

## Research Article

# Introducing Internet-Based Services in the Mountain Areas of Nepal: An Asset Pentagon Perspective

### Øystein Sæbø

oystein.sabo@uia.no  
Associate Professor  
University of Agder  
Department of Information  
Systems  
Gimlemoen  
4604 Kristiansand  
Norway

### Devinder Thapa

devinder70@hanyang.ac.kr  
Assistant Professor  
Hanyang University ERICA  
Campus  
Department of Industrial &  
Management Engineering  
Gyeonggi-do 426-791  
Ansan  
South Korea

### Abstract

*Information and communication technology for development (ICT4D) projects can only be considered successful if they lead to some kind of individual, social, or economic development. The benefits of introducing ICT4D projects in developing countries are yet to be realized, particularly those introduced in mountainous and remote areas. Our study addresses this knowledge gap by analyzing the Nepal Wireless Networking Project from the mountain areas in Nepal using the assets pentagon model (APM). The main contributions of this work are threefold: First, we illustrate and discuss the use and usefulness of introducing APM, addressing the call for more clarity as to how ICT4D projects add to development. Second, our study expands the research knowledge of the relationships among various capital assets. Finally, our study reports on an ICT4D project from the mountain areas of Nepal, representing a country and an area that have been scarcely reported in our research community.*

## 1. Introduction

Introducing information and communication technology (ICT) into remote communities influences the flow of information (Díaz Andrade & Urquhart, 2009) to facilitate these communities' undertaking of development activities (Chand, Leeming, Stork, Agassi, & Biliki, 2005; Dabla, 2004; Kumar & Best, 2006). The reduced cost of installing infrastructure enhances the possibility of technology diffusion contributing to development (Aitkin, 2009; Chapman & Slaymaker, 2002) and plays an important role in the development of remote communities (Aitkin, 2009; Akhtar & Gregson, 2001; Heeks & Kanashiro, 2009). However, ICT for development (ICT4D) projects can only be considered successful if they lead to some kind of development (Avgerou, 2008; Walsham & Sahay, 2006). Thus, simply focusing on the technology and considering its use as the main success variable provides a limited view of the success, or lack thereof, of such projects (Heeks, 2002).

More research is needed to understand how ICT4D projects influence development in developing countries. In particular, studies are needed on the projects carried out in remote and mountain areas, since current research on such issues is scarce (Heeks & Kanashiro, 2009). These areas in developing countries are among the poorest and most inaccessible in the world (Heeks & Kanashiro, 2009; Kuhler, Hurni, Wiesman, & Klây, 2002), and they are often socially, politically, and economically excluded, isolated from mainstream development (Heeks & Kanashiro, 2009). So far,

the global information explosion has had little impact on access to information for remote communities in developing countries (Pringle, 2002). The distribution of ICT in terms of geographical dispersion has been heavily skewed in favor of urban areas (Akhtar & Gregson, 2001; HLCIT, 2004). In Nepal, the area of interest for our research, more than 90% of the Internet access points are located in urban areas, which are occupied by around 15% of the country's total population (HLCIT, 2004). Thus, IT services fall short of meeting the demand of remote mountain areas.

Few studies have investigated the opportunities and challenges of ICT4D projects in mountain areas. Heeks and Kanashiro (2009) argue, based on a study from a mountainous region of Peru, that ICT projects can be instrumental in overcoming remoteness and social exclusion. Furthermore, ICT4D projects can be helpful in creating social capital vis-à-vis human capital in remote communities, suggesting the exploration of a wide set of assets to understand the development in these areas (Díaz Andrade & Urquhart, 2009). Given the absence of research on mountainous, remote areas, the actual outcomes of ICT4D projects under such circumstances have yet to be identified (Díaz Andrade & Urquhart, 2009; Heeks & Kanashiro, 2009). Hence, there is a need to explore the outcomes within both the communities directly affected by ICT intervention and the broader context of those communities (Ashraf, Swatman, & Hanisch, 2007).

Our study addresses the call for more research to understand the multidimensional opportunities created by ICT4D projects (Heeks, 2002) by deploying the analytical lens of the assets pentagon model (APM; DFID, 1999). The APM introduces five principal categories of livelihood capital assets: financial, human, physical, social, and natural assets (DFID, 1999; Heeks & Shoba, 2010). This model is based on insight on poverty, realizing that even though economic growth may be essential to poverty reduction, development is dependent on poor people's capability to take advantage of it (Krantz, 2001). Poverty is more than a question of income; it includes dimensions such as bad health, illiteracy, and lack of access to government and social services. Therefore, livelihoods depend on a combination of assets of various kinds—not only from one category, but from all five (Krantz, 2001).

Current research that uses the APM to identify

various assets (e.g., Heeks & Shoba, 2010; Parkinson & Ramirez, 2006) does not discuss in depth the interrelationships among these assets. Nevertheless, the importance of combining various assets is a core element of the APM, and the interrelationships are particularly important for generating positive outcomes (DFID, 1999). We address these issues by focusing on how ICT influences various assets and the relationships among them. Our research questions are these: How does an ICT4D project in a remote mountain area influence social, human, physical, financial, and natural capital assets, and what are the relationships among these capital assets? Through an interpretive case study (Walsham, 1995; Walsham & Sahay, 1999) in the mountain areas in Nepal, we explore the challenges and perspectives of an ICT intervention called the Nepal Wireless Networking Project (NWNP).

The rest of the paper is organized as follows: In the next section, we present and describe the theoretical premises. Then, we introduce the research strategy, context, and method, and also present our findings. Next, we discuss the study's contribution to, and implications for, practice and future research. Lastly, we offer our conclusion.

