University of Oxford

Department of International Development

SLPTMD Working Paper Series

No. 019

Sustainability of Technology-intensive Social Innovation: the Role of Absorptive Capacity, Complementary Assets and Customer Freedom of Choice

Xiaolan Fu and Christine Polzin

Sustainability of Technology-intensive Social Innovation: the Role of Absorptive Capacity, Complementary Assets and Customer Freedom of Choice

Xiaolan Fu[1] and Christine Polzin[2]

[1]University of Oxford; [2]Sustainable Europe Research Institute (SERI)

Abstract

This paper explores the determinants of the sustainability of technology-intensive social innovation with special emphasis on absorptive capacity and complementary assets. A series of cases studies from India are examined. Findings from the paper show that absorptive capacity and complementary assets can be critical factors of success and sustainability for innovative ICT-enabled projects in developing countries. Evidence from rural e-services projects indicates that customer freedom of choice enables social innovation to meet the needs of the grassroots, and thereby, enhances the vitality and sustainability of the technology-intensive social innovations.

Acknowledgement: The authors are grateful to the Engineering and Physical Science Research Council (EPSRC) (Grant No. EP/E026052/1) financial support, and to John Toye, Andy Dearden, Haider Rizvi, Subodh Gupta, Paul Matthews and conference participants at the Development Studies Association annual conference (2008) for helpful discussions.

1. Introduction

Over the past 30 years, technology-intensive social innovations have gained an ever growing role in the development of many low-income countries and can be expected to remain prominent drivers of social and economic change. Information and Communication Technologies (ICTs), such as internet and mobile phone tools, may help to create links to commercial and social networks, cut transaction costs, and foster innovative ways of delivering social services such as education and healthcare to remote areas. One of the most innovative countries in terms of ICT for development projects is India.[1]

In India and developing countries sustainability appears to be one of the most challenging aspects of technology-intensive social innovations, given the institutional weaknesses, multiple dimensions of poverty and widespread illiteracy in many (especially rural) communities (Pal 2003; Bell 2006; Torero and Von Braun 2006; Unwin, forthcoming).[2] Moussa and Schware (1992), evaluating the performance of 76 World Bank projects with IT components in Africa, identify a number of core constraints which typically threaten the implementation and long term sustainability in these contexts which may still be relevant today, including institutional weaknesses such as inadequate planning and unpredictable absorption capacity; a lack of human resources reflected in shortages of qualified personnel, a high turnover of technical and competent managerial staff as well as a lack of professional training programmes; funding issues such as underestimated project costs and a lack of recurring expenditures; local environmental problems such as a lack of vendors, back up equipment and spares; as well as technology and information changes occurring during the

[1] While precise or even rough estimations of the current number of such projects are (to our knowledge) not available in India, Pal et al. (forthcoming) provide a excellent overview of the current usage and future challenges of ICT usage for development in various domains (healthcare, agriculture, education, communications and infrastructure, governance, user interface design), based on extensive literature reviews and expert interviews.

[2] Some critics hence question the usefulness and priority given to ICTs in development efforts to relieve extreme poverty (Kenniston 2002; Upadhaya 2002).

projects, such as limited hardware and software availability and inappropriate software (Moussa and Schware 1992: 1743).

However, successful and sustainable value creation through innovation has been an old concern for researchers on entrepreneurship (Drucker 1985; Schumpeter and Clemence 1989). Most of this research has focussed on the analysis of technical innovations in products, services and processes in business enterprises. A number of general factors have been analysed which may determine the potential of a technological innovation to be successful in creating value. These factors may include internal characteristics of the firm (e.g. managerial abilities, absorptive capacity, complementary assets), human factors (Venkatesh et al. 2003), geographic and political determinants (Audretsch and Feldman 1996).

In this paper, we attempt to explore the relevance of the success factors identified in technology innovation for the sustainability of technology-intensive social innovation. We focus on absorptive capacity (Cohen and Levinthal 1990), complementary assets (Teece 1986) and the role of user-led innovation processes. To investigate the challenge of sustainability of technology-intensive social innovations in such developing country contexts this paper looks at relatively simple information and communication technologies (such as internet connected telecentres and mobile phones to enable e-services) as opposed to more complex organizational technologies for managerial use. Drawing on three case studies from India (Drishtee, n-Logue and e-Choupals), this paper aims to identify and examine factors which determine the sustainability of technology-intensive social innovations in rural settings. This paper makes two important contributions to the study of social innovation. First, it begins to fill a gap in the literature on social innovation by identifying synergies and complementarities with different streams of literature. It builds a bridge between the traditional literature on innovation and the newly emerging fields of social entrepreneurship

and social innovation. Secondly, it contributes to the theory-building process in the field of social innovation by exploring the determinants of sustainability. So far, the special case of technology-intensive innovations for social development has not been explored in great detail. The field still lacks well developed explanatory or prescriptive theories, and the existing literature is characterised by a strong focus on practical considerations, using descriptive case studies to extract lessons learnt and to suggest guides for implementation (e.g. Weigel and Waldenburger 2004).[3]

The paper is organised as follows. Section 2 analyses the theoretical framework of the determinants of sustainability of social innovation. Section 3 discusses the research methodology. Section 4 presents the evidences from India. Section 5 discusses the determinants of sustainability of technology-intensive social innovation, with special emphases on absorptive capacity, complementary assets and customer freedom of choice. Section 6 concludes.

2. Theoretical framework

2.1 Social innovation – delineating the field

Since the term of "social innovation" has been used to describe a great variety of different ideas any discussion about it is meaningless without a clear definition of the concept. In the literature, it first emerged in the early 1970s (Taylor 1970; Gabor 1970). For the behavioural scientist James B. Taylor social innovation could result from applied interdisciplinary research responding to social needs by introducing 'new ways of doing things' such as new ways of 'dealing with poverty' (1970: 70). Gabor thought of social innovations as instruments to fight for new social arrangements, for example in the form of new laws or technologies. The plethora of other definitions which has been offered by scholars from different fields to

[3] A notable early exception is an edited volume by Mansell and Wehn (1998) on information technologies for sustainable development.

date almost seems to deprive the concept of any meaning (e.g. Brooks 1982; Chambon et al. 1982; Gershuny 1983; Henderson 1993; Lallemand 2001; Mulgan et al. 2005; Phills et al. 2008).

Following Phills et al. (2008: 36) we define social innovation as a '*novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals'*.In order to have some boundary around the term innovation it may be distinguished from "improvement" (diffusion innovation) - which is more incremental in nature, "creativity", and "invention" (novel innovation), which are vital components of innovation. These 'new ideas that work in meeting social goals' (Mulgan et al. 2005: 8) could take some form of replicable programmes or organisations. They may arise from the public, private, and non-profit sectors.

