate the interaction of many participants across geographies while being identity neutral; thus curbing discrimination against users based on gender, caste, religion or other social labels. However, a new form of inequity, characterized by the 'Digital Divide' has emerged.

The digital divide, is a term used to refer to the gap between those who benefit from digital technology and those who do not. Initially, the divide was seen as a consequence of underdeveloped infrastructure facilities that curtailed access. Interestingly, increased access to IT has only caused the gap to widen rather than close up. To understand this paradox, we must step away from the conventional explanation that the information asymmetry induced 'digital divide' is just a question of access; a simple problem of some societal segments having too much information and some too little, but rather, incomplete access. In reality, many of the so called information poor – for example rural communities in different countries, do possess vast stores of native information that has been coded into their culture and practices. Thus, to bridge the divide, communities have to transfer tacit knowledge into digital content to make it available for access and collaboration. This transfer however seems to depend on more than just having access to IT, as evidenced by studies of P2P (peer to peer) sharing systems where the network is burdened by inefficiencies caused due to insufficient participation, lack of financial sustainability and free riding. Networked nodes that only draw from the system for their gain without participating in a two way exchange process are defined as free riders. Any ICT enabled network will always have its share of free-riders which can adversely impact network sustainability. Sometimes, this could be a consequence of inequality of the participating nodes – in terms of size, access to resources and individual capacity to contribute to the network. Co-creation is possible only when actors are bound together –and all actors have a personal stake in the end results which act as checks on free riding.

One way of understanding there co-ordination problems is in terms of building trust and social capital. 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 promoting cooperation and co-ordination. The property of social capital of interest to us is the way it affects information flows and cooperation

within a group and how it affects economic transactions. In this paper, we explore the link between social capital and co-operation within e-communities, and how the synergies generated by utilizing ICT can be directed towards development. A new framework for understanding the arrangement of communities in the digital domain is the Digital ecosystem paradigm. We examine the suitability of this concept in terms of e-collaboration and content creation, with special reference to the case of DEAL, an ICT intervention in the Indian agricultural domain.

E-Communities and Social Development

Definition and Scope

ICT has fast become an integral part of daily human life. From the telegraph to the telephone to the internet, ICT tools have progressively become more seamless, user friendly and enabling better expression.

With growth of ICT tools, people have begun to interact meaningfully using electronic media. These interactions can be for many purposes: social, economic, academic or recreational. Users with similar interests come together to form e- communities. An e-community or online community is a group of people that primarily interact via communication media such as telephone internet rather than face to face.

In today's information driven world, success depends not only on finding and using information, but on doing so fast. Agriculture, manufacturing, and business- all are now wired. Rapid information dissemination aids rapid adoption of technology and corrects information asymmetries for better informed economic transactions. However, information, being a public good, is bound to be under produced because of the positive externalities it generates, and sub optimal levels can prevent households, businesses and governments from timely adopting new technologies, developing new financial instruments or exploiting competitive advantages. Global economy requires an active process of technical change, allocate an adequate amount of resources on research, and design policies aimed at enhancing knowledge (Ortiz, 2006). The lead actors need to engage in a collaborative effort to bypass the possibility of collective action failure. This online effort can be broadly understood as e-collaboration. It refers to a range of technology-supported activities, using computer and non-computer-mediated communication elements (Kock, 2006). By building partnerships between diverse partners, it allows households, businesses, and governments to efficiently implement joint tasks and bring seemingly unrelated functional areas closely together.

E-collaboration is important for profit as well as not-for-profit institutions in the economy, as it speeds up information transmission. Thus, it can play a significant role in aiding development programs to achieve to the twin objectives of economic growth and social inclusion. ICT tools integrated into projects help social groups from geographically dispersed locations trade information and enter transactions. Most of all, e-collaboration removes impediments to decision making- providing users with both the tools and information, while enabling them to exercise their right to choose; underlining the philosophy that the individual freedom of choice is central to well being. (Sen, 1999).

E-communities and Social Capital

The success or failure of a project aimed at fostering development by increasing the information capital, is a function of not only the efficiency of ICT tools in delivering information and enabling networks , but also of involving communities collectively to integrate the inputs into their activities.