## 2. Theoretical Premises

We deployed the APM to understand the multidimensional potential of ICT4D projects, so as to draw on a conceptualization of various capital assets (DFID, 1999; Heeks & Shoba, 2010). The APM is a core component of the sustainable livelihoods framework that was introduced as a "tool to improve our understanding of livelihoods, particularly the livelihoods of the poor" (DFID, 1999, p. 18). The framework identifies the main factors affecting people's livelihoods and the relationships among them. The core of the framework, the APM, identifies five core capital assets on which livelihoods are built, as well as the relationships among these assets (DFID, 1999; Heeks & Shoba, 2010). Any single capital of the APM might be a necessary, but not sufficient, condition for development. Therefore, to achieve overall socioeconomic development, contributions to multiple capitals are needed. The model is useful for illustrating the interrelationships among the various capital assets. Thus, it is introduced to analyze how the NWNP influences various capital assets and their relationships.

### **Social Capital**

Social capital focuses on the social resources on which a community draws in pursuit of its livelihood objectives. Social capital has three forms: bonding, bridging, and linking (Putnam, 2000; Woolcock, 2001). Bonding social capital refers to the relations among homogenous groups, such as family members, close friends, and ethnic fraternal organizations (e.g., religion-based groups). Bridging social capital refers to the relations among distant friends, associates, and colleagues, as well as institutions (loosely defined; one example might be a civil rights movement). Linking social capital refers to the relations between individuals and groups in different social strata in a hierarchy where power, social status, and wealth are accessed differently by different groups (Field, 2003).

Social resources are developed through a number of interrelated concepts (DFID, 1999). Furthermore, networks and connectedness increase people's trust and their ability to work together. Therefore, membership in formalized groups, often with commonly accepted rules, norms, and sanctions (DFID, 1999), may extend people's access to, and influence on, other institutions. Similarly, the relationships among trust, reciprocity, and exchanges may facilitate cooperation, reduce transaction costs, and increase the informal safety nets for the poor (Heeks & Shoba, 2010; Woolcock & Narayan, 2000).

### **Human Capital**

Human capital may be defined as "the skills and knowledge acquired by an individual" (Coleman, 1988, p. 100). It "symbolizes the individual abilities that are indispensable to benefit from the new available technological tools from an individualistic perspective" (Díaz Andrade & Urquhart, 2009, p. 112) and represents the skills and knowledge that enhance people's capabilities to pursue their livelihood objectives. Hence, the people themselves need to be willing to participate and invest in their human capital—for instance, by attending training sessions or accessing medical services.

Access to information is important for the promotion of human capital. Trainers need knowledge and access to information to be able to provide relevant teaching (DFID, 1999). Moreover, provisions must be made to extend access to the knowledge generated. For example, new technology may provide access to education and training through dis-

tance learning programs and enable the easy transfer of digital content in the form of text, images, video, and radio to remote locations. Therefore, to promote human capital, it is necessary to adopt strategies to guide people in the process of generating relevant knowledge based on digital content (Chapman & Slaymaker, 2002).

### **Physical Capital**

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods (DFID, 1999). Infrastructure that provides access to information or communication opportunities is important, and lack of infrastructure is commonly considered a core dimension of poverty. Infrastructure provides the accessibility needed to create other kinds of capitals, and the development of physical infrastructure should be guided by input from intended users to establish the users' priorities and needs (*ibid.*). Since infrastructure is only an asset as far as it renders service provision possible, it is important to consider its relationship to other assets to identify potential benefits for the poor.

### **Financial Capital**

Financial capital denotes the financial resources that a community uses to earn its livelihood (*ibid.*), and it is critical in ICT4D projects (Duncombe, 2006). The two main sources of financial capital are available stock and regular inflows of money. Available stocks may be held in various forms, such as cash, bank deposits, or liquid assets, whereas regular inflows of money are mainly pensions or remittances. These streams of inflow should be reliable to enable people to plan and invest. Furthermore, financial capital is versatile and can be converted into other types of capital, but it can also be used for the direct achievement of livelihood outcomes (DFID, 1999).

Organizational, institutional, and legislative means may be supported to build financial capital for the poor. In remote areas, access to financial services is often inadequate or absent. Therefore, there is a need to develop reliable and accessible financial services, as well as the legislation under which financial services operate.

### **Natural Capital**

Livelihoods for the poor are commonly derived from natural resource stocks (Duncombe, 2006). Natural capital varies from intangible public goods, like the air quality and biodiversity, to more divisible assets

needed for production, like land and trees (DFID, 1999). In the mountain regions of Nepal, where farming is the main occupation, access to resources like fodder for the animals, firewood, and land for growing vegetables is critical for sustaining livelihoods. These societies are located in vulnerable environments that are often altered by floods, rainfall, and temperature changes.

Introducing ICT may support the more sustainable use of natural resources by simplifying the coordination of how such assets are used (*ibid.*), monitoring natural resources, and providing increased access to markets to generate income from natural assets (Duncombe, 2006).

### **Relationships Among Assets**

The APM endeavors to improve the understanding of multiple interactions among the factors that affect livelihood. Where people require “a range of assets to achieve positive livelihood outcomes, no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek” (DFID, 1999, p. 24). Various capitals represent a wide conception of the resources to which people need access in the process of earning their livelihoods (Bebbington, 1999), which, in turn, “depend on combinations of assets of various kinds and not just from one category” (Krantz, 2001, p. 19). Despite the conceptual understanding of the importance of the relationships among capital assets, current ICT4D studies that introduce the APM (e.g., Duncombe, 2006; Heeks & Shoba, 2010) to analyze empirical data do not focus on the relationships among various capital assets. Thus, our study addresses these issues to identify both the relationships among various capital assets and the influences they have on each other.