In order to approach the definitional problem further, social innovation can be contrasted with "business innovation" (Mulgan et al. 2007: 44; table 1). While the critical resource for the latter is research and development (R&D) expenditure and manpower, social innovations may also depend on other resources, including political recognition and support, voluntary labour and philanthropic commitment. The motives for social innovation usually go beyond the material dimension and include wider incentives such as recognition, compassion, and care. Last but not least, different indicators of success distinguish social innovation from business innovation. Scale or market share, for example, may not be important indicators of success if a social innovation aims to address certain contained needs. Measuring and evaluating social innovation may thus require altogether different metrics.

[Insert table 1 here]

2.2 Sustainability of social innovations

Since social innovations are not intended to provide temporary charitable relief but should ideally be scalable and replicable, the question is *how* to address and theorize the concept of sustainability. How can sustainability be defined and measured? What are the different dimensions of sustainability in social innovations?

While different dimensions of sustainability are part of any evaluation of the long-term success of a social innovation, it is hard to find any systematic treatment of this question in the social innovation literature. Many of the so-called "success stories" of social innovation, particularly those using ICT to achieve developmental goals, are based on documentations about pilot projects. At this stage, there is a lack of serious engagement with projects which have evolved beyond the pilot stage and proved sustainable in financial and social terms.[4] At the same time, there is little or no analysis being done on failure stories.[5]

Sustainability is a widely discussed topic without any common definition. In business studies the success of innovations is usually evaluated in terms of the ability to successfully commercialise or implement them (Fagerberg 2005). For the purpose of this analysis sustainability will comprise financial, social and political components.

2.3 Technology-intensive social innovations and sustainability

Innovative technology solutions can help to overcome the often characteristic lack of physical infrastructure in rural areas and to reach out into remote regions. The emergence of internet and mobile phone technologies have sparked a great leap forward in terms of innovative

[4] One of the most cited and documented exceptions is Grameen Bank (see for example Bayes 2001).
[5] For some recent exploratory attempts at documenting and categorizing failures, see for example Heeks 2000, 2002; Dossani et al. 2005; Klimaro and Nhampossa 2005; and Kumar and Best 2006. Again, however, there is no systematic treatment of the question of sustainability.

projects for the delivery of social services in rural areas over the last decade. Examples range from e-health (telemedicine) to e-governance, IT education, e-commerce, online matrimonial services, online horoscopes and many other services. This study will look more closely at providers of such services[6] and compare experiences in the third sector and in the commercial sector.

To examine the sustainability of these technology intensive social innovations we will first look at how the success of traditional technology innovation has been analysed in the literature. Bearing in mind the differences between business and social innovation described above, we will, in a second step, identify the limitations of drawing such parallels and suggest additional parameters which are necessary in evaluating the sustainability of social innovations based on ICT.

In our case studies of innovative e-services, we looked at the importance of absorptive capacity and complementary assets as technology-specific determinants of long-term sustainability. Before analysing their role in social innovation, it is useful to understand their meaning and importance in the traditional technology innovation literature.

2.3.1 The role of absorptive capacity

> *One of the most important prerequisites for building technological capabilities is the accumulation of the skills needed to use ICTs.*
>
> (Mansell and Wehn 1998: 55).

Traditional (industrial) innovation studies have found that successful development and commercialisation of innovations depend crucially on the ability of an organisation to acquire,

[6] Excluded from our study of technology-intensive social innovations are social software and open source methods (for a discussion of these innovations, see Mulgan and Steinberg 2005).

assimilate and exploit knowledge from the environment (Cohen and Levinthal 1989, 1990). This organisational learning ability, the "absorptive capacity" of a firm, is a key capability when innovation depends on external knowledge. According to Cohen and Levinthal, the level of absorptive capacity of an organisation depends on the absorptive capacities of its individual members. 'To this extent, the development of an organisation's absorptive capacity will build on prior investment in the development of its constituent, individual absorptive capacities' (Cohen and Levinthal 1990: 131).

Since innovative research and development draws mainly on a firm's existing knowledge base, absorptive capacity may increase the speed, frequency and magnitude of innovation.[7] The knowledge which is thus produced through the process and results of innovation becomes part of the firm's absorptive capacity (Lane at al. 2006: 849). This development of absorptive capacity tends to be a cumulative and path dependent process, depending on routines and processes within the organization which enable individual-level learning to be shared, communicated and transferred to the organisational level. Absorptive capacity may thus contribute significantly to the firm's sustainability and long-term ability to innovate.

New knowledge may be easily available, but Cohen and Levinthal stress the importance of investment into absorptive capacity. Public technological knowledge, for example is of little benefit without sufficient capacity to acquire, assimilate and exploit it for commercial ends. Similarly, acquiring new knowledge through membership in interorganisational networks depends on the firm's ability to exchange, assimilate and exploit this knowledge with the network. This, in turn, depends on the structure of the links and the processes within the network.

[7] Therefore, absorptive capacity is commonly measured in terms of the responsiveness of research and development (R&D), assuming that R&D generate new knowledge and thus contribute to a firm's absorptive capacity. Research and development intensity reflects the responsiveness of R&D activity (in a static model as R&D/sales) to learning incentives (relevance, ease, and appropriabilty).

While the traditional innovation literature offers a number of valuable lessons for social innovation[8] there is a lack of explicit and practical recommendations on how to build and exploit absorptive capacity for sustainability and scaling. The ones that have been suggested tend to be so general that they are hard to implement. Lane and Lubatkin (1998), for example, suggest that 'a firm must develop a thorough understanding of its own knowledge, the processes by which it converts knowledge into capabilities, and the capacity of those capabilities to meet the demands of its environment' (1998: 474).

With external knowledge from target communities assuming primary importance in social development projects, absorptive capacity is an equally important strategic resource for technology-intensive social innovation. While technological innovations in business usually evolve from separate R&D departments social innovations often get their inspiration directly from the needs and of communities, are designed with participatory involvement of the grassroots level, and aim for social sustainability. Empirical evidence further suggests that the implementation of ICT-enabled social innovations requires absorptive capacity in form of generic and specific skills. Enos (1996, cited in Mansell and Wehn 1998: 111) distinguishes three types of specific skills, namely participatory, facilitating and control skills. Participatory skills are needed for the involvement in networked communication and information sharing. These include computer literacy and fluency in English (unless software and content is available in the local language). Facilitating skills are useful for the design, implementation and maintenance of networks. They include technical skills for implementation, maintenance and the training of users. Last but not least, control skills, based on the authority of

[8] Absorptive capacity has been used as a predictor of innovative activity (Cohen and Levinthal 1990), as a predictor of the extent of managerial IT use (Boynton et al. 1994), as a predictor of the effective transfer of best practices within a firm (Szulanski 1996), as a moderator of the level of innovative activity (Veugelers 1997), as a predictor of research productivity (Cockburn and Henderson 1998), and at organisational learning in general as a function of absorptive capacity (Kim 1998). (Zahra and George 2002: 187).

governments, are needed for the allocation of funds to acquire appropriate ICT equipment in order to manage access to networks.

