

Social Capital in enabling quality healthcare: The case of a telemedicine project in Nepal

Maung Kyaw Sein
University of Agder, Norway
Luleå University of Technology, Sweden

Devinder Thapa
University of Agder, Norway

Paper Category: Research Paper

ABSTRACT

Information and Communication Technology (ICT) can play a crucial role in meeting multifaceted developmental challenges such as providing access to quality healthcare in developing countries. Initiatives such as telemedicine have been vital in bringing healthcare to marginalized groups in remote areas of such countries. While the implementation and effects of telemedicine projects have been studied in the literature, the actual mechanisms and conditions that facilitate the process has seldom been addressed. In this paper, we present an interpretive case study of a telemedicine project in a remote mountainous region of Nepal. Our findings indicate that it was the action of a group of focal actors who leveraged a supportive social capital that resulted in successfully bringing in quality healthcare to marginalized groups in these remote villages. Our findings reveal social capital as a facilitating condition through which ICT can play a crucial role in meeting developmental challenges such as quality health care.

Keywords: Telemedicine, developmental challenges, developing countries, social capital, marginalized groups, Nepal.

INTRODUCTION

The United Nations human development index (HDI) lists life expectancy as one of the necessary conditions for human development that underscores that healthcare is vital. Not surprisingly healthcare related goals feature prominently in UN's Sustainable Development Goal (SDG). In a remote mountainous region where primary infrastructures such as roads and clean

water are at a very basic level, providing quality healthcare becomes a huge developmental challenge. Moreover, few doctors would come to these remote regions. For basic care, the sick has to rely on “village health-sisters” or traditional medicine men. The unavailability of healthcare systems in the mountain regions inhibits what Amartya Sen (1999, pg. 17) states as ‘the freedom of choice’. In short, villagers living in these remote mountain regions are marginalized.

Providing quality healthcare is shaped by dynamic and interdependent factors (scarcity of doctors who do not find it attractive to move to a region beset with poverty and poor infrastructure). No single intervention can solve this, but that has not prevented policy makers and donor agencies from seeking exactly such a solution. For example, UN explicitly states leveraging the power of ICT to meet the SDGs. This reliance on a technological solution pervades the thinking of the development community as a whole. We refocus the problem into examining the mechanisms and the conditions that facilitate the processes through which ICT can play a role in meeting complex developmental challenges such as providing quality healthcare.

In this paper, we explore this issue through the case of a telemedicine project that has brought healthcare to remote villages in the mountainous regions of Nepal. We call it the Nepal Telemedicine Project or NTMP for short. The initiative we studied was implemented on the infrastructure provided by the Nepal Wireless Network Project (NWNP). The story of NWNP has been told elsewhere (Thapa et al., 2012). Part of the story of NTMP has also been told (Thapa and Sein, 2017). Here we continue this telling by presenting another aspect of NTMP.

The specific research question we sought to study was:

What are the facilitating conditions through which ICT can play a role in meeting the challenge of providing quality healthcare to marginalized groups in remote areas?

ICT by itself does not enable quality healthcare: we need to provide facilitating conditions to realize the possibilities of ICT interventions (identifying reference). Social capital can be one such facilitating condition. The social capital perspective, focusing on resources embedded in social networks for mutual benefits of parties within the networks (Putnam, 2000) has been used to explore the effects of ICT intervention in healthcare in developing countries (Thapa et al., 2012). In this paper, we used social capital as the interpreting lens to make sense of our data.

The rest of the paper is organized as follows. In the next section, we review the literature on ICT and healthcare specifically examining the telemedicine area. We then present the theory of social capital. Next, we describe the research strategy, data collection, and data analysis. In the following section, we first narrate our case and then present the analysis of our case. We conclude the paper with a discussion of our findings and their implications for practice and research and in doing so, we point to future research directions.