### **3. Case Description**

Nepal is located in South Asia, on the southern slopes of the Himalayan mountain range, between Asia's two giants, India and China. With 27 million inhabitants, Nepal is divided into five development regions, 14 zones, and 75 districts. Around 4,000 village development committees (VDCs) comprise the administrative unit below district. About one-third of the total population lives in rural and remote areas, and roughly 25% of the population lives below the national poverty line. The literacy rate is around 55%, of which 82% of the literate

population reads and writes in Nepali (the national language) and 18% also in English.

While the government has installed around 300 telecenters across Nepal, they are mostly concentrated in the urban areas and district headquarters (NTA, 2010). Most of the remote communities have no Internet, e-mail, or telephone services. However, a few remote communities use Internet services operated by community initiatives using local VSAT (very small aperture terminal) technologies.

### **Nepal Wireless Networking Project**

The NWNP was initiated in 1997 and currently covers around 150 villages across Nepal. Despite the difficult circumstances faced in the initiation phase, such as a lack of government support, funding, technical knowledge, and unstable political systems, the project succeeded in providing Internet services with simple wireless technology, including homemade antennas and relay stations hidden in trees up in the mountain regions.

The project was initiated to support existing rural development activities to reduce migration from remote areas to urban areas and abroad. The NWNP's initiator, Mahabir Pun, identified two major reasons for the migration. First, the health care system is exceptionally poor. “Village ladies” are responsible for providing health services in the villages, and it is common to spend several days walking to the nearest doctor. Second, there is a lack of access to education in the mountain areas, as well as a lack of work opportunities for well-educated candidates. Due to the absence of roads, lack of trained personnel (such as doctors and nurses), and low status and salaries in the villages, it is difficult to attract teachers and doctors to work in the villages.

The NWNP was designed to provide communication infrastructure in the mountain regions to support three main areas: education, health care, and business opportunities. To support and improve education, the NWNP collaborates with Open Learning Exchange (OLE), Nepal, an NGO based in Kathmandu. OLE develops online educational content in the Nepali and English languages for students, and makes e-library content available online for the students and villagers. Similarly, to improve the health system in Nepal's villages, the NWNP collaborates with several hospitals to provide telemedicine services. The health workers in the villages communicate with both medical doctors in the

urban centers and health workers from other villages through net-meeting services.

The NWNP also develops e-commerce solutions to create business opportunities in the villages. Collaborations with private companies have enabled the creation of a virtual marketplace called Haat Bazaar, where villagers can advertise their local products for sale, such as cows, buffaloes, goats, chickens, vegetables, and cheese. In addition, the NWNP is running a pilot project of a virtual ATM machine to operate credit card transaction services for tourists on trekking routes. Further, a plan is in place to start a remittance service in Nepal's remote areas, as most members of the remote communities have family members who work abroad.

The World Bank and Nepal Telecommunication Authority support the NWNP financially to help it fulfill its vision of providing Internet services to all the remote villages of Nepal in an endeavor to contribute to the country's socioeconomic development.

### **Research Site**

The chosen locations for this research were the Nangi and Tikot villages in the Myagdi district, located in western Nepal. The combined population of these villages is around 2,000 people. The village inhabitants have to go to urban areas to obtain employment, education, and health care services. Tikot is inaccessible by road. From Nangi, it takes approximately four hours by Jeep or one day of walking to reach the nearest town of Beni. From Beni, there is another seven-hour bus ride to reach the capital city to access central hospitals and universities. These villages are inhabited predominantly by the Magar ethnic community, in addition to minority castes and social groups. Most villagers are farmers. A common employment opportunity is to join the military service in India or the UK, since this career path does not require a high level of education. The youth tend to go to neighboring countries to find employment. Thus, the main source of revenue is remittance from family members working outside the villages and overseas.

## **4. Research Approach**

The goal of this study is to explore how the NWNP influences social, human, physical, financial, and natural capital assets, as well as the relationships among them. Given the emphasis on understanding the phenomena within its real-life context through a

rich description of particular instances (Yin, 2009), it is appropriate to design a qualitative study. Our study follows an interpretive research approach, where the context of the phenomenon under study is explicitly included (Walsham, 1995). In this article, we generally follow the qualitative case study approach described by Yin (2009), who argues that qualitative case studies typically answer research questions that address "how" and "why."

### **Data Collection**

The explorative nature of this research considers that "research is a continuous process of data collection, followed by analysis and memo writing, leading to questions that lead to more data collection" (Corbin & Strauss, 2008). The data were collected in spring 2009 through interviews, focus group interviews, workshop, and observations. Secondary sources of data, such as project reports, were also included. To obtain the primary data, we conducted interviews with a sample of 40 community members. A semistructured guide was used for the interviews, each of which lasted between 15 and 55 minutes. We interviewed representatives of ICT service users, schoolteachers, social activists, health workers, students, and "non-users" (people not using Internet-based services), such as drivers, retired army personnel, and farmers. Focus group interviews were conducted with teachers, activists, and experts. The interviews were supplemented with observations of ICT usage in schools, telecenters, and village telemedicine clinics, as well as informal discussions with villagers to understand both the cultural and social contexts, and their perspectives on the NWNP.

Additional information was obtained to understand the context and the case under investigation. Such information came from relevant Internet sites, email exchanges, social networking sites, websites of ICT4D projects, and a workshop held in Kathmandu, which attracted around 30 participants, including researchers, practitioners, experts, medical doctors, government officials, a telecom director, teachers, students, and NWNP members.

### **Data Analysis**

All interviews were transcribed, coded, and categorized (Bryman, 2008) on the basis of the multi-dimensional prospects and challenges of the project. The APM guided the analyses to identify content related to social, natural, physical, financial, and human capitals. The categorization effort was based

on the iterative process of moving around data, concepts, and categories, as Klein and Myers (1999) suggest in their principle of evaluating interpretive field study. Connections were made among the data and subcategories, vis-à-vis subcategories and core categories. Regular discussions with other researchers and practitioners were attempted throughout the project to increase the reliability and validity of the interviews and interpretations. The researchers' varied perspectives helped with understanding the reality of the research context, since one had more of an insider view (having been born in Nepal) and the other, a more external view as a foreigner.