Electronic tools alone are not enough to secure collaboration between members in an e-community. Studies suggest "that similar ICT's can have different outcomes in different situations" (Kling, et al, 1994), emphasizing the contextual dependence of technology. Social context here refers to social relations, denoted by membership in formal and informal networks used by an individual in entering both market and non market transactions, and the strength of these ties. These linkages appear to be causally linked to information flows by fostering trust, reciprocity and cooperation. Successful adoption of new technologies requires collective action and co-operation, which social capital helps secure.

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). By definition, social capital is neither positive nor negative. Well run Mafia gangs are as much an evidence of strong social capital as Silicon Valley's success. Where social capital is of interest, is the way in which it affects information flows and cooperation within a group and how it affects economic transactions. The 'embededdness' of economic transactions in social networks was first discussed by Granovetter (1985). 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. His work has shown that in economic decision making, the social context

is important and social ties act as a source of trust. Thus, the benefits intended by e-collaboration based projects for the community are moderated by the existent social capital.

For instance, most ICT interventions based in the rural communities in India failed to significantly correct social exclusion. In these implementations, it was attempted to influence the flow of information by placing members drawn from underrepresented sections in important positions in the structure of access - the kiosk owners, the tutors etc. Whether these measures have any long term impact on correcting these inequities however, is debatable. In the eChoupal, caste barriers prevented lower caste farmers from participating in the network. 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 socially enforceable behaviour, that they are governed by. Specific norms within the group, (like saying no to permitting different castes to mingle socially) can nullify the benefits of enhanced availability of information. Improving access to information can thus end up not significantly empowering marginalized members of society

The key to utilizing social capital is to make it a part of the system rather than to try to formalize it. We now look at a Digital Ecosystem as a possible solution to this problem of harnessing social capital without supplanting it as an input in the ICT dissemination system.

Digital Ecosystem Approach

Definition

The concept of a DE was first discussed in Europe as a response to how best the EU could assist the SMEs (Small and medium enterprises), traditionally the back-bone of the European economy, to adopt ICT applications more effectively (Nachira et al, 2002).

Formally defined, Digital ecosystem describes an ICT enabled network that displays associative and autopieotic properties. In other words, not only is a so defined network capable of self sustenance, but also of expansion through heightened inclusion (i.e., increasing heterogeneity in the network composition) and growth (i.e., increase in the size and scope of the network). In simple terms, a DE is a web of interconnected and interdependent ICT enabled users who transact in the digital mode resulting in synergistic benefits for all. The strength of this system is that it enables a resilient, multi-user exchange relationship capable of adjusting to change. The natural system

metaphor is employed by several schools (Rothschild , 1990; Moore , 1997; Tapscott, 2000; Power, Jerjian ,2001) to digital ecosystem as a 'digital' environment populated by 'digital species' which could be software components , applications, services, knowledge , and 'agents' or the actors in this ecosystem.(individuals, SMEs, Governments). True to it's biological antecedents, the design of a DE aims to mimic a natural ecosystem to encourage autopoiesis, whereby a system produces its own organization and maintains and constitutes itself in a space.

E-Communities, DE and Development

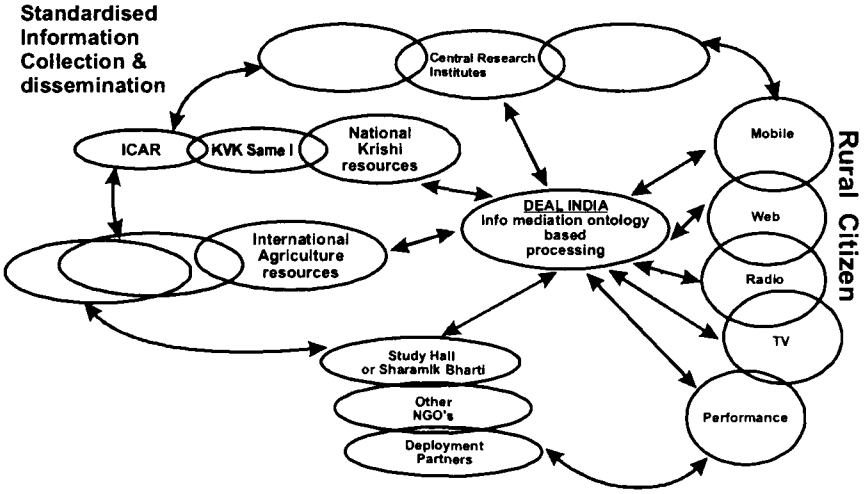
A DE for a social system needs to deal with heterogeneity and greater variations in actors' abilities and resources to participate in the network. As seen in the case of rural ICT deployment, differences in participants are induced by social and economics factors (caste, income group), level of education and exposure and so on. The vision of a DE as network that finally evolves into an "agents-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" (IEEE DEST 2008), 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. Participation here refers to both content sharing and creation. Sustained growth and heightened inclusion are the keys to successful development .Thus 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 in contrast to some of the other ICT implementations discussed earlier.