THE CHALLENGE OF HEALTHCARE IN THE DEVELOPING WORLD

In their foreword to the special issue of MIS Quarterly on IS in Developing countries, the co-editors emphatically state that the debate on "... whether ICTs were relevant to DCs. has been resolved with a clear "yes". The question has now become not whether, but how ICTs can benefit development." (Walsham et al. 2007: 317). One of the specific areas they list where ICTs can provide substantial benefits is "health delivery to rural villages" (ibid). Healthcare features prominently in the Sustainable Development Goals (SDGs) set by the United Nations (UN, n.d.)). Health is one of the key dimensions of the human development conceptualization of development, is a key item in measuring "Human Development Index", and is a cornerstone of the capability approach developed by Sen (1999).

In keeping with this emphasis, the ICT4D community has delved into the challenges of providing quality healthcare in developing countries. One approach has been to design and implement the information infrastructure in healthcare. The most prominent example is the long running and well-established Health Information Systems Program (HISP) originated by the University of Oslo (see - <http://www.hisp.org/> for details). Starting in Southern Africa as a so-called North- South initiative (collaboration between developed countries of the North and developing countries of the South), it has now extended to Latin America and the Indian subcontinent. HISP initiatives in the South are now collaborating with each other thus morphing the North-South paradigm into South-South collaborative efforts. HISP has not only improved decision-making capabilities of the health sector in developing countries but has also fostered knowledge transfer to these countries.

Programs such as HISP aim primarily at improving the decision-making capability of health personnel in developing countries. They do not deal with health service delivery and specifically providing actual healthcare such as diagnosis and treatment. That aspect is covered under the

broad rubric of telemedicine, which can be conceptualized as use of ICT to remotely provide or support healthcare activities (Miscione, 2007). There are multiple formal definitions of the term telemedicine. A survey by the World Health Organization (WHO) found 104 definitions (WHO, 2010). The definition adopted by the WHO is “The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities” (WHO, 2010:9).

This wordy definition underscores the multifaceted nature of telemedicine, but emphasizes two crucial aspects – diagnosis and continuing education. These aspects, also listed as prime uses by Wooten (2001), are of particular interest for our study reported in this paper. While there is a growing body of literature on telemedicine, most are of non-academic nature such as reports (WHO 2009). Most academic articles report initiatives in the developed world (e.g. Hartvigsen 2013). Not surprisingly, the findings and the resultant design recommendations for telemedicine apply primarily to developed countries. For example, lessons listed by Hartvigsen (2013) relating to re-imburements, working laws and electronic health records have limited applicability in the developing world. Nevertheless, this stream can be a useful source on which to base telemedicine research and practice in the developing world. One lesson relating to the use of video-conferencing from the same list is implementable and has been applied in the Solomon Islands (Baruchli et al. 2005).

More relevant are the lessons listed by WHO (2010) which stress (a) sustainability through collaboration, participation and capacity building, (b) awareness of the local context and use of local resources, (c) use of simple solutions appropriate for local needs, (d) constant evaluation, and, (e) considering social benefits of telemedicine as important goals by themselves. Most existing telemedicine networks are based in developed countries and they provide referral consultation services to developing countries (Wooten 2008). Research has been mainly on the technology and the medicinal aspect of telemedicine. A literature review conducted by WHO lists 87 articles, the clear majority of which are from specialized publications such as *Journal of Telemedicine* or even medical journals such as *Lancet* (WHO 2010). Apart from some noteworthy exceptions (e.g. Mort et al. 2003), there is a lack of research on the socio-technical

interplay on which ICT initiatives such as telemedicine are built. This could be attributed partly to lack of interest on the topic by the mainstream IS research community and by core IS journals. We could find only one article (Miscione 2007) in a “basket of 8” IS journal that reports an intensive study of a telemedicine initiative in a developing country. In this fascinating paper, Miscione found that in remote regions of the Amazon, it was critical to integrate and respect traditional medical practices to the modern medical approaches enabled by telemedicine. It highlights the importance of integrating local practices and interaction with the local context. A similar finding was observed in the case of implementation of a land records system in India (Puri 2007). Though not on telemedicine, Puri’s work further emphasized the need to integrate scientific knowledge to indigenous knowledge.