### 5. Research Findings

The findings are organized on the basis of the three main areas of use: education, health care, and business opportunities, before main challenges are introduced on the basis of the capital assets.

#### **Educational Purposes**

The NWNP has facilitated the development of **physical capital** in these villages by providing infrastructure, such as Wi-Fi stations and computers in primary schools, where the equipment is also used to provide Internet access to other villagers in the afternoon and early morning. Many of these village residents are able to use computers and online services. Students and teachers are offered e-mail accounts through the project, while others use free Web mail accounts, such as Yahoo! and Gmail. There is a bulletin board for local news, local advertisements, announcements, and urgent messages. ICT infrastructure is rarely present in remote communities in Nepal. One teacher expressed his feelings on the matter:

There are a lot of benefits of using computers in this village. There are many places in Nepal where children have not seen computers. But in our remote village, children are able to use and feel the new technologies. They are able to read updated news, and some are busy playing games. To enjoy playing games on a computer is also a breakthrough achievement for them.

The NWNP facilitates the **social capital** building process. The people from the villages who are working abroad use e-mail to communicate with their families back home, which facilitates their bonding social capital (strengthening their existing family

relations). Moreover, they use these communication opportunities to extend their social networks, thereby increasing their bridging social capital. A principal of one of the schools involved said the following:

By using e-mail, we can meet people from other villages. We can exchange our information and put news on the homepage. We can easily find out about any events. It has facilitated the resource exchange. Through the Internet, we can also connect inside and outside of our country.

Teachers and students obtain access to educational materials on the project's intranet, which facilitates **human capital**. The NWNP helps school children use online educational resources, as stated by one student:

It helps us in our study. For example, to understand history, the course book is not enough. Now, we may download additional information to get to know more. It's helping me to receive external information related to my studies.

School children and teachers seemed more motivated to study and learn after they got access to the Internet. One of the teachers expressed his excitement as follows:

It was clearly exciting to get this new technology. When the computers arrived in the village, we would be up learning to use the computers until midnight. Gradually, the interest to work on the computers was cultivated.

The capitals, based on the educational purposes, are summarized in Table 1.

#### **Telemedicine**

**Physical capital** is facilitated through the telemedicine project. The team leader of the NWNP explained the telemedicine project as follows:

People who have not seen doctors can meet the doctors through this technology. These are the main focuses of our project. Whenever we are connecting villages, we are connecting schools and health post stations.

Connecting local health workers and doctors from main hospitals facilitates **social capital**. The telemedicine part of the project addresses bonding and bridging social capital by strengthening the connection between the local health worker and her patients. Patients do not converse directly with doc-

Table 1. Facilitation of Capitals by Educational Efforts.

Capital	Description	Relationships
Social	Facilitates bonding and bridging social capital by strengthening and extending social networks.	<ul style="list-style-type: none"> <li>• The infrastructure, representing physical capital, facilitates other capitals.</li> <li>• Social and human capitals are facilitated through the services provided.</li> <li>• Social and human capitals are not only facilitated for students, but for all villagers, by inviting them to use the infrastructure in the afternoon and early morning.</li> </ul>
Human	Provides access to up-to-date educational resources and online resources to facilitate the development of relevant knowledge and skills.	
Physical	Offers infrastructures such as computers, wireless, e-mail accounts, and a bulletin board to enable service provision.	
Financial	No direct influence.	
Natural	No direct influence.	

tors through the net-meeting services unless the local health worker is present. The consultations are between the patient and the local health worker, who communicates with the doctor. The health workers argue that the telemedicine project assists in the fostering of trust among villagers, due to the virtual presence of the doctors that it facilitates. A doctor associated with this project said the following:

Particularly in the villages, people are afraid of diseases. When they see a doctor in front of the camera prescribing medicines to them, they feel psychologically confident.

Developing virtual networks among health workers from several villages also facilitates bridging social capital by extending each worker's professional network. Linking social capital is facilitated by the communication among the less-educated local health workers and the doctors working at the main hospital. A health worker commented:

Here, we have a small clinic where two sisters are working. If they face any difficulties or emergencies, then they connect directly to Kathmandu, or four to five other main hospitals, and consult with the doctors there.

Thus, telemedicine allows the local health workers to expand their social networks with other health workers and doctors.

Once these networks were established, the local health workers gradually began to feel comfortable within them, and also able to trust the technology and other participants. These networks are used to facilitate **human capital** by developing competence

and increased skills among local health workers. The networks are useful in many ways: Doctors give lessons online, online information is provided through the Internet, and the health workers present their cases to other health workers and doctors. The participants in these online sessions actively engage in discussions about topical issues and practice making diagnoses. As such, the facilitation of human capital is based on the presence of physical capital (infrastructure, network, and devices) and social capital (social networks).

The capitals, based on the telemedicine project, are summarized in Table 2.

### **Income Generation**

The community of Nangi is running a crossbreeding project between the yak and the cow. The management committee can communicate via net-meeting to make appropriate decisions regarding the project. Thus, the facilitation of **physical capital** could enhance other capital assets. For example, the infrastructure allowed villagers to extend their linking **social capital** and become involved in the income-generation projects. Their extended social networks then influenced their **financial capital** by providing income-generation activities, such as Haat Bazaar, in their own regions. The Haat Bazaar website allows the villagers to advertise the local products they are selling, such as cows, buffalo, goats, chickens, and cheese. The team leader of the NWNP explained:

They can use it (Haat Bazaar) for advertisements in the village. Thanks to the Internet, we can promote local products such as Doko, Namlo, Nepali spices, mushrooms, and cattle. Anyone who wants to sell their products may use services like

Table 2. Facilitation of Capitals by the Telemedicine Project.