Our fieldwork interviews confirmed that the lack of IT skills was one of the most frequently encountered challenges to implementing and sustaining technology-intensive innovations in rural India.[9] Part of the reason for this shortage is that IT-skills, in contrast to most traditional professional skills, cannot be passed on within families over generations through hereditary training. They must be acquired through the market, which is usually coupled with high fees for training. Acquiring IT skills through such courses thus excludes poor or otherwise disadvantaged sections of society and constrains the growth of absorptive capacity for the implementation of technology-intensive social innovations. Having such skills often draws people towards the urban labour market. As a result of this and other challenges, which shall be discussed later, only a small minority of social entrepreneurs manage to create and sustain ICT-enabled social innovations in rural India that can be scaled up.

2.3.2 The role of complementary assets

> *In almost all cases, the successful commercialization of an innovation requires that the know-how in question be utilized in conjunction with other capabilities or assets.* (Teece 1986: 288)

Apart from its (internal) absorptive capacity, the degree to which a company can gain from innovations and changes in information technology also depends on its ability to exploit investments in (internal and external) complementary assets – human and organizational processes as well as physical capital (Hughes and Scott Morton 2006: 50). The effective

[9] A review of the literature on IT projects in developing countries suggests that this is not an exceptional result. Moussa and Schware (1992), for example, report that in 20 per cent of the World Bank projects with IT components implemented between 1983-90 'little or no attention was paid to training people who would use the system, service support, absorption capacity of the institution, and data availability and validity' (1992: 1745).

combination and utilization of technological and complementary assets may be a key for successful and sustainable innovation. Broadly defined, complementary factors to IT range from organization and management practices to industry organisation and regulation, economic structure, government policy, and human capital investment. These assets may influence capital deepening, technical progress and labour quality and thus improve the production process (Dedrick et al. 2004: 3).

Teece (1986) differentiates between generic, specialized, and cospecialized complementary assets: 'Generic assets are general purpose assets which do not need to be tailored to the innovation in question. Specialized assets are those where there is unilateral dependence between the innovation and the complementary asset. Cospecialized assets are those for which there is a bilateral dependence' (289), as shown in figure 1.

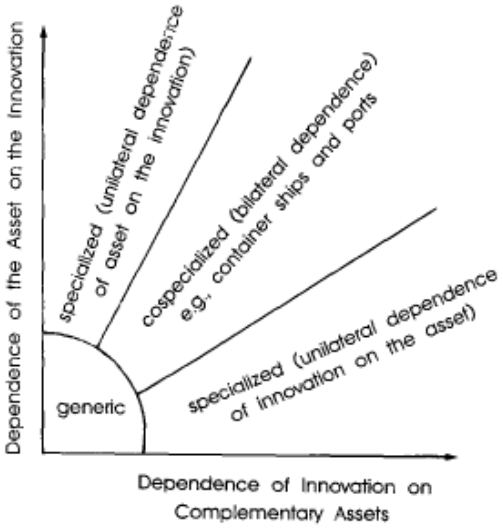

Figure 1: Complementary assets: generic, specialized, and cospecialized.
Source: Teece (1986: 289)

The successful commercialization of an innovation usually requires that 'the know-how in question be utilized in conjunction with other capabilities or assets' (Teece 1986: 288) and services such as marketing and after-sales support. These services are often obtained from

specialized complementary assets. To commercialize a new product or service via the internet, for example, information needs to be disseminated over specialized information channels.

In the context of IT innovations, the traditional literature has mainly focussed on the role of complementary assets as a determinant of the return on IT investments in terms of organisational payoff (Barua et al. 1996, Davern and Kaufman 2000)[10]. In order to reap the elusive productivity rewards of IT (extracting the greatest value) an organization may not only need to exploit investments in physical capital but also change the way it does business by rethinking its corporate strategy and remaking its basic structure, processes and culture (Hughes and Morton 2006).

The complementary assets and capabilities identified in the traditional innovation literature are similar to those needed for technology intensive social innovation. In the rural parts of developing countries, physical capital in form of reliable ICT equipment, power supply and internet connection are still a huge operational challenge (Annamalai and Rao 2003: 19; Dossani et al. 2005: 31; Bell 2006: 3-6). For many e-services projects, however, the timely access to information is vital for the success of the business model. Human capital in form of committed and well trained staff may be equally important (Dossani et al. 2005: 28). In the traditional literature less attention is paid to "social factors" such as trust, political influence and social networks (Heeks 2000). It is easy to underestimate the importance of these factors. In our case studies, however, they had significant weight.

[10] For extensive literature reviews on the impact of ICT on business performance in general see for example Dedrick et al. (2003), Draca et al. (2006), Melville et al. (2004).

3. Research methodology

To investigate the sustainability of technology-intensive social innovations, we compared different case studies in India. Case investigations provide detailed information that may present unexpected patterns which might not otherwise be revealed. As Bradshaw and Wallace (1991: 166) point out, case studies are particularly appropriate for studies which are adversely impacted by data availability, as it is the case with technology-intensive social innovations in developing countries. A comparative approach is useful in understanding the complex phenomena embedded in long-term dynamics (Yin 2003; Miles and Huberman 1994). We have, therefore, chosen three case studies of e-services, of which two (Drishtee and e-Choupal) have been widely recognised as successful while the third one (n-Logue) has experienced more difficulties in scaling up. Among the two successful cases, Drishtee represents innovative third sector projects and e-Choupals is an example of commercial ICT project initiated by the private sector

The sample selection process involved three steps. First, a range of critical criteria was defined which would allow an investigation of technology-intensive social innovation. Given the interest of this study in the sustainability of these innovations, case studies were sought with sufficient experience in order to evaluate the determinants of their long-term performance. Case studies to be selected had to fulfil the following criteria:

- existence for at least three years and reached beyond the pilot project stage;
- selection reflects a range of different business models, allowing for focussed comparisons and identification of key variables in the business model components that determine the sustainability and potential of scalability of the projects;
- reputation as social innovations with the ambition to provide models which could be replicated and scaled up;

- location in central or south India in order to be easily and cost effectively accessible for the research team.

In the second step, an extensive review of the literature on ICT for development (including academic literature, reports, internet resources, journals and other media sources) and interviews were conducted with the research project's partners in India, in order to construct a list of innovative ICT-enabled service delivery projects in rural India. Seven projects met the criteria.[11] The third step was the selection and detailed investigation of a sample of case studies from the list, which reflected both successful and less successful projects in terms of sustainability. For the investigationsemi-structured interviews were conducted with project managers of nine case studies in India (six out of the seven identified in step two (ASA; Drishtee; the information villages project of the M.S. Swaminathan Research Foundation; the i-community project in Kuppam, run by the NGO BASIX; n-Logue; and the Indian Tobacco Company's e-Choupals)[12], plus three which were younger than three years but which offered additional insights into new business models and challenges in establishing innovative social innovations in rural India. Out of the six long-term projects, three were chosen for further investigation in this paper (Drishtee, n-Logue and e-Choupals).