These studies give us revealing insights into the implementation and acceptance of ICT initiatives such as telemedicine in developing countries. What is not examined is the process of how these systems came into being. Moreover, the ICT projects they study are typically built following design recommendations from research in the developed world (see Latifi et al., 2009 for an example). These include predominantly top down, centrally planned, aid driven, and government controlled initiatives (Heeks, 2006). Not surprisingly, the need to have government control, or at least reliance on governments have been listed prominently as critical success factors in the literature (e.g. Pal et al., 2004; Martinez et al., 2005). The question remains how organic, bottom up initiatives come to be developed. NTMP in Nepal based on NWNP was precisely such an initiative. For us, this was an ideal vehicle to examine our research question:

What are the facilitating conditions through which ICT can play a role in meeting the challenge of providing quality healthcare to marginalized groups in remote areas?

Our study was informed by the theory of Social Capital, which we present next.

SOCIAL CAPITAL

Social capital can be a means for collective action to enhance the developmental opportunities through involvement and participation in group activities (Thapa et al., 2012, Diaz Andrade & Urquhart, 2009). It can be helpful in building goodwill, fellowship, sympathy, and social interaction among individuals and groups by virtue of the network. The foundation of social capital is based on trust, reciprocity, and exchanges (Putnam, 1995). Social capital also has negative consequences, such as restrictions imposed on actors who do not belong to network,

lacking perception of environmental changes outside the network, dependency on central actors and their loyalty towards the network (Portes, 2000).

There are three forms of social capital: bonding, bridging, and linking (Adler and Kwon, 2002; Woolcock, 2001). Bonding social capital refers to relation amongst homogenous groups, whereas bridging social capital refers to relation among distant friends, associates and colleagues. Bonding and bridging social capital can be seen as horizontal ties, however linking social capital refers to vertical ties between individuals and groups with different power, social status and wealth. The concept of linking social capital, in economics, is extended to include capacity to leverage resources, ideas and information from formal institutions beyond the community (Woolcock, 2001). Bonding social capital also referred as strong ties (Granovetter, 1973) is good for maintaining existing relations, however, bonding social capital may sometime have adverse impact and serve to exclude and create a context for the growth of reactionary ideology. Bridging or linking social capital also referred as weak ties (Granovetter, 1973) is crucial for extending social networks, and it could be an important resource in facilitating mobility and finding job opportunities.

Studies show that the social interaction afforded by ICT can create social capital (Wellman et al., 2003). For example, ICT-enabled communication and just-in-time ties, have been ascribed to stronger social ties, which in turn can enable resource exchange, emotional support, and collective action (Resnick, 2001). We argue that such networking and collective action are built upon a bedrock of norms, trust and social obligations. In summary, social capital theory can help us understand the process of how ICT can help tackle the developmental challenge of providing quality healthcare to marginalized groups in remote regions.

RESEARCH METHOD

The goal of our research was to acquire the understanding of a phenomenon in a real setting, namely the mechanisms and the conditions that facilitated the process through which the telemedicine project played a role in bringing quality health care to the mountain regions of Nepal. Therefore, we selected case study as the appropriate research method. The approach we took was interpretive. The mode of inquiry of interpretive approach is rooted in the philosophical ideas of hermeneutics and phenomenology (Butler, 1998). Interpretive approaches produce an understanding of the context of the information system, and the process whereby the information

system influences and is influenced by the context (Walsham, 2006). Our study sites were Kathmandu, Hetauda and Myagdi districts in Nepal. The mountain village of Nangi and Tikot in the district of Myagdi were the primary sites. We chose this site because it was here that NTMP was initiated.

Data Collection

Our primary source of data collection was interviews (See Table 1 for a summary). In addition, we employed complementary techniques such as observation, focus group, group discussion, and document analysis. We conducted 60 semi-structured interviews in Nangi, Tikot, Sikha, Hetauda, Poudar, and Dolakha villages, in KMH and other participating hospitals in the project. Our interviewees were individuals directly or indirectly involved in the project, and those who benefitted through it such as health-workers, doctors, community people, personnel of E-Networking Research and Development (ENRD) and NWNP. The interviews were carried out in three phases in the period between March 2010 and May 2011; each interview lasted from 20-90 minutes. In addition, we conducted in-depth interviews with the two key actors in the telemedicine initiative, Pun, the initiator of NWNP, and Dhital, the initiator of NTMP.