Capital	Description	Relationships
Social	Facilitates bonding, bridging, and linking social capital by strengthening and extending social networks.	<ul style="list-style-type: none"> <li>• The infrastructure, representing physical capital, facilitates other capitals.</li> <li>• Social capital is facilitated through infrastructure and represents a necessary condition for developing human capital.</li> <li>• The infrastructure and social networks enable the facilitation of human capital to increase skills and knowledge.</li> </ul>
Human	Provides access to other professionals, online resources, training, and reflection sessions to facilitate the development of relevant knowledge and skills.	
Physical	Offers infrastructures such as computers, networks, and net-meeting equipment to enable service provision.	
Financial	No direct influence.	
Natural	No direct influence.	

Haat Bazaar on the Net. They contact the Internet operator, who will put the information online for other people to see and buy that product.

Another example is the newly initiated remittance service, the importance of which is yet to be determined. In this regard, the team leader added the following:

Remittance services are going to start soon in this village. By using this service, family and friends in foreign countries and in the big cities may transfer money easily, which is clearly beneficial for the community.

The crossbreeding project demonstrates the facilitation of **natural capital**, and it may result in more sustainable use of natural resources and increased access to resource stocks for all those involved. The NWNP plans to develop e-commerce services that could support eco-tourism, which, in turn, could increase the sustainable use of natural resources—for example, by providing virtual ATM services at the local lodges around the villages to allow tourists to pay for both lodging and local products through the Internet.

The facilitations of the various capitals by income generation activities are summarized in Table 3.

**Main Challenges**

It is challenging to get farmers involved, especially the elderly, due to a lack of understanding of the importance of learning to use computers, a lack of education, and a lack of time and effort to participate in training to increase their ICT competence. Another major challenge concerning both **social**

**and human capital** is the literacy rate, which restricts participation, especially from the elderly. Furthermore, there is a need for services and online context based on the Nepalese language. Also, most of the villagers use ICT services to communicate with their relatives and friends—that is, their existing social network. However, for the creation of macro-level socioeconomic development, they should extend their social network (Woolcock & Narayan, 2000).

Developing competence for IT teachers, clinic health workers, and network technicians generates local manpower and facilitates **human capital**, though the lack of skilled manpower to maintain and develop the project further poses a major challenge. There are trained technicians (local youth) who can solve very basic technical problems, but there are no certified engineers. One technician described this situation:

We are not using the computers for complex tasks, therefore, we don't have any problems. But we will face difficulties if we start using them for more complex tasks . . . If the computers are out of order, there is no one to fix them. We have just one technician and he is not perfect. He works according to the instructions given by Mahabir Pun by phone. Otherwise, if the problem is bigger, then Mahabir needs to come.

Although the NWNP has the support of community members, these people are highly dependent on Mahabir Pun, the team leader, for funding, planning, development, maintenance, and action. One teacher expressed his concerns as follows:

Table 3. Facilitation of Various Capitals by Income-Generation Activities.

Capital	Description	Relationships
Social	Facilitates bridging social capital by extending the networks of people involved in income generation projects.	<ul style="list-style-type: none"> <li>• The infrastructure, representing physical capital, facilitates other capitals.</li> <li>• Social capital is facilitated through infrastructure and is instrumental in facilitating financial and natural resources.</li> </ul>
Human	No direct influence.	
Physical	Offers communication infrastructure to manage projects and online advertising opportunities.	<ul style="list-style-type: none"> <li>• The infrastructure and the social networks facilitate financial capital (by providing an extended network for income generation activities) and natural resources (by providing an extended network for managing natural resources).</li> </ul>
Financial	Promotes local products and remittances received from family members living in cities or abroad.	
Natural	Enables more sustainable access to natural resources and improved income generation from tourists visiting the mountain areas.	

It would not be possible without him; still, I haven't found any other person who has come here to work like Mahabir. For example, many people have come from foreign countries to observe the project, but there was no one who said, "I will work with Mahabir." Therefore, as long as Mahabir is here, it will function properly, however, in his absence, we need another person like him to sustain this project. Without his presence, this project will not function properly. I am a bit worried about it.

Power shortages, combined with poor infrastructure, are major obstacles that threaten the facilitation of **physical capital**. For example, the lack of sophisticated devices has hampered the quality of the telemedicine services in the villages. The team leader said:

The only constraint to make voice over IP telephone calls to the villages from abroad using the extension number is that they don't have enough Internet bandwidth from the ISP. People are using Skype and Yahoo! Voice Chat in the morning or evening, when acceptable Internet bandwidth is available.

Furthermore, the lack of equipment in these villages hinders health workers in the achievement of their potential, as expressed by a health worker:

The last time that I went to Kathmandu Model Hospital for training, I was able to use a lot of lab facilities that are not yet available here. Thus, I'm not able to make full use of my new competence here.

Since there is a shortage of power in most parts of Nepal, and the power supply is unreliable due

to the mountainous terrain, the project is highly dependent on solar power systems, which are still quite expensive and not always reliable in the rainy seasons.

Small-scale industries for income generation have been initiated. So far, these are still in the testing phase. Sustainable business models need to be developed to realize macro-level socio-economic benefits to facilitate **financial capital**. According to the director of the Nepal Telecommunication Authority, the private sector is uninterested in remote locations because they offer few business opportunities:

The major challenge for the private sector is the lack of a business model in remote places. In the liberal economic system, a business model is very important, we have so far not been able to design the correct sustainable business model.

Financial capital is required to implement the NWNP in more villages in other regions, as well as to develop more sophisticated services. Upgrades and purchases of new equipment are difficult because of poor economic conditions.