One of the main drawbacks to the use of case studies is the uncertainty about whether or not the cases are representative and whether we can draw generalizations from the cases (Hamel et. al. 1993: 20). This research does not attempt to build a theory about technology-intensive social innovations on a single case, assuming that other cases are similar (Bradshaw and Wallace 1991: 157). Instead, using a comparative method it combines the specificity and holistic approach of single case studies with the generalizing capability of comparative

[11] The projects thus selected included ASA, the Computer Munchi project by the NGO PRADAN, Drishtee, eChoupal by the Indian Tobacco Company (ITC), the MSSRF information village project, n-Logue, and Warana i-community.
[12] The Warana Wired Village Project had to be excluded on the basis of cost and time constraints in the field.

approaches, keeping in mind the historical and social specificities of our country of investigation, India.

4. Technology-intensive Social Innovation – Evidence from India

4.1 Recent developments in rural e-services

Over the past decade, rural e-services have become increasingly popular in India, mainly driven by private social entrepreneurs, corporations, and NGOs. In 2005, the Indian Department of Information and Technology announced a plan to establish 100,000 Common Service Centres (CSCs) across the country, financed and implemented by the Government of India and the private sector.[13] The Scheme, as approved by the government in 2006, envisions CSCs as delivery points for government, private and social sector services to citizens in rural areas.

4.2 Case Studies from rural India – Background

Table 2 provides a brief overview of the three cases. Drishtee and n-Logue are both commercially focussed rural kiosk initiatives, offering e-services through entrepreneurial village computing centres (see figures 1 and 2). Drishtee initially developed and implemented software for an e-governance initiative ("Gyandoot"). Later, it started providing e-governance services to rural villages and computerised a number of government services (e.g. birth certificate applications) in its region of operation and added commercial services in partnership with banks, insurance companies and other private companies. Drishtee sells the start-up equipment for kiosks and provides training. Most operators take loans to finance the initial investment. Kiosk services are based on Drishtee's website and support for the kiosk owners is provided from Drishtee representatives. Revenues for Drishtee are generated through three different sources: a one-time license fee, monthly franchise fees, and revenues

[13] http://www.mit.gov.in/default.aspx?id=825

from the services providers (banks, insurances, education, and health) for every transaction on the network.

n-Logue was founded by the Telecommunications and Computer Networks (TeNet) group at the Indian Institute of Technology in Madras. The TeNet group developed corDect wireless local-loop technology to provide connectivity in rural areas. Entrepreneurs who act as "local service providers" (LSPs) run a regional kiosk based on a corDect tower that provides phone services and internet connectivity. Each LSP needs to set up as many kiosks as required to sustain itself. n-Logue sells kiosk start-up kits, training and support to the LSPs and shares profits and losses with them. Revenue is generated through the provision of phone services and connectivity (based on hourly or fixed monthly fees for unlimited access). After a rapid expansion of its services across several states, n-Logue realized that most of its new kiosks did not generate sufficient returns on investment. More than half of all the kiosks had to close down.

With regard to village computing projects like Drishtee and n-Logue, Bell (2006) notes three important commonalities, '1) the existence of and the need for an umbrella organization to support the network of village computing centers, 2) the need to focus applications and services on specific and clearly defined community needs or desires with the understanding that these may and will likely evolve over time; and 3) the need to establish an appropriate funding mix through the creation of "win-win" relationships between all stakeholders to ensure the financial sustainability both of the village computing center and the network that supports it' (Bell 2006: 16). Financial sustainability of such innovative projects depends on sufficient revenues to cover the costs for complementary assets, notably organisational infrastructure and back-end operations such as experienced management resources, software development, client support services, and marketing.

E-Choupal, a commercially focussed e-services initiative, following a corporate-based model was established by the Indian Tobacco Company (ITC Ltd), a major Indian conglomerate with various business lines (including agri-business, fast moving consumer goods, hotels, packaging, paper, and paperboards) (see figure 3). At the time of analysis, it is one of very few comparable efforts that have been judged as both effective and sustainable. E-Choupals are operated by a local farmer and provide farmers with information on agricultural market prices, the weather and good farming practices. The computer also allows farmers to place orders for agricultural inputs such as seeds and fertilizers. By providing real time price information on agricultural products through its e-Choupals, ITC encourages the farmers to sell their agricultural produce directly to its hubs instead of involving numerous intermediaries. The vertical supply chain integration has enabled ITC to have direct access to producers, while the latter may benefit from higher prices for their agricultural produce. The model has also enabled ITC to improve its business conduct through increased transparency of information and operations.

5. Challenges to sustainable social innovation

Challenges to sustainability may differ between the private and the third sector. Taking Drishtee and n-Logue as examples of innovative third sector projects and e-Choupals as a commercial case study we can identify and compare a number of challenges to sustain technology intensive social innovations. Despite promising initial success both Drishtee and n-Logue faced problems related to the lack of absorptive capacity and complementary assets in their target market. ITC managed to overcome these challenges due to its ability to cross-subsidize and invest substantial resources into research and development. Less obvious perhaps but still substantial is the common underestimation of the degree of freedom that rural customers have in choosing new products and services. Our evidence suggests that it is more

difficult for third sector companies to overcome this challenge. This difficulty is linked to their limited ability to provide comprehensive end-to-end solutions.

5.1 Absorptive capacity

The case studies illustrate the importance of the three specific skills suggested by Enos (1996), participatory, facilitating and control skills, in enabling the success and sustainability of rural e-services. A number of more general skills are also mentioned.

First, participatory skills of kiosk operators are a very important strategic resource for social innovation and key for sustainable operations. n-Logue and Drishtee demand a certain minimum level of education and computer literacy from their kiosk operators and invest in their training in order to ensure that they can adequately explain and promote their services. With the rapid expansion of their services, however, both Drishtee and n-Logue experienced difficulties in finding sufficiently qualified staff and kiosk operators who could easily acquire, assimilate and exploit knowledge from the environment to foster further innovation and sustainability.

Secondly, social innovations which are highly technology-intensive require facilitating skills for the design, implementation and maintenance of networks. For the design and implementation of new services, however, technical skills are not a sufficient guarantee for success when they are not complemented by other assets. The experience of n-Logue shows that innovative e-services often take time to generate acceptance and sustainable demand and clients will not immediately be willing to pay for them. The TeNeT group developed video-conferencing software for n-Logue which works on low bandwidth and enabled face to face interaction with service and information providers in areas such as health, government, and agriculture. Despite widespread interest in the villages, however, n-Logue faced ‘difficulties

in promoting these video-conferencing based services and developing revenue models around them' (Gurumurthy et al. 2005: 166). Small private operators in the third sector may not have the capacity to test such services without sufficient revenues. Financial reserves or grants from external partners may be needed to provide such new services for free until they are deemed commercially viable. Even then, social entrepreneurs may need such capacity or other solutions (such as cross-subsidizing) if they wish to enable equal access for poorer sections who cannot afford the fees for such services. With fewer financial resources n-Logue could not implement as many e-services for its kiosks as Drishtee which received support from various donors and philanthropic organisations including the Acumen Fund, Nike Foundation and the World Bank's International Finance Corporation (IFC).

