ICTs and Poverty Reduction: A Social Capital and Knowledge Perspective

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Research article

ICTs and poverty reduction: a social capital and knowledge perspective

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Abstract
The efficacy of information and communication technology (ICT) projects and initiatives in developing countries, and how they may assist poverty reduction or otherwise improve the quality of life for communities in those countries, is still a topic of debate. Knowledge empowers people, while information technology integrates such knowledge for purposeful action and reaction. This paper describes a framework, based on social capital and knowledge management theories, which aims to further that debate in the field of information systems. The framework is primarily a sensitising device, designed to assist thinking about how social capital and knowledge theories facilitate ICT interventions for poverty reduction. The framework has four stages, the process of ICT development, the ICT intervention, the evaluation of the impact of the ICT intervention and the process of poverty reduction, which is the final and most contested stage of an ICT intervention. Each stage of the framework is discussed, using illustrations from various development projects. Finally, the paper draws some conclusions about the contribution of social capital and knowledge management theories to the issue of ICT intervention and evaluation in developing countries.
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Introduction

While the debate on the utility of information and communication technologies (ICTs) in developing countries has largely been won, the challenge of how best to use ICTs for poverty reduction remains (Avgerou and Walsham, 2000; Walsham *et al.*, 2004). Although the link between economic growth and ICT has been well established (Kraemer and Dedrick, 2001; Jalava and Pohjola, 2002), the exact process of how ICTs can be used for poverty reduction in developing countries need exploration and are open to challenge (Kenny, 2002). In particular, there are few if any theoretical explanations as to how ICTs can assist in building human capacity for poverty reduction in a developing country setting.

The economic argument for ICTs in developing countries is highlighted in a relatively recent UK government report, which discusses the distinct role ICTs can play in bridging

the information and knowledge gap for the poor (Marker *et al.,* 2002). Despite the complexity and cost of ICTs, their use in developing countries have ramifications for knowledge, information access, and the economic and social welfare of communities. A strong correlation exists between the access to education and knowledge and poverty indicators such as infant mortality, family size and women's health (Marker *et al.*, 2002). Other studies have also established a close link between poverty and an information gap of the poor (see e.g., Burch and Grudnitski, 1986; Humphrey, 2006). In the case studies reported in this paper, we could see that information had the potential to close that gap in various ways: For instance, in a Sri Lankan village studied, although there were skills in dressmaking, there was a lack of information about how to make patterns for those dresses. In another village, villagers were aware of

new varieties of rice but had no access to support and information on growing these varieties.

ICT projects aimed at reducing poverty have often used models based on providing access to new technology, new skills and better ICT infrastructure with the expectation that ICTs will primarily stimulate economic growth and production efficiency. Those communities with a low income and impoverished economies are expected to benefit from such ICT interventions. A direct correlation is assumed between ICT intervention and poverty reduction. Such a supply push approach has distinct limitations, because they do not take into account the endogenous capacity building and absorptive capacity of the community's knowledge, as well as the process of the social capital formation.

In this paper, we have developed a framework that combines IT infrastructure and social capital formation. It is primarily a 'sensitising device' (Klein and Myers, 1999) that has been developed to assist our thinking about ICTs and poverty reduction and how this issue could be theoretically grounded. The framework takes into account two major theoretical approaches – theories of human and social capital (Bourdieu, 1986; Coleman, 1988; Nahapiet and Ghoshal, 1998; Schuurman, 2003) and the theories of knowledge creation, transfer and diffusion (Nonaka and Takeuchi, 1995; Alavi and Leidner, 2001). Both these theoretical strands are important in synthesising and translating knowledge into action for poverty alleviation as they draw on effective use of knowledge for the formation of tangible and intangible social and human capital. This model also considers social and cultural dimensions of poverty. Thus the central theme of this paper is the exploration of the interaction of human and social capital with ICT interventions in projects aimed at reducing poverty.

The central research problem addressed in this paper is:

How can human capital, social capital and knowledge perspectives assist ICT capacity building and poverty reduction?

The paper first discusses the theoretical underpinning of the framework, and then presents the framework with some illustrations from ICT projects in developing countries. The paper concludes with a critical discussion of this model's contribution to ICT development projects, and suggests further research avenues for exploration.