A main concern for the facilitation of **natural capital** is the insufficient roads and lack of infrastructure. Farmers face difficulties when transporting local products to nearby cities, and the difficulty in transporting tourists into the mountain areas inhibits more tourism and better use of natural resources. Moreover, tourism is also hindered by the political situation. Ten years of Maoist insurgency, the massacre of the king's family, and a fragile government, among other things, have yielded the unstable political situation and lack of government support. This

instability influences the NWNP in several ways. For example, despite the allocation of money to the Rural Telecom Development Fund to facilitate the development of telecom infrastructure in rural areas, the funds have not been distributed or used, due to the political instability and delayed bureaucratic processes. The head teacher of one of the area schools offered an example of the practical difficulties due to the tense political situation:

We sent our computer teacher to Kathmandu for one month of training in hardware. Due to the Nepal Banda [strike] and other political movements, he received just 15 days of training instead of one month.

Similarly, there is a lack of government support for these kinds of community-based projects. A villager from Tikot expressed the following:

The District Education Office is not helping us directly, but the Education Ministry provides around 40–50,000 rupees to fund Internet provision to the schools. They sometimes offer us a program to provide an equal amount of money from the community and from the District Education Office . . . but that small amount is not enough to contribute to the big change.

### **Summary of the Case Study Finding**

The major issues from the case analysis are summarized in Table 4.

## **6. Discussion**

Before discussing the implications of our findings, we should point out some limitations of the study. The study is context-dependent, with the data collected from two remote mountain villages in Nepal. The primary data were collected at one point in time, while secondary sources, such as project reports, represented the longitudinal perspective. The time frame of the study raises the possibility that we may not have captured the effects at the “right” time. Such projects may require a longer period to demonstrate their importance; hence, a longitudinal study may be appropriate. Our findings should be interpreted in light of these limitations.

The NWNP was initiated to support various rural development efforts, such as facilitating access to quality education, income-generating activities, and quality health care, which, in turn, can collectively reduce migration from the mountain villages. By

doing so, the NWNP aims to increase the villagers’ opportunities to influence their own lives by improving their capability to influence their livelihood outcomes. The APM represents a logical point of departure to analyze the NWNP, since the project objectives coincide with the model’s theory on how to empower people to influence their own lives. Based on our experience, we agree with Duncombe, who argues that “[t]he livelihoods framework is of value as an analytical tool for investigation of ICT and poverty reduction because it helps us to contextualize the analysis within a particular set of social, political, and economic relations” (2006, p. 96). Existing research on ICT4D has already validated the importance of the APM in analyzing the multiple impacts of ICT intervention on social, natural, human, financial, and physical capital assets (Duncombe, 2006; Heeks & Shoba, 2010). Our analysis explored the relationships among these assets and their influences on each other. We found that the physical asset, the ICT infrastructure, facilitates other capital assets. The NWNP could not run without the ICT infrastructure, but even in just the initial phase, the project focused more on other assets than only the physical, by initiating services, developing online content, and supporting coordination mechanisms for business projects. Similar to physical capital, we found social capital to be important in influencing other capital assets. For instance, the village ladies who are responsible for local health services would probably not have been able to increase their human capital (knowledge and skills) through the virtual professional networks if the social capital (their extended networks) had not already been established and earned the trust of the participants. The need of these health workers for extended social capital is addressed by the design and management of the services: For instance, by not allowing patients to discuss directly with doctors without the village lady participating as a mediator, the village lady builds her social capital with the doctors. Thus, instead of using the technological opportunities to exclude the local health worker from the process (the patient and the doctor could easily have communicated directly through the net-meeting services), her social capital increases and inspires her confidence as an important participant in the process. The same pattern occurs in the income generation projects, where the social capital is addressed to influence other capital assets. Existing social net-

Table 4. Summary of Case Analysis.

	Contributions	Relationship with other capitals	Challenges
<i>Social Capital</i>	<ul style="list-style-type: none"> <li>• Extended communication between family members in the villages and those working abroad.</li> <li>• Access to local news, advertisements, and urgent messages.</li> <li>• Increased trust in the health system in the villages.</li> </ul>	<ul style="list-style-type: none"> <li>• Physical capital facilitates social capital building process.</li> <li>• (In most cases) other capital assets are dependent on social capital. The financial, natural, and human capitals are based on the facilitation of existing or extended social networks.</li> </ul>	<ul style="list-style-type: none"> <li>• High illiteracy rate, especially among elderly people.</li> <li>• Difficulties in extending external social networks.</li> <li>• Lack of online context based on the Nepalese language excludes non-English literates.</li> </ul>
<i>Human Capital</i>	<ul style="list-style-type: none"> <li>• School children get access to online educational resources.</li> <li>• NWNPN provides job opportunities in the villages.</li> <li>• Competence for IT teachers, clinic health workers, and network technicians is developed through the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on social and physical capital.</li> <li>• Occurs (most often) after social capital is established, when trusted social networks are already established.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of skilled manpower to develop NWNPN further.</li> <li>• High dependency on key personnel.</li> </ul>
<i>Physical Capital</i>	<ul style="list-style-type: none"> <li>• Access to computers and courses on how to make use of online opportunities.</li> <li>• Access to telemedicine labs in the villages.</li> <li>• Better access to external doctors through daily net-meetings.</li> <li>• Management opportunities for income-generating projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on social capital and facilitates other capital assets.</li> <li>• Physical capital only adds to development when combined with other capital assets.</li> <li>• Shortcomings in the facilitation of physical capital (e.g., the shortage of power) heavily influences the facilitation of other capital assets.</li> </ul>	<ul style="list-style-type: none"> <li>• Power shortages.</li> <li>• Poor ICT infrastructure.</li> <li>• Difficult circumstances in the high mountain areas.</li> </ul>
<i>Financial Capital</i>	<ul style="list-style-type: none"> <li>• Income-generating services initiated.</li> <li>• Reduced transaction costs in the pilot projects.</li> <li>• Potential access to new markets.</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on social and physical capitals.</li> <li>• Heavily related to natural capital, since local farming products dominate the income generating opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of sustainable business models.</li> <li>• Lack of funding to invest in future development.</li> </ul>
<i>Natural Capital</i>	<ul style="list-style-type: none"> <li>• More sustainable access to natural resources.</li> <li>• Improved income generation for eco-tourism.</li> <li>• Better management facilities for farming projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on social and physical capitals.</li> <li>• Heavily related to financial capital, where income-generating opportunities may improve the facilitation of natural resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient infrastructure to transport farming products.</li> <li>• Unstable political situation hinders eco-tourism.</li> </ul>