We also conducted a focus group interview in a suburban hospital 'Hetauda District Hospital' connected to the project. The focus group was composed of expert doctors, technician related to the telemedicine, nurses and other stakeholders such as district development officer. In the discussions, doctors shared their reasons for participating in the project. Pun was also present in this group interview. His concern was more on involving interested stakeholders to deploy telemedicine. We conducted a number of follow-up interviews, especially with Pun and Dhital. In addition, we conducted a one-day workshop in Kathmandu that focused on understanding the challenges and opportunities of telemedicine in remote mountain regions. The workshop also explored the role of various stakeholders in implementing telemedicine. These discussions were also recorded and transcribed. We also consulted documents (mainly related to telemedicine activities) published by ENRD and NWNP. Regular email exchanges with various stakeholders related to NWNP and NTMP also enriched the collected data.

Table.1 List of some key informants and their objectives

Organization	Position	Objectives of using ICT	Duration
Dolakha District Hospital	Doctors (2)	To provide healthcare training and medicinal services	60 m
Hetauda District Hospital	Doctors (3) District development officer Technicians	To facilitate healthcare services and disseminate learning and teaching using tele-education	90 m
Kathmandu Model Hospital	Saroj Dhital* Interns Director	To install telemedicine services in the mountain regions	90 m 60 m 30 m
NWNP (Nepal wireless network project)	Mahabir Pun, Team Leader Technical Expert	To promote socioeconomic development of mountain regions To provide better internet connections to remote places	90 m 40 m
ENRD (E-Networking Research and Development)	Director Researchers (3)	To provide platform for international research collaboration in ICT4D (telemedicine is one of the main focus of ENRD)	90 m
CHEST (Community Health Education Services by Tele-health)	Dermatologist	To improve healthcare, provide education and collaboration	60 m
Nangi Health Center	Health worker	To provide better healthcare services to remote communities	90 m
Tikot Health Center	Health worker	To provide better healthcare services to remote communities	90 m

Data Analysis

Analyzing the data in an interpretive case study is a challenging task, especially triangulating the results derived from different sources such as interviews, focus group, workshop, observation and note-taking. As we engaged in a dialogue with the data, the data started to reveal the relevance of social capital as a theoretical lens for sense-making. Consider this example from our interview transcripts. *“It is the effort of Mahabir to connect the whole Nepal through wireless technology. There are other 3-4 institutions working along with him, we are one of them to provide health related services. There is another organization called NREN (Nepal research and education network), in this institute there are 3-4 friends including Mahabir and I. this organization is also helping us, besides that there are other private companies who are working with us. They are also motivated to make this telemedicine project successful. (Saroj Dhital, 21/03/2010)”*. Accordingly, we analyzed our data using social capital as the sense-making lens.

We applied coding techniques suggested by Corbin and Strauss (2008). The analysis went through several cycles of coding and categorizing. The categories that emerged in the first round were different actors and their roles, various stakeholders (governmental and non-governmental), the role of technology (e.g. telemedicine), the role of NWNP (e.g. as an infrastructure), the role of communities and healthcare opportunities created due to these networks. In the second round, data analysis revealed the role of various stakeholders and social capital in perceiving and actualizing the NTMP. To refine these categories, we made constant comparison between the theoretical constructs and data from various sources.

While analyzing and interpreting the data, we had regular follow-up interviews with the interviewees and conducted a number of peer-reviews. We validated the methodological approach by applying the principles of hermeneutic circle (Klein and Myers, 1999). The principles were also useful for addressing criteria such as authenticity, plausibility, and criticality (Walsham 2006). To ensure authenticity we conducted our research in ten villages of the Myagdi district, and had three rounds of interviews with various stakeholders who were related to NTMP and NWNP; to ensure plausibility, we presented and discussed initial results at various workshops and conferences. Finally, to ensure criticality the two authors took different perspectives for supporting or contradicting the interpretation and evaluation of the findings. To manage and organize the huge set of qualitative data we used nVivo version 10.