The control skills of governments were also important determinants of success. In the case of n-Logue, for example, the lack of influence on important government regulation hindered the company from implementing its original business model based on cheaper access to rural telephony. n-Logue was not able to obtain a license for telephony, and its prospects to tie-up with the license holder were 'rendered more difficult since new [2003] regulation removed obligations on them for providing certain minimum rural telephony coverage' (Gurumurthy et al. 2005: 166).

General skills and absorptive capacity may be assessed through feasibility surveys indicating the capacity of the local environment to absorb and sustain innovative e-services. Drishtee follows stringent rules in choosing the places for its kiosks. Eligible villages must have a minimum population of 1,200, be accessible from three to five surrounding villages and have favourable conditions for telecommunication. The literacy level of the targeted age-group and the paying capacity of the villagers also play an important role for sustainability.

5.2 Complementary assets

The development of Drishtee, n-Logue and ITC's e-Choupal network illustrates how different kinds of complementary assets can contribute to the sustainability of technology intensive social innovations.

Drishtee managed to develop diverse supply chains for the delivery of various e-services including computer courses, matrimonial services, mobile phone top ups and e-governance. The same network was leveraged to diversify into the distribution of physical products such as mobile phones, low-cost eye glasses, seeds and fertilizers.[14] The technical progress reflected in the range of increasingly innovative products and services was enabled through networks and partnerships. Both constitute crucial generic assets for technology intensive social innovations, especially in third sector institutions where resources for research and development are often limited.

In the commercial sector, ITC may have been less dependent on networks and external partners. However, it also combined its technologies with various complementary assets. Investments into physical and digital infrastructure, human and organisational processes, as well as improved business conduct were used to eliminate market inefficiencies and to sustain its innovation. Setting up e-Choupal kiosks enabled farmers to unbundle price discovery and physical transactions at the mandi (foodgrain trader's shop). At the same time, the inefficiencies inherent in the physical flow through the mandi were eliminated by establishing procurement hubs for clusters of e-Choupals for scientific inspection of quality and procurement and for the preservation of the produce (storage and testing equipment).

[14] Building these partnerships and seeking funding may have been helped by the large social network of Drishtee's founder, Satyan Mishra, an Ashoka Fellow.

Human and organisational processes along the supply chain were changed to manage the digital and physical infrastructure and to fill critical gaps in the chain. ITC's former commission agents at the mandi have been incorporated into the new supply chain as collaborators (now known as Samjojaks) to provide logistical support and manage the physical infrastructure. One farmer is appointed to handle the digital infrastructure in the village and to inspect the farmers' produce (the so called "Sanchalak"). According to S. Sivakumar, CEO of ITC's International Business Division, this human infrastructure is the "social capital of the village" which makes up for the shortage of physical and institutional infrastructure (interview, December 2007).

ITC may also use e-Choupals to compete on produce variety to increase its own returns as well as that of the farmers. Sanchalaks and Samjojaks constitute vital complementary assets in this process and have also been trained to implement segregation and identity preservation of agricultural produce. ITC's procurement of wheat through e-Choupals illustrates how the range of complementary assets enables ITC to trace the produce delivered and to respond to consumer concerns. In India's different agro-climatic zones, wheat grains vary widely in grades and satisfy different consumer preferences. By selling wheat to the mandis, however, farmers gained no benefit from higher quality grains because all varieties were aggregated as one average quality. ITC's e-Choupal innovation enables farmers to compare prices for their quality at the village level. Providing specialised knowledge though the internet, e-Choupals may help farmers customise their produce to the right consumer segments. In combination with ITC's storage and handling logistics this configuration of physical infrastructure at the hubs and digital infrastructure in the spokes allows ITC to preserve the identity of different varieties of wheat (and other grains) throughout the supply chain. It also encourages farmers to improve the quality of their produce and attract higher prices.

5.3 Customer freedom of choice

E-services providers usually conduct surveys to analyse the needs of the villagers and to estimate the demand for their products and services. With an increased range of available products villagers are supposed to take more informed decisions. What is easily forgotten is that many potential rural customers, however well informed they may be, are not completely free to take their own decisions. Interlinked contracts involving loans, for example, have been found in all parts of India under various terms and conditions (Bardhan 1980, Bell and Srinivasan 1989, Harriss 1991, Sarap 1991, Harriss-White 1996). A commonly found contract involves the sale or purchase of goods such as grains or household items. The strength of interlinked contracts may differ from region to region and among different groups of people. In Western Orissa, for example, Sarap (1991) found that interlinked transactions were highest among (collateral poor) tenants and landless labourers, followed by small farmers. Furthermore, they seemed to be confined to households with a low operated area, tenant households, and/or households with low educational and caste status. Medium or large farmers did not enter into interlinked credit transactions. This is not a universal pattern, however, and other studies have observed widely differing relations in other parts of India. They also illustrate the variety of terms and conditions of interlinked contracts.

Depending on the conditions of these contracts with moneylenders or other middlemen, potential customers may not be able to purchase certain goods and services from e-services providers like Drishtee or n-Logue even if they indicated a need. For the Indian Tobacco Company, however, the interlocked contracts of many farmers were a market opportunity. Without modern communication tools farmers often only know the price for their produce once they are at the mandi. To avoid the uncertainty and high transaction costs for trading through mandis especially small and marginal farmers often enter into interlocked contracts which offer end-to-end solutions, for example buying inputs and taking loans from a village

trader who will purchase, transport and sell the produce as well as lend money. These apparently convenient end-to-end solutions may easily drive farmers enter into cycles of dependence and exploitation (Harriss 1982, Sarap 1991; Narayanamoorthy and Kalamkar 2005). The ITC decided to offer farmers both an unbundled option and a (voluntary) end-to-end solution around its technology intensive social innovation.

6. Conclusions

Research on technology-intensive social innovation can benefit from parallels in established research on traditional technology innovation and emerging concepts of social entrepreneurship. This paper has shown that absorptive capacity and complementary assets – key concepts in innovation research – can be critical factors of success and sustainability for innovative ICT-enabled projects in developing countries. Embedding these concepts into the frameworks of social entrepreneurship may form a useful framework for analysis and generate new insights.