works are supported and extended (by connecting villagers from neighboring villages) to manage the farming projects. Thus, opportunities are created to influence natural and financial capitals through influencing social capital.

### **Implications for Research**

Based on our analyses, we see some implications for future research. First, our empirical finding reflects

Bebbington's (1999) conceptual work, where he points to the preference for social capital among the five capital assets. He argues that social capital is a critical precursor to gaining access to other capitals, which coincides fully with our findings. Moreover, Bebbington argues that social capital is the least tangible and least understood of the five, so more research is needed to fully understand the role of

social capital and the interrelationships among social capital and other capital assets. We concur. Even though our analysis illustrated some sequences where social capital seemed conditional for other capital assets, more research is needed to fully understand the importance of social capital. For example, what are the consequences of influencing bonding, bridging, and linking social capital? Social capital can further be divided into individual and collective categories (Portes, 1998). However, the discussion of the consequences of influencing social capital on individual (as opposed to collective) levels lies beyond the scope of this paper, but it is a question of concern for future research.

Second, more research is needed to understand the roles of various stakeholders in the project. A core argument for introducing the sustainable livelihoods framework (including the APM as a core element) is the people-centered perspective:

The framework is centered on people. It does not work in a linear manner and does not try to present a model of reality. Its aim is to help stakeholders with different perspectives to engage in structured and coherent debate about the many factors that affect livelihoods, their relative importance and the way in which they interact. (DFID, 1999, p. 2)

However, the APM deals inadequately with the role of stakeholders within the initiatives, failing to help us understand how various roles and interests influence such initiatives. As is presently argued, the NWNP would not have been initiated without the effort of the team leader, Mahabir Pun, and the project is still dependent on his presence. Other stakeholders, both external (such as doctors at the hospitals, OLE, external funding partners) and internal (such as teachers, farmers, heads of local committees), influence the design, evaluation, and effects of the NWNP on the local societies. The different stakeholders' roles and influences change dynamically throughout a project's life cycle (Sæbø et al., 2011). Therefore, future research is needed to investigate the roles of the people within the initiatives, so as to better understand the importance of the various stakeholders.

Third, there is a need for more research to guide the development of sustainable business models. So far, the NWNP has been dependent on donors and some restricted payments made by the village development committees. Hence, business models should

be developed to both make the NWNP sustainable and generate more income for the villagers.

### ***Implications for Practice***

Our analyses emphasize the important role that social capital performs for other capital assets. Current social structures and potential opportunities for social network extensions should be targeted to influence the local societies. To truly affect the people's opportunity to influence their livelihood objectives in remote areas, there is not only a need to support communication within the existing social networks, but also to increase their external network by supporting communication with individuals and communities outside their own village.

Comprehensive knowledge of contextual issues is needed to address social structures. For instance, knowledge is needed about family structures, power relationships, and the real needs with respect to the education and health systems in these villages. Access to the Internet will have only limited impact for the majority of the local people if services and information are not provided in their own language. Furthermore, it is important to understand the contextual issues, so as to be able to design and implement services to increase trust among the community members. For example, in the NWNP case, the initiator was familiar with the local societies and aware of the importance of developing services to support local health workers and teachers, not replace them. His contextual knowledge influenced both the design of the services and the trust accorded the NWNP by citizens living in these societies.

Finally, the NWNP demonstrates the strengths and challenges of being heavily dependent on one central actor. Projects such as the NWNP most probably succeed because of a central activist or an activist group whose knowledge is instrumental to them. However, the dependence on the team leader also represents a challenge for the growth and sustainability of the NWNP. It is essential to identify and educate personnel who can take charge of the regular installation and maintenance of the ICT software and hardware. A lack of trained personnel can also be a barrier to the further expansion of the NWNP to other mountain regions of Nepal.

## **7. Conclusion**

The remote communities in the mountain regions of developing countries are deprived of socioeconomic

and political advantages (Aitkin, 2009; Akhtar & Gregson, 2001; Heeks & Kanashiro, 2009). In this study, we described the NWNP and explored how the project addresses these shortages. Our work demonstrated the usefulness of deploying APM as an analytical lens to explore the multidimensional perspectives of the NWNP. The project was initiated to address community needs in the villages, where access to Internet and ICT infrastructure was a means, but not an end objective, of the project. Thus, the NWNP's approach correlates with the APM by focusing primarily on developing the capabilities of the community through ICT intervention, not on the technology itself.

Social capital seems instrumental in enabling other capital assets, such as physical, natural, human, and financial capital assets. From its initial phase, the NWNP mobilized existing and extended social networks that positively influenced financial, human, and natural capitals.