FINDINGS

The timeline of the project is shown in Appendix 1. Below we first narrate the case and then present our case analysis

The Case Narrative

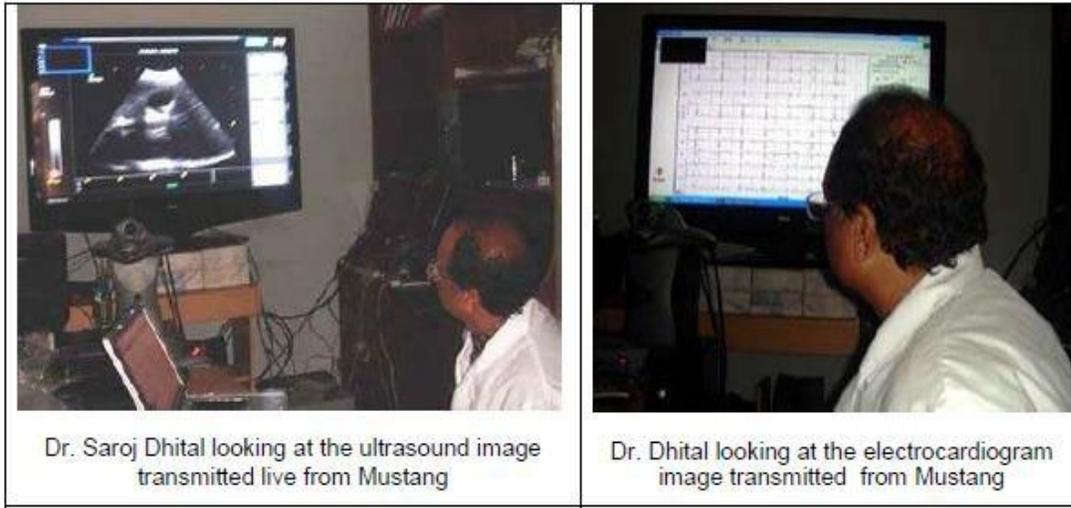
Kathmandu Medical Hospital (KMH) works as a central hub to connect all the clinics in the mountain villages to hospitals in the project. The basic technologies used to operate the telemedicine services are Cisco routers POLYCOM device, video conferencing cameras (e.g. Polycom VSX 800), speaker, monitors, laptop or desktop computers, and internet connection with 10 to 30 mbps bandwidth. Other devices such as telephone, mobile phones, digital cameras and microphones are also used. The equipment and technologies are mostly donated by agencies such as International Telecom Union (ITU), Donald Strauss Foundation, and foreign universities.

The centers are run by volunteers who belong to some of the community groups such as mother group (*Aama Samoh* in Nepali).

The initial use of these technologies is to store and forward audio/video images of patients from remote areas to urban hospitals. These provide diagnostic information and clinical history of the patient to the specialist doctors in these hospitals. Depending on the criticality of the case, the communications can be synchronous or asynchronous. These technical features enable consultative diagnosis. In addition to consultative diagnosis, NTMP also enables tele-education. The foundation of both is the daily video-conference, between the local village health-workers and doctors from urban hospitals (e.g. KMH or Om). Consultative diagnosis is done by collaboration between rural health workers and the remote doctors (See fig. 2). While patients are also present, and while the remote doctors can see them and visually examine them, they do not directly communicate with the doctors. Rather, all consultation occurs between the doctors and the health workers. If needed, two remote doctors take part in this consultative diagnosis. In addition, the health-workers contact remote doctors whenever they need advice. Often KMH also contacts other international hospitals in US, Indonesia and Japan to consult on complex issues. At present, the consultancy services are provided on surgery and general medicines.

The other service provided by NTMP is education to the village health-workers. They get training through regular classes on general medicine. They also learn how to provide medical assistance in emergency circumstances, in addition to diagnosing and providing basic treatment to patients. The telemedicine services are also useful in providing advance surgery classes to Nepalese interns. For example, KMH arranges a platform where interns can watch live surgeries performed by doctors from other parts of the world (e.g. Korea and Indonesia). The platform also provides interactive sessions between interns and experts. So far, around ten telemedicine centers have been established in the remote mountain regions and rural areas. There are also challenges that need to be overcome. These include lack of robust infrastructure, shortage of electricity, lack of skilled work force, and lack of policies for security and privacy of the patients' records.