Using ICTs as an enabler of human and social capital through knowledge

ICTs facilitate the building of human and social capital through increasing flows of information, and building on endogenous knowledge and human capacity for poverty reduction. An important element of the model is the broadening of the concept of poverty to include consideration of the ICT dimensions of poverty such as access to information (McNamara, 2003).

The concept of social capital has continued to evolve and it has been characterised as 'a wonderfully elastic term' by sceptics (Lappe and Du Bois, 1997 in Adler and Kwon,

2002). Both individual actors and collective capital are viewed from directly immeasurable and subjective variables such as relationships, capacity, flow and path dependence, opportunity and trust. Some of the collective perspectives, such as networks, value and goodwill, can have notional economic variables. Beyond the notion of connectivity of individuals, trust, collaboration and relationships, we argue that social capital theory needs to examine information and knowledge theories as they are central to building the sort of social capital that helps poverty reduction. ICTs can be viewed as an enabler that churns the 'right type' of social capital for economic and social progress in a community.

Social capital can be viewed from an individual actor or a collective viewpoint (Schuurman, 2003). Schuurman's definitions were further extended by Adler and Kwon's (2002) definition of social capital by adding goodwill as the substance of social capital. They argued that the effects flowing from the information, influence and solidarity are those that such goodwill makes available. Another important dimension of social capital in Nahapiet and Ghoshal's (1998) definition of social capital, which emphasises trust as an inherent factor in relationship between and among persons and a productive asset, facilitating some forms of social action while inhibiting others. This inhibiting aspect is particularly influential in poverty stricken communities. The collective perspective that links social capital to intellectual capital, from a knowledge and knowing capability perspective, is important in instigating the growth of social capital.

Coleman (1988) defines human capital as created by changes in persons instilling skills and capabilities for them to act in new ways. Human capital is essential for access to ICT interventions. Warschauer (2003) points out that mass education correlates with high levels of Internet access and that this makes sense given the role of mass education in the post-industrial economy. At the individual level, literacy is a prerequisite for computer use and local language interfaces are not always available, so lack of English language may also be a barrier as it has tended to become the dominant computing language. Warschauer also points out that there are distinct differences between computer literacy, information literacy, multimedia literacy and computer-mediated communication literacy.

Coleman (1988) defines social capital as a particular type of resource available to an actor, and embedded in relations between people. He cites a number of examples where social capital in the family facilitates human capital development among family members. Bourdieu's (1986) notion of cultural capital exists in three forms: (1) in the embodied state; in the form of long lasting-dispositions in mind and body; (2) in the objectified state in the form of cultural goods (books, pictures, machines, etc.); and (3) in the institutionalised state, for instance in the form of academic qualifications. Clearly, Bourdieu's concept spans both the individual and the organisations, and encompasses other social characteristics than just human capital. Indeed, one of the key constructs of Nahapiet and Ghoshal's (1998) intellectual capital is the reference to the knowledge and knowing capability of as a social collectivity.

One thing missing from many discussions of social capital is that the concept is not always positive. Positive and negative social capital formation can occur in projects.

Some social actors and actions inhibit the formation of social capital, whereas others help to recreate and build social capital. For example, in our study of a remote village in Sri Lanka to provide information and knowledge access through implementing ICTs in an educational project, the lack of cohesion and trust among those who were supposed to coordinate and facilitate the project was a major constraint. Such negative social capital can arise due to drugs, alcohol, robbery and other social ills that act as barriers to successful implementation of project activities.

Harriss (2002), in Cummings *et al.* (2003) has also noted that there is a detrimental side to the social capital – strong networks that engage in negative activities such as mafias, gangs and cartels. Corruption, an inherent problem in most developing countries, is a typical example of the negative aspect of social capital formation, which persists in some societies. Schuurman (2003) maintains that the use of the social capital concept allows development organisations such as the World Bank to advance neo-liberal economics that exclude the consideration of the role of the state and substitute it with the role of the civil society.

In the discipline of community informatics, where ICT is applied to achieve the social, economic, political and cultural goals of communities, promoting social capital is a key strategy (Warschauer, 2003). Social capital is leveraged by building the strongest possible coalitions and networks in support of technology projects that act as a focal point for the community (Warschauer, 2003).