The NWNP has created a positive wave of development in the Nangi and Tikot villages. Despite some challenges, the NWNP is an important example of an ICT4D project in the mountain regions of Nepal, representing both a context and a country that are rarely discussed by the ICT4D research community. Conducive government policies, infrastructure development, and public-private partnerships may support the replication of the NWNP across other mountain regions in Nepal. ■

## References

- Aitkin, H. (2009). Bridging the mountainous divide: A case for ICTs for mountain women. *Mountain Research and Development*, 22(3), 225–229.
- Akhtar, S., & Gregson, J. (2001). Internet technologies in the Himalayas: Lessons learned during the 1990s. *Journal of Information Science*, 27(1), 9–17.
- Ashraf, M., Swatman, P., & Hanisch, J. (2007). Some perspective on understanding the adoption and implementation of ICT interventions in developing countries. *The Journal of Community Informatics*, 3(4).
- Avgerou, C. (2008). Information systems in developing countries: A critical research review. *Journal of Information Technology*, 23(3), 133–146.
- Bebbington, A. (1999). Capitals and capabilities: A framework for analyzing peasant viability, rural livelihoods and poverty. *World Development*, 27(12), 2021–2044.
- Bryman, A. (2008). *Social research methods*: Oxford, UK: Oxford University Press.
- Chand, A., Leeming, D., Stork, E., Agassi, A., & Biliki, R. (2005). *Impact of ICT on rural development in Solomon Islands*. Retrieved from [http://www.olpcnews.com/files/pfnet\\_evaluation\\_report.pdf](http://www.olpcnews.com/files/pfnet_evaluation_report.pdf)
- Chapman, R., & Slaymaker, T. (2002). *ICT and rural development: Review of the literature, current interventions and opportunities for action*. (Working paper 192, Overseas Development Institute [ODI]). Retrieved from <http://dspace.cigilibrary.org/jspui/handle/123456789/22957>
- Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94(1), 95–120.
- Corbin, J., & Strauss, A. (2008). *Basics of qualitative research* (3rd ed.). Thousand Oaks, CA: SAGE Publications.
- Dabla, A. (2004). The role of information technology policies in promoting social and economic development: The case study of the state of Andhra Pradesh, India. *EJISDC*, 19(5), 1–21.
- Department for International Development (DFID). (1999). *Sustainable livelihoods guidance sheets 1–4*. London: DFID. Retrieved from [www.eldis.org/vfile/upload/1/document/0901/section2.pdf](http://www.eldis.org/vfile/upload/1/document/0901/section2.pdf)
- Díaz Andrade, A., & Urquhart, C. (2009). The value of extended networks: Social capital in an ICT intervention in rural Peru. *Information Technology for Development*, 15(2), 108–132.
- Duncombe, R. (2006). Using the livelihoods framework to analyze ICT applications for poverty reduction through microenterprise. *Information Technologies and International Development*, 3(3), 81–100.
- Field, J. (2003). *Social capital*. New York: Routledge.

## INTRODUCING INTERNET-BASED SERVICES IN THE MOUNTAIN AREAS OF NEPAL

- Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18(2), 101–112.
- Heeks, R., & Kanashiro, L. (2009). Telecentres in mountain regions—A Peruvian case study of the impact of information and communication technologies on remoteness and exclusion. *Journal of Mountain Science*, 6(4), 320–330.
- Heeks, R., & Shoba, A. (2010). Social outsourcing as a development tool: The impact of outsourcing IT services to women's social enterprises in Kerala. *Journal of International Development*, 22, 441–454.
- High Level Commission for Information Technology (HLCIT). (2004). *A fact book on information and communications technology sector of Nepal*. Retrieved from [www.hlcit.gov.np](http://www.hlcit.gov.np)
- Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly*, 23(1), 67–93.
- Krantz, L. (2001). *The sustainable livelihood approach to poverty reduction*. Swedish International Development Cooperation Agency (SIDA). Retrieved from [www.forestry.umn.edu/prod/groups/.../cfans\\_asset\\_202603.pdf](http://www.forestry.umn.edu/prod/groups/.../cfans_asset_202603.pdf)
- Kuhler, T., Hurni, H., Wiesman, U., & Klåy, A. (2002). Mountain infrastructure: Access, communication, and energy (background paper). *Paper presented at the Bishkek Global Mountain Summit*, Kathmandu.
- Kumar, R., & Best, M. (2006). Social impact and diffusion of telecenter use: A study from the sustainable access in rural India project. *The Journal of Community Informatics*, 2(3).
- Nepal Telecommunications Authority (NTA). (2010). *Ten-Year Master Plan (2011–2020 AD): For the development of telecommunication sector in Nepal*. Retrieved from [www.nta.gov.np](http://www.nta.gov.np)
- Parkinson, S., & Ramirez, R. (2006). Using a sustainable livelihoods approach to assessing the impact of ICTs in development. *The Journal of Community Informatics*, 2(3), 116–127.
- Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Annual Review of Sociology*, 24(1), 1–24.
- Pringle, I. (2002). Rural community ICT applications: The Kothmale model. *EJISDC*, 8(4), 1–14.
- Putnam, R. (2000). *Bowling alone—The collapse and revival of American community*. New York: Simon & Schuster.
- Sæbø, Ø., Flak, L. S., & Sein, M. K. (2011). Understanding the dynamics in e-participation initiatives: Looking through the genre and stakeholder lenses. *Government Information Quarterly*, 3, 416–425.
- Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems*, 4, 74–81.
- Walsham, G., & Sahay, S. (1999). GIS for district-level administration in India: Problems and opportunities. *MIS Quarterly*, 23(1), 39–65.
- Walsham, G., & Sahay, S. (2006). Research on information systems in developing countries: Current landscape and future prospects. *Information Technology for Development*, 12(1), 7–24.
- Woolcock, M. (2001). The place of social capital in understanding social and economic outcomes. *ISUMA Canadian Journal of Policy Research*, 2(1), 11–17.
- Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *World Bank Research Observer*, 15(2), 225–249.
- Yin, R. K. (2009). *Case study research: Design and methods* (4th ed., Rev. ed.). Newbury Park, CA: SAGE Publications.