Analyses of the factors contributing to sustainability of technology-intensive social innovations in developing countries are still rare. Our case studies of ICT-enabled services in rural India help to fill this gap in the literature and suggest that absorptive capacity, complementary assets and consumer choice are important factors for sustainability of such social innovations. In technology-intensive social innovation, absorptive capacity is a vital strategic resource for innovation – both as a stock of relevant prior knowledge and as continuous investment into research and development. Complementary assets assume similar importance, as demonstrated by the different performance of n-Logue and Drishtee and by the way in which the digital and physical infrastructure of the ITC's e-Choupal system helped the company change its agri-business. Last but not least, a factor which has not featured in the

traditional innovation literature but which assumed primary importance in the sustainability of e-services in rural India is the degree of freedom that customers have in choosing and using the services provided through ICTs. The adoption of design-driven innovation and participatory approaches which give priority to customer needs will enable social innovations to meet the needs at the grassroots level and thus enhance the vitality and sustainability of technology-intensive social innovations. More systematic research on how these and other factors interact with the social and economic conditions in developing countries is needed if technology-intensive innovations are to sustain and achieve their objectives.

Table 1: Main differences between business and social innovation

	Business innovation	**Social innovation**
Critical resource	R&D investment and manpower	Political recognition and support, Voluntary labour, Philanthropic commitment (Financial)
Motives	Profitability, rents, market expansion, quality improvement, strategic purposes	Recognition Compassion Care Social responsibility
Indicators of success	Return on investment Scale Market share Profit	Social goals (e.g. poverty reduction, inclusion of discriminated groups) Sustainability
Major players	Private sector, research institutions and universities	NGOs, governments, social entrepreneurs
Process	R&D project, and commercialisation (production and marketing)	New ideas, often originating from the grassroots, seeking financial support and implementation
Sustainability	Sustainable if there is market demand. Market exit when it is no longer profitable.	Many social innovations fail to sustain when initial funding runs out.

Table 2: Three cases of social innovation

Case	Essential information	Social Innovation
Drishtee	• For-profit ltd. Company, set up in the year 2000 in Dhar (Madhya Pradesh) • Microfranchising model • Other firms may use Drishtee's platform to market their products and services • Kiosk provider finances equipment (usually through bank loan) • In 2008, approximately 1,700 Drishtee entrepreneurs operate in 10 states of India.	• Internet kiosks for villages offering wide variety of e-services, sometimes including e-governance • Direct delivery network with potential cost and time savings
n-Logue	• For-profit company, set up in 2001 • Microfranchising (3 tiers) • Targeting very small villages (1,000-1,500 people) • Kiosk providers pay for equipment, maintenance and training (usually through bank loans) and keep all marginal revenues • N-Logue derives revenue from kiosk providers who pay for internet access • N-Logue gradually set up 3,500 Internet kiosks, at least 50% are now closed and the remaining are only half functioning	• Wide variety of e-services for very small villages • Shared-use model
e-Choupal	• Established by the Indian Tobacco Company (ITC Ltd) • Started in 2000 with a pilot of 6 e-choupals in Madhya Pradesh • In 2008, more than 6,400 e-Choupal kiosks are operational in six states of India • ITC provides all equipment and pays for telephone bills	• Social value for small and medium farmers derives from transparent and informed transactions and often higher prices when selling to ITC. • Value from additional services marketed through e-Choupal.

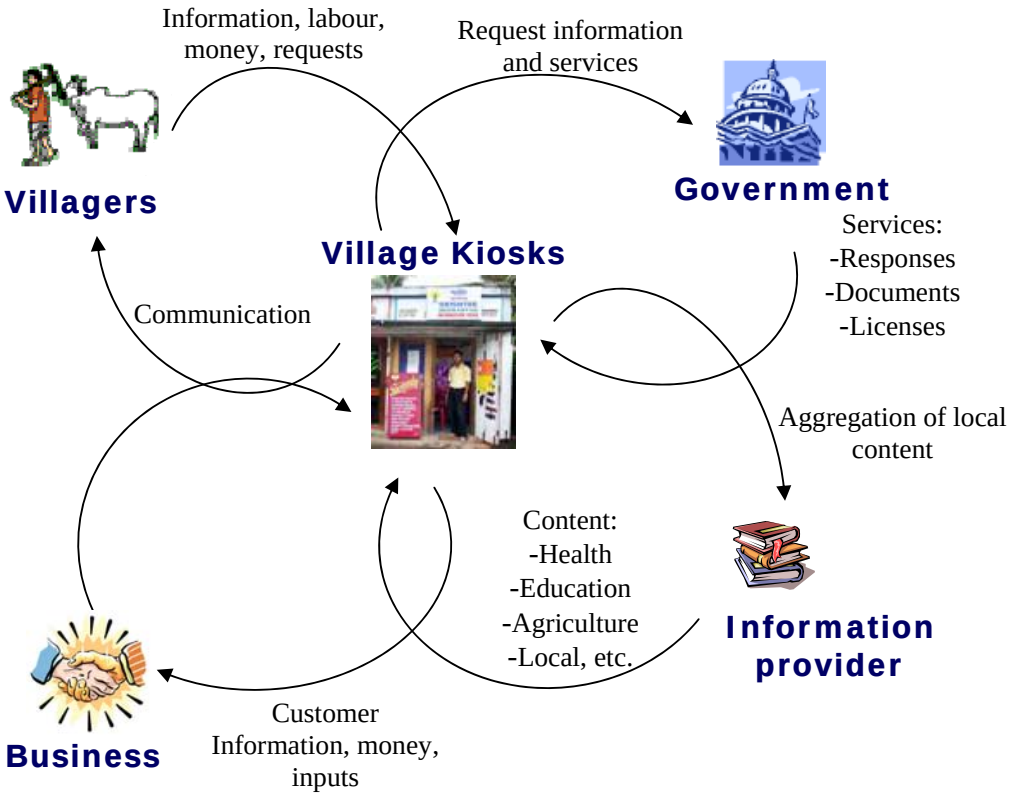

Figure 2: Drishtee system
Source: Loonker (2004: 154-155)