Figure 2. Telemedicine service between KMH and Mustang



Case analysis

By all accounts, this was a successful ICT intervention in a developing country. Much of the foundation on which NTMP was built and spread was bonding social capital. Table 2 summarizes how social capital played a key role in the success of NTMP.

Table 2: Role of Social capital in NTMP's success

Social capital type	Role in success of NTMP
Bonding	NTMP enrolled the team leader of NWNP to mobilize local communities of Nangi village while implementing the first telemedicine center between Kathmandu Model Hospital (KMH) and Nangi. Involvement of the local health-sisters in the NTMP. Involvement of the team leader and local health-sisters created the trust of local people, which in turn leads to first consultative diagnosis between KMH and Nangi telemedicine center.
Bridging	NTMP gradually started to extend to other villages. KMH along with Om hospital started to provide tele-education to the health workers in the mountain remote regions. Many doctors from urban hospitals started to provide volunteer services.
Linking	Education and consulting services from international doctors to KMH

When we analyze the project in light of the design recommendations and the CSFs found in the literature (e.g. Wooten, 2001; 2007; WHO, 2010), we can identify some factors that lay behind its success. Table 3 summarizes how NTMP met the design recommendations

Table 3: NTMP vs. Design recommendations from the literature

Critical success factors	How NTMP met the criteria
Tie in to an infrastructure development project	NTMP was not just tied to NWNP, the two played a mutually-beneficial role. The infrastructure (NWNP) needed an application to sustain itself. The application NTMP needed an infrastructure on which to be built.
Sustainability through collaboration, participation and capacity building	Social capital was leveraged to achieve collaboration and participation. Capacity building was achieved through education of local “health-sisters”
Awareness of the local context and use of local resources	NTMP did not disrupt local practices and used existing social ties
Use of simple solutions appropriate for local needs	The “distant consultative diagnosis” aspect of NTMP was based on simply the daily videoconferences
Constant evaluation	Dhital continuously assessed the effectiveness of NTMP
Considering social benefits of telemedicine as important goals by themselves	New uses of NTMP resulted in training of local health workers and education of medical interns. Urban doctors found NTMP a platform to pay back to the society for educating them as doctors at a nominal cost.

We can see that NTMP fulfilled the CSFs listed in the literature. Perhaps the most vital aspect was that NTMP almost seamlessly assimilated into the local context. Dhital was careful not to disrupt the local practice, a key aspect of telemedicine success observed by Miscione (2007).

Before NTMP, primary health in villages was provided by the village health-sisters. They were locals, knew their patients intimately, and were trusted by their patients. NTMP did not replace them. Patients did not interact directly with remote doctors, they still came to their trusted health-sisters. NTMP was primarily a resource for the health-sisters to make better diagnosis and decision making through consulting the remote specialists. Indigenous knowledge was thus incorporated into modern knowledge brought in by NTMP.

Another key criterion as well as use of telemedicine is training of health workers (Travers et al., 2004). This was a key ingredient of NTMP especially after its expansion into tele-education. Not only did this improve the competencies of the health-sisters, it also empowered them. In Sen's word, their capabilities were enhanced (Sen 1999).

DISCUSSION AND IMPLICATIONS FOR RESEARCH AND PRACTICE

The findings of our study echo the socio-technical nature of telemedicine observed by Mort et al. (2003). Our paper illustrates how research and practice can mutually inform each other. The critical success factors for telemedicine initiatives came from practice. These were based on lessons learnt from such initiatives around the world by international organizations such as WHO and by observers such as Wooten (2001). Academic research provided a theoretical basis for these factors. For instance, we can see that collaboration and local participation can be understood through the social capital lens. The question then is how social capital is used to achieve this collaboration. Our paper does not provide an answer to this question. A theoretical premise that we can forward is Actor Network Theory (Latour 2005). One dimension of ANT is the process through which actors enroll other actors into a network, which then can lead to collective action to achieve a goal.

Another critical success factor was awareness of the local context and use of local resources. The latter can be understood from the social capital perspective. Local context though is a much more complex concept. What precisely is meant by local context? One theoretical premise that has been used is Information Ecology (Thapa and Sein, 2016). This view gives us a holistic and systematic picture of the environment, the stakeholders and how the various components of telemedicine system co-evolve.