DE approach in forming E-Communities: The case of the DEAL

The DEAL (Digital Ecosystem for Agriculture and Livelihood) project is a

step towards addressing these issues by assembling a technology enhanced agricultural extension intervention in a DE framework. Conceived by IIT K and funded by Media Lab Asia, DEAL 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. The project aims to create a digital knowledge base by involving the various actors in the existing system in the content creation process and making this knowledge accessible to farmers and other agricultural practitioners. Though there are many ICT projects, conceived with the same objectives , operating in the agricultural domain, the content that is online and free, is often not updated regularly, uncoordinated with other providers so there is lot of duplication of general information and not enough 'specific' local information, making "pertinent content" harder to find. DEAL aims to rectify these.

Given below is the schema of the conceptual architecture for a knowledge network:



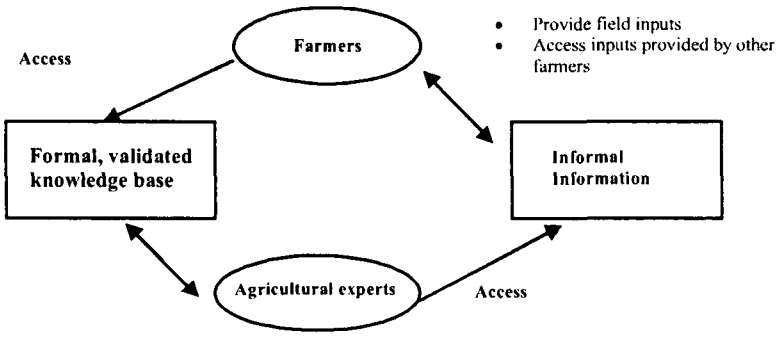
Source: Chatterjee and Prabakhar (2005)

The moderating node in this system is 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 in the network. The agricultural experts and educational institutions are responsible for verification of content generated. Dissemination of information is designed to be routed through different media, underlining the interoperability of the digital content generated. Interoperability underlines

the platform independence of the created databases, which makes content accessible to a wider audience, at the same time increasing the scope for engaging participants in sustained content creation activities. DEAL thus supports the explicit and tacit transfer of knowledge in the network. Creating dynamic databases – for instance, the Agropedia tool which allows users to search for and access information about crops, pests etc, supports explicit knowledge transfer. The Kissan Blog tool contains the voice recorded experiences of farmers with respect to practical applications – grade of seeds, fertilizer or pesticides used etc. Queries of farmers can also be recorded which are answered by the KVK agricultural scientists. This promotes the tacit dissemination of knowledge.

The uniqueness of this initiative is in the attempt to make the entire process of content creation and dissemination self generating, node independent and self sustaining using the electronic medium. With the infrastructure already in place, the challenge is to use ICT tools to collect and disseminate relevant local content by enabling critical information flows between partners and create a user friendly interface that would make the network more accessible.

The intended content creation process in DEAL can be depicted as follows:



The key to evolving a sustainable content creation loop is to give currency to the information that is contributed by members. In this case, agricultural experts have an incentive to share their research results and update the database, if they are able to avail of field inputs from farmers which is difficult and time consuming for them to obtain on their own. Thus, when members rationale for participation is satisfied by the network objectives, there can evolve an autopiotic and associative network that is capable of delivering the benefits of agricultural extension to its members.