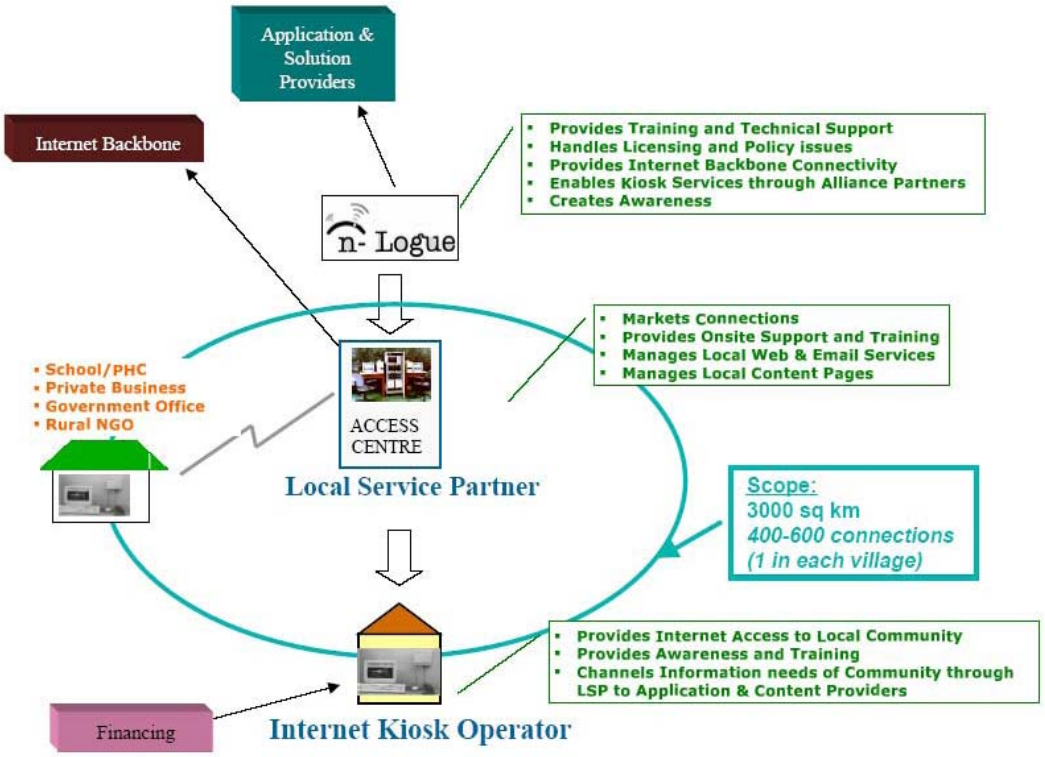

Figure 3: n-Logue system
Source: Jhunjhunwala et al. (2004: 33)

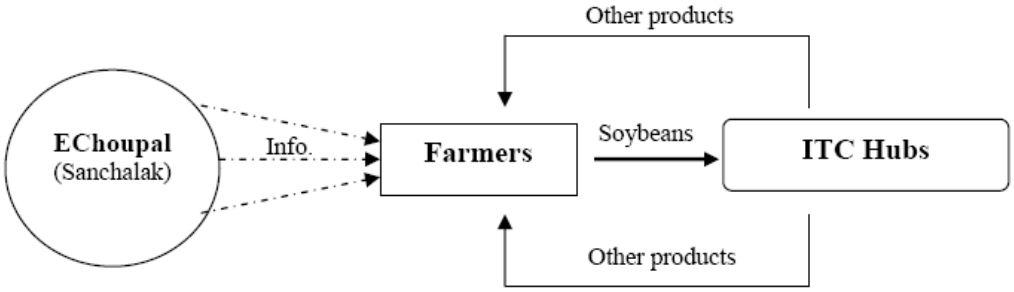

Figure 4: E-Choupals system
Source: UNITAR (2005: 5)

Bibliography

Annamalai, K. & Rao, S. (2003) ITC's E-Choupal and Profitable Rural Transformation: Web-based information and procurement tools for Indian farmers. *What Works* August.

Audretsch, D. B. & Feldman, M. P. (1996) R&D Spillovers and the Geography of Innovation and Production. *American Economic Review,* 86**,** 630-640.

Bardhan, P. K. (1980) Interlocking factor markets and agrarian development: a review of issues. *Oxford Economic Papers,* 32**,** 82-98.

Barua, A., Lee, C. H. S. & Whinston, A. B. (1996) The Calculus of Reengineering. *Information Systems Research,* 7**,** 409-428.

Batchelor, S. & Norrish, P. (2005) Framework for the assessment of ICT pilot projects. Beyond Monitoring and Evaluation to Applied Research. InfoDev. Retrieved 20 July 2008 from <http://www.infodev.org/en/Publication.4.html>.

Bayes, A. (2001) Infrastructure and rural development: insights from a Grameen Bank village phone initiative in Bangladesh. *Agricultural Economics,* 25**,** 261-272.

Bell, T. (2006) Village Computing: A State of the Field. Reflections on the Village Computing Consultation. Washington, DC: Grameen Foundation. Retrieved 19 October 2007 from <http://www.grameenfoundation.org/pubdownload/dl.php?pubID=39>.

Bell, C. & Srinivasan, T. N. (1989) Interlinked Transactions in Rural Markets: An Empirical Study of Andhra Pradesh, Bihar and Punjab. *Oxford Bulletin of Economics & Statistics,* 51**,** 73-83.

Boynton, A. C., Zmud, R. W. & Jacobs, G. C. (1994) The Influence of IT Management Practice on IT Use in Large Organizations. *MIS Quarterly,* 18**,** 299-318.

Bradshaw, Y. & Wallace, M. (1991) Informing Generality and Explaining Uniqueness: The Place of Case Studies in Comparative Research. *International Journal of Comparative Sociology,* 32**,** 154-171.

Brooks, H. (1982) Social and technological innovation. IN Lundstedt, S. B. & Colglazier, E. W., Jr. (Eds.) *Managing innovation: the social dimensions of creativity, invention and technology* New York, Pergamon Press.

Chambon, J.-L., David, A., and Devevey, J.-M. (1982), *Les Innovations sociales* (Que sais-je Paris: Presses universitaires de France).

Cohen, W. M. & Levinthal, D. A. (1989) Innovation and Learning: The Two Faces of R&D. *Economic Journal,* 99**,** 569-596.

Cohen, W. M. & Levinthal, D. A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly,* 35**,** 128 - 152.

Cockburn, I. M. & Henderson, R. M. (1998) Absorptive capacity, coauthoring behavior, and the organization of research in drug discovery. *Journal of Industrial Economics,* 46**,** 157-182.

Coleman, James S. (1970), 'Social Inventions', *Social Forces,* 49 (2), 163.

Davern, M. J. & Kauffman, R. J. (2000) Discovering potential and realizing value from information technology investments. *Journal of Management Information Systems,* 16**,** 121-143.

Dedrick, J., Gurbaxani, V. & Kraemer, K. L. (2003) Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys,* 35**,** 1-28.

Dossani, R., Misra, D. C. & Jhaveri, R. (2005) Enabling ICT for Rural India. *Project Report* November 2005.

Draca, M., Sadun, R. & Van Reenen, J. (2006) Productivity and ICT: A Review of the Evidence. *Discussion Paper* No. 749, Centre for Economic Performance, London School of Economics, London.

Enos, J. (1996), 'Human Skills and Institutions for Information-Sharing: The Challenge to Least Developed Countries', commissioned by UNU/INTECH and COLCIENCIAS as a background paper for the UNCSTD Working Group on IT and Development.

Fagerberg, J. (2005) Innovation. A Guide to the Literature. IN Fagerberg, J., Mowery, D. C. & Nelson, R. R. (Eds.) *The Oxford Handbook of Innovation.* Oxford, Oxford University Press.

Gabor, D. (1970), *Innovations: scientific, technological, and social* (New York: Oxford University Press) vi, 113.

Gershuny, J. (1983), *Social innovation and the division of labour* (Library of political economy; Oxford: Oxford University Press).