For practice, our findings illustrate that organic, grounds-up initiatives can be successful provided social capital exists that can be leveraged to foster collective action. This approach also is rooted in the local context. This reduced the potential for mistrust that often accompanies technology interventions in developing countries (see Puri 2007 and Miscione 2007 for similar findings). Moreover, NTMP fostered the creation of “counter networks” (Walsham et al 2007) by involving hitherto marginalized groups such as low-level health workers who are generally excluded from existing power and influence.

While these factors plausibly explain to a great extent the success of NTMP, we do not get a good understanding of the conceptual role of the technology in the process. To shed some light on this, we put forward the proposition that ICTs provide the possibilities of action through affordances echoing the stance of Volkoff and Strong (forthcoming). (See Gibson 1979 for an understanding of the root of affordances). Affordance theory is particularly useful to shed light on the role of technology (Leonardi 2013). It has been used to analyze NTMP already (Thapa and Sein, 2017). Combining Affordance theory and Social Capital theory can provide a sharper lens to understand the role of ICT in development. Studies show that such technology enabled shared affordances to promote networking and collective action, which in turn create a meaningful impact on the organization (Leonardi, 2013). Most of the existing studies discussed how technology can help creating social capital, which in turn help solve social problems (Díaz Andrade and Urquhart, 2009; Thapa et al., 2012). What is rarely discussed is how specifically social capital interacts with aspects of the technology itself in such cases. It is reasonable to argue that social capital can play a vital role in the process through which affordances are perceived and then actualized. Through bridging and linking social capitals remote mountain communities can access a pool of resources that can assist in perceiving and realizing the latent and perceptible affordances of telemedicine. Research has shown that social capital not only play a role in actualizing the perceived affordances and promote the interaction among various communities, but also improves the many aspects of the quality of life including healthcare (Scott and Hofmeyer 2007).

The picture we get is that a number of theoretical bases are needed to understand the link between ICT and Development (Avgerou 2017). In this paper, we have presented one such theory. It does not give us the full picture, but it does offer an important glimpse.

REFERENCES

- Avgerou, C. (2017). "Theoretical Framing of ICT4D Research". In J. Choudrie et al. (Eds.), *Information and Communication Technologies for Development*. New York: Springer. pp. 10-23.
- Adler, P. S., and Kwon, S.-W. (2002). "Social Capital: Prospects for a New Concept," *Academy of Management Review* (27:1), pp. 17-40.
- Baruchli, K., O'Mahony, Banach, L. and Oberholzer, M. (2005). "iPath: A Telemedicine Platform to Support Health Providers in Low Resource Settings", *The Journal of Information Technology in Healthcare*, (3:4), pp. 227-235.
- Butler, T. (1998). "Towards A Hermeneutic Method for Interpretive Research in Information Systems," *Journal of Information Technology* (13:4), pp. 285-300.
- Corbin, J., and Strauss, A. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, Thousand Oaks, CA:Sage.
- Díaz Andrade, A. E., and Urquhart, C. (2009). "The Value of Extended Networks: Social Capital in An ICT Intervention in Rural Peru," *Information Technology for Development* (15:2), pp. 108-132.
- Gibson, J. J. (1979). "The Theory of Affordances," in *Perceiving, Acting, and Knowing: toward an Ecological Psychology*, R. Shaw and J. Bransford (eds.), Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., pp. 67-82.
- Granovetter, M. (1973). "The Strength of Weak Ties," *American Journal of Sociology* (78:6), pp. 1360-1380.
- Hartvigsen, G. (2013). "Ten Lessons for Successful Implementation of Telemedicine Services in North Norway", *Proceedings of Scandinavian Conference on Health Informatics, Copenhagen, Denmark*, pp. 25-28.
- Heeks, R. (2006). "Health Information Systems: Failure, Success and Improvisation", *Medical Informatics*, (75), pp. 125-137.
- Klein, H. K., and Myers, M. D. (1999). "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly* (23:1), pp. 67-93.