Linking together all the actors in dynamic relationships helps retain both strong and weak ties. The links between agricultural experts within the same KVK or bureaucrats within the same organization are examples of strong ties, like links between KVKs, and those between KVKs and NGOs are examples of weak ties. By keeping the structure loosely coupled, DEAL facilitates direct interactions between the nodes, and this in turn aids transparency as all nodes can access the information lodged with others. The vision of DEAL is to become a dynamic knowledge repository – language and medium independent, with in built interoperability. Greater interoperability increases ease of content creation and assimilation. The moderating node will be gradually phased out with the responsibility for sustaining the network becoming distributed.

Field deployment of the DEAL project was between December 2006 and June 2007. Following this, a study was conducted at 4 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 on 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 the 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 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 1 lists the members who are part of the network (actors), both before and after the DEAL intervention with their respective roles.

Node	**Role played**
ICAR	Government Body
ICDS	Government Body
ICRISAT	Research Institute
IIPR	Research Institute
NSI	Research Institute
CSA	Educational Institution
NDU	Educational Institution

ZCU	Zonal Co-ordination Body
KVK(P)	KVK (agricultural extension centres)
KVK(D)	KVK
KVK(R)	KVK
KVK(K)	KVK
SAC(P)	Scientific Advisory Committee
SAC(D)	Scientific Advisory Committee
SAC(R)	Scientific Advisory Committee
SAC(K)	Scientific Advisory Committee
ZF1	Zilla (Ditrict) Line Functionaries
ZF2	Zilla Line Functionaries
ZF3	Zilla Line Functionaries
ZF4	Zilla Line Functionaries
IITK	Educational Institution
PNU	Educational Institution
Fr1	Farmers
Fr2	Farmers
Fr3	Farmers
Fr4	Farmers
KV1	Kisan Vidyalaya (village school)
KV3	Kisan Vidyalaya
KV4	Kisan Vidyalaya
Pvt	NGO
NBFGR	Research Institute
BK	Bank

Explanatory Note:

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
KV1	Kisan Vidyalaya
NBFGR	National Bureau of Fish Genetic Resources

Table 1: Actors in agricultural extension

The following network diagram, prepared in NetDraw, represents the ties that were present before the implementation of DEAL.

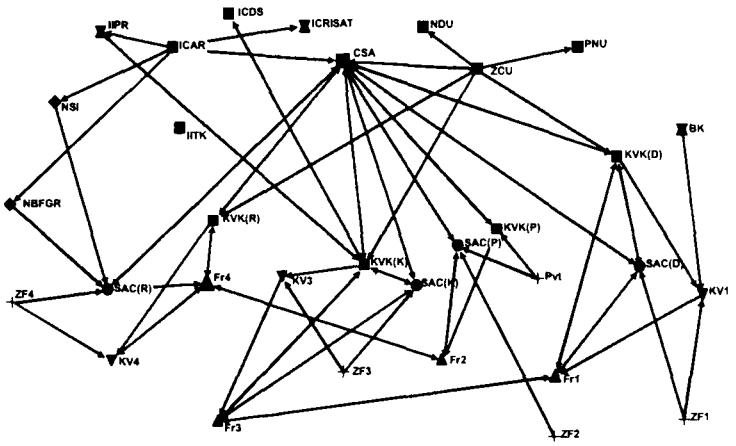


Figure 1: Network Ties before DEAL

The shapes of actors in the network are based on their role, i.e. KVKs, Research Institutes, Government agencies, etc. The thickness of lines 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 preexisting , structure based links that individual nodes supply information to or draw information from (or both), as the 'strong ties'. By this definition, all links sanctioned by the structural framework of the agricultural extension system can be denoted as strong links. However in practice, most of these channels are too infrequently used by 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, though 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 remain links only on paper. For instance, IIPR is linked to all the KVKs through the Zonal co-ordination unit, but only one KVK (at Dileepnagar) has directly consulted with experts from the institute. Similarly, there exist links between the KVKs and educational institutes like PNU and NDU, but these links are more or less dormant. The network shows the information flows within and across 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 e.g, between the farmer of a village and the respective village KVK while across groups' links includes links between actors from different villages – like the link between farmers of different villages. By the strata of operations classification, information flows between members of the same functional role also qualify– IITK is a member of the educational institutions group, KVK are part of the villages' level functionaries, and the ZCU, ICAR are all implantation and monitoring agencies. In this above network diagram, we have represented the different sources of agricultural information and the interrelations, both formal and informal, between them. Formal links are characteristic of the reporting relationship between actors – for instance, in the case of a KVK and the 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 is that while there are well established and clearly defined relationships between members from the different layers, there are very few formal ties between the members of the same layer. For example, the relationship between the ZCU and a KVK, or between a KVK and farmer 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.