Gurumurthy, A., Singh, P. J. & Kasinathan, G. (2005) TeNeT, n-Logue and the DHAN Foundation: Exploring Appropriate Ownership Models for Rural Pro-Poor ICTD initiatives. IN Siochrú, S. Ó. & Girard, B. (Eds.) *Community-based Networks and Innovative Technologies.* New York, UNDP.

Hamel, J., Dufour, S. & Fortin, D. (1993) *Case Study Methods,* Newbury Park ; London, Sage.

Harriss, J. (1982) *Capitalism and Peasant Farming: Agrarian Structure and Ideology in Northern Tamil Nadu,* Bombay, Oxford University Press.

Harriss-White, B. (1996) *A Political Economy of Agricultural Markets in South India: Masters of the Countryside,* New Delhi ; London, Sage.

Heeks, R. (2000), 'The approach of senior public officials to information technology-related reform: Lessons from India', *Public Administration and Development,* 20 (3), 197-205.

Heeks, R. (2002), 'Information Systems and Developing Countries: Failure, Success, and Local Improvisations', (18: Taylor & Francis), 101 - 12.

Henderson, H. (1993), 'Social innovation and citizen movements', *Futures*, 25 (3), 322-38.

Hughes, A. & Morton, M. S. S. (2006) The transforming power of complementary assets. *MIT Sloan Management Review,* 47**,** 50-58.

Jhunjhunwala, A, Ramachandran, A. & Bandyopadhyay, A. (2004), 'n-Logue: The Story of a Rural Service Provider in India', *The Journal of Community Informatics*, 1(1), 30-38.

Keniston, K. (2003) IT For The Common Man: Lessons from India. *i4donline,* May-June**,** 4-13.

Kim, L. (1998), 'Crisis Construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor', *Organization Science*, 9 (4), 506-21.

Kumar, R. & Best, M. L. (2006) Impact and sustainability of E-government services in developing countries: Lessons learned from Tamil Nadu, India. *Information Society,* 22**,** 1-12.

Lallemand, D. (2001), *Les défis de l'innovation sociale* (Collection Actions sociales Société; Issy-les-Moulineaux: ESF).

Lane, P. J. & Lubatkin, M. (1998) Relative absorptive capacity and interorganizational learning. *Strategic Management Journal,* 19**,** 461-477.

Lane, P. J., Koka, B. R. & Pathak, S. (2006) The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review,* 31**,** 833-863.

Latour, B. (2005), *Reassembling the Social: An Introduction to Actor-Network-Theory* (Clarendon lectures in management studies; Oxford: Oxford University Press).

Loonker, S. P. (2004), 'Drishtee: Connecting India Village by Village', in M. L. M. Dacanay (ed.), *Creating a Space in the Market: Social Enterprise Stories in Asia* (AIM and CAFO), 149-77.

Mansell, R. & Wehn, U. (eds.) (1998), *Knowledge Societies: Information Technology for Sustainable Development* (Oxford: Oxford University Press).

Melville, N., Kraemer, K., & Gurbaxani, V. (2004), 'Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value', *MIS Quarterly*, 28 (2), 283-322.

Miles, M. B. & Huberman, A. M. (1994) *Qualitative data analysis: an expanded sourcebook* (Thousand Oaks, Calif.; London: Sage).

Moussa, A. & Schware, R. (1992) Informatics in Africa: Lessons from World Bank experience. *World Development,* 20**,** 1737-1752.

Mulgan, G., et al. (2007), 'Social Innovation: What it is, why it matters and how it can be accelerated.' *Skoll Centre for Social Entrepreneurship Working Paper*.

Mulgan, G. & Steinberg, T. (2005) *Wide Open: Open Source Methods and their Future Potential,* London, Demos.

Narayanamoorthy, A. & Kalamkar, S. S. (2005) Indebtedness of farmer households across states: Recent trends, status and determinants. *Indian Journal of Agricultural Economics*, 60**,** 289-301.

Pal, J. (2003) The developmental promise of information and communications technology in India. *Contemporary South Asia*, 12**,** 103-119.

Pal, J., Patra, R. & Nedevschi, S. (forthcoming) "ICTD State of the Union: Where have we reached and where are we headed" ICTD2009, ACM IEEE Conference Proceedings, Doha April 17, 2009.

Phills, J. A., Deiglmeier, K. & Miller, D. T. (2008) Rediscovering Social Innovation. *Stanford Social Innovation Review***,** 34-43.

Sarap, K. (1991) *Interlinked agrarian markets in rural India*, London, Sage.

Schumpeter, J. A. & Clemence, R.V. (1989) *Essays: on entrepreneurs, innovations, business cycles, and the evolution of capitalism* (New Brunswick, N.J; Oxford: Transaction Publishers).

Szulanski, G. (1996), 'Exploring internal stickiness: Impediments to the transfer of best practice within the firm', *Strategic Management Journal*, 17 (SUPPL. WINTER), 27-43.

Taylor, J. B. (1970), 'Introducing Social Innovation', *The Journal of Applied Behavioral Science*, 6 (1), 69-77.

Teece, D. J. (1986), 'Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy', *Research Policy*, 15 (6), 285-305.

Torero, M. & Von Braun, J. (Eds.) (2006) *Information and Communication Technologies for Development and Poverty Reduction: The Potential of Telecommunications,* Baltimore, Md., Johns Hopkins University Press.

UNITAR (2005) “Expansion of ITC’s eChoupal Initiative in ASEAN Countries via FDI: An Interactive Case Study“, *UNITAR/SHU Series on International Economics and Finance Foreign Direct Investment for Development Financing*, 16 - 19 May 2005 Hiroshima, Japan

Unwin, T. (Ed.) (forthcoming) *ICT4D - Information and Communication Technology for Development,* Cambridge, Cambridge University Press.

Upadhaya, G. R. (2002), 'Digital delusions in the South', *HIMAL*, August*;* retrieved 4 July 2008 from <http://www.himalmag.com/2002/august/essay.htm>.

Venkatesh, V., et al. (2003), 'User acceptance of information technology: Toward a unified view', *MIS Quarterly: Management Information Systems*, 27 (3), 425-78.

Veugelers, R. (1997), 'Internal R&D expenditures and external technology sourcing', *Research Policy*, 26 (3), 303-15.

Weigel, G. & Waldburger, D. (Eds.) (2004) *ICT4D - connecting people for a better world : lessons, innovations and perspectives of information and communication technologies in development*, Berne, Swiss Agency for Development and Cooperation Global Knowledge Partnership.

Yin, R. K. (2003), *Case Study Research: Design and Methods* (3rd edition, Applied social research methods series; v. 5; Thousand Oaks, Calif. ; London: Sage).

Zahra, S. A. & George, G. (2002), 'Absorptive Capacity: A Review, Reconceptualization, and Extension', *Academy of Management Review*, 27 (2), 185-203.