- Latour, B. (2005). "Reassembling the Social: An Introduction to Actor-Network-Theory," *Reassembling the Social-An Introduction to Actor-Network-Theory*, by Bruno Latour, pp. 316. Foreword by Bruno Latour. Oxford University Press, Sep 2005. ISBN-10: 0199256047. ISBN-13: 9780199256044 (1).
- Leonardi, P. M. (2013). "When does Technology Use Enable Network Change in Organizations? A Comparative Study of Feature Use and Shared Affordances". *MIS Quarterly*, (37:3), pp. 749-775.
- Miscione, G. (2007). "Telemedicine in the Upper Amazon: Interplay with Local Health Care Practices", *MIS Quarterly* (31:2), pp. 403-425.
- Mort, M., May, C. R., & Williams, T. (2003). "Remote Doctors and Absent Patients: Acting at a Distance in Telemedicine?". *Science, Technology & Human Values*, (28:2), pp. 274-295.
- Portes, A. (2000). "Social Capital: Its Origins and Applications in Modern Sociology," *LESSER, Eric L. Knowledge and Social Capital. Boston: Butterworth-Heinemann*), pp. 43-67.
- Puri, S. K. (2007). Integrating Scientific with Indigenous Knowledge: Constructing Knowledge Alliances for Land Management in India. *MIS Quarterly* (31:2), pp. 355-379.
- Putnam, R. D. (1995). "Bowling Alone: America's Declining Social Capital," *Journal of Democracy* 6(1), pp. 65-78.
- Resnick, P. (2001). Beyond Bowling Together: Sociotechnical Capital. *HCI in the New Millennium* (77), pp. 247-272.
- Scott, C., and Hofmeyer, A. (2007). "Networks and Social Capital: A Relational Approach to Primary Healthcare Reform," *Health Research Policy and Systems* (5:1), pp. 1-8.
- Sen, A. (1999). *Development as Freedom*, Oxford University Press, Oxford New York.
- Thapa, D. and Sein, M.K. (2017). "Trajectory of Affordances: Insights from a Case of Telemedicine in Nepal". *Information Systems Journal*. 1-22. <https://doi.org/10.1111/isj.12160>
- Thapa, D., & Sein, M. K. (2016). "Information Ecology as a Holistic Lens to Understand ICTD Initiatives: A Case Study of OLPC Deployment in Nepal". In *Proceedings of the*

Eighth International Conference on Information and Communication Technologies and Development (p. 27). ACM.

Thapa, D., Sein, M. K., and Sæbø, Ø. (2012). "Building Collective Capabilities through ICT in a Mountain Region of Nepal: Where Social Capital Leads to Collective Action," *Information Technology for Development* (18:1), pp. 5-22.

UN (n.d.) Sustainable Development Goals:

<https://sustainabledevelopment.un.org/?menu=1300> (accessed on Nov 5, 2017).

Volkoff, O. & Strong, D.M., (forthcoming). "Affordance Theory and How to Use it in IS Research," in *The Routledge Companion to Management Information Systems*, R.D. Galliers and M.-K. Stein (eds.), New York: Routledge.

Walsham, G. (2006). "Doing Interpretive Research," *European Journal of Information Systems* (15:3), pp. 320-330.

Walsham, G., Robey, D. and Sahay, S. (2007) "Foreword: Special Issue on Information Systems in Developing Countries", *MIS Quarterly* (31:2), pp. 317-326.

WHO (2010). Telemedicine Opportunities and Developments in Member States: Report on the Second Global Survey on eHealth", *Global Observatory for eHealth series – Volume 2*, 93 pages.

Woolcock, M. (2001). "The Place of Social Capital in Understanding Social and Economic Outcomes," *Canadian Journal of Policy Research* (2:1), pp .11-17.

Wooten, R. (2001). "Telemedicine and Developing Countries – Successful Implementation Will Require a Shared Approach", *Journal of Telemedicine and Telecare*, (/:Suppl.), pp. 1-6.

Wootton, R. (2008). "Telemedicine Support for the Developing World". *Journal of Telemedicine and Telecare*, (14:3), pp. 109-114.

APPENDIX-1: Timeline of the Nepal telemedicine project