Fig 2 represents the ties after implementation of the DEAL project.

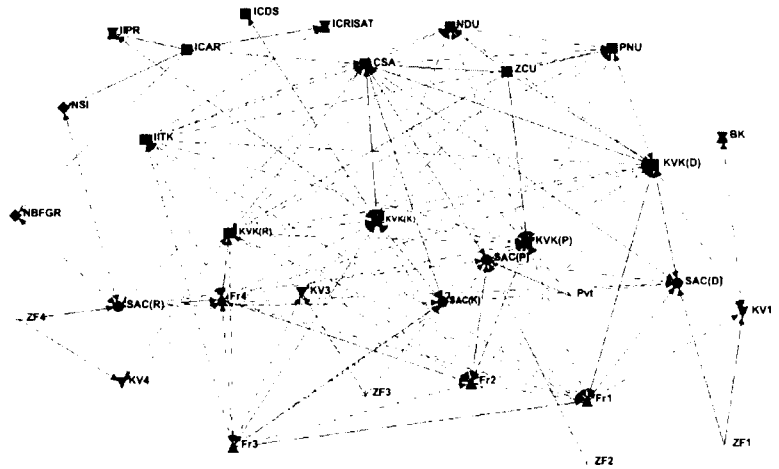


Figure 2: Network Ties after DEAL

As is evident, 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. These are voluntary clusters of members who are from different groups. Groups in the network can be understood at 2 levels – one, at the geographic level , which consists of members of different types (farmer, KVK , research institute) at a specific location , and the other is related to functional relationships. These could include academic ties, administrative reporting relationships (financial flows) or operational ties, for example, between KVKs. Linking together all the actors in dynamic relationships helps retain both strong and weak ties. We present here salient results from the

analysis done using Ucinet. The total number of ties increased from 77 to 183, and no old ties were displaced. No old actors in the network were deleted after implementing the DEAL, while only one completely new node (IITK, the implementer) was added. What was observed was that several weak links were introduced between existing nodes, signifying greater interaction (and hence innovation), and a deepening of community relations. Thus, the ICT intervention has led to the enhancement of social capital (Granovetter, 1985, Coleman, 1988). While these early reports are in some measure indicative of positive network externalities, more field reviews are needed to confirm these results. Since social change is an evolutionary phenomenon requiring time in the order of decades to manifest significantly, this is an area for further investigation.

CONCLUSION

There has been growing consensus that information technology is fast becoming as essential as education, health etc. The rationale behind ICT gaining importance in developmental projects is that it contributes significantly to the accretion in human wellness by enabling economically and socially marginalized sections to exercise their right of choice. In order to 'localize' the content, the end users have to be involved in the process of content creation. This is demonstrated in the design of the various ICT initiatives aimed at eliciting community participation. While there are tangible benefits to the community from these, overall success is limited because of lack of sustainability and low penetration (as the relevance of the digital content employed in most initiatives is low). A possible explanation for these impediments could be the impact of these projects on social capital and how the disruption of existing set of relations while building a P2P based network can lead to excessive identification with the central node. A key to elicit involvement of the community is to tap into the social capital contained in the existing norms and networks. ICT provides the tools to induce and sustain such e collaborative efforts. In this context, the establishment of a DE as a network of flows building a self generating and a self sustaining knowledge ecosystem promoting rapid diffusion, absorption and creation of relevant content for local communities was examined in some theoretical detail. Giving currency to the information flows creates avenues for collaboration between members and encourages participation. The moderating node can be gradually phased out with the responsibility for sustaining the network becoming distributed. Finally, the DEAL project model was presented as an illustration of the digital ecosystem framework, highlighting

the transformed information flows and its beneficial effect on the various actors as envisioned by the project.

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