The lack of available avenues to stimulate and sustain social capital in networks and among people is one of the reasons why developing countries fail to fully exploit the existing global technologies (Lim, 1999; Bhatnagar, 2000; Braa *et al.*, 2001; Lee, 2001; Okunoye, 2003). It is also important to consider not only the lack of human capital, but also that low absorptive capacity of individuals and organisations inhibits the use of ICTs together with the weak social capital formation that acts as a barrier.

Any definition of social capital will necessarily have limitations, as it encompasses complex social dynamics such as integration, sharing, relationship building, motivation, trust and commitment. Our view is that the weaker the social capital, the harder it is for the knowledge and human capital to grow in a community, thereby perpetuating poverty.

Knowledge and ICT capacity building

Capacity building is essential to the introduction of new technologies to all societies. Necessary capabilities include individual, collective and relational capabilities that enable the creation, exchange, absorption and reconfiguration of knowledge and skills. ICT capacity building plays a central role in the application of ICTs in developing countries for two reasons. First, the lack of ICT skills and expertise in the country of application may hinder continued operation of the ICTs implemented (Adam and Myers, 2003). There is much anecdotal evidence to suggest that systems failure occurs once project funding is ended, due to the lack of specific IT skills on the ground. Lack of information literacy on the part of users of the intervention may also hinder adoption (Lee, 2001). Second, knowledge plays a pivotal role in poverty reduction, and ICTs could make available that knowledge (Marker *et al.*, 2002). These two

factors have been recognised as the key constraints to implement ICT projects in impoverished societies. How valid are these claims? Undoubtedly, knowledge is central and the key concept for social and human capital formation. Several dimensions and contextual differences in different societies and countries act as specific local organisational factors (Okunoye and Karsten, 2002; van der Velden, 2002).

Checkland and Holwell (1998) make some useful distinctions between information and knowledge. Information is defined as meaningful facts surrounded by a context (cognitive, spatial, temporal) that helps make sense of that information (Checkland and Holwell, 1998). It is widely accepted that ICTs give access to information. However, knowledge is defined as larger, longer, living structures of meaningful facts (Checkland and Holwell, 1998). These differentiations of knowledge and information emphasise the 'individual nature' of attributing meaning to information, even if that attribution is done in a shared basis. The individual emphasis is not dissimilar to Polyani's (1966) definition of tacit knowledge as 'personal, context-specific and thus, not easily visible or expressible' – not easy to formalise and communicate to others (Kakabadse *et al.*, 2001).

ICTs networks allow the mixing of two dimensions of knowledge: knower-*centred* and *knowledge-centred* (van der Velden, 2002). This distinction is, however, contested by others. For example, Polyani (1966, in Kakabadse *et al.*, 2001) maintains that there is no sharp distinction between the two types. Given that knowledge is intimately connected to action, Orlikowski (2002) talks of knowing in practice and learning by knowing and doing. From a social capital perspective, tacit knowledge resides in the relational dimension (how people are interacting over the network). ICTs consist largely of networks and the actors who are recipients in the network need to connect and interact cognitively.

Nahapiet and Ghoshal (1998) suggest that intellectual capital (which is also the collectivity of human capital) is created by processes of combination and exchange. Combination is defined as the creation of new knowledge through building on existing knowledge. Exchange refers to making radically new combinations by connecting various types of knowledge. When considering how this might operate over an ICT network, combination could occur either in acquiring ICTs skills or new information over the network, at the individual (human capital level) as well as at the collective level. Exchanges or transfer of knowledge for instance could occur by way of educational courses offered over an ICT network.

IT capacity building – the human capacity to utilise ICTs – can be seen as the acquiring of human and cultural capital through attaining new skills or knowledge. Thus in an ICT intervention, ICT capacity building ideally occurs in two ways. Firstly, by providing the necessary skills and training for the ICT intervention to be sustainable from the outset of the intervention. Secondly, by building on human and intellectual capital by the use of the ICT network itself.

Poverty reduction and ICTs

Knowledge and action is central to poverty alleviation. Without an accompanying action, knowledge is mean-

ingless in poverty alleviation. For instance, in a case we studied in Indonesia, the fear of authority and lack of encouragement by government officials meant that the development of information systems was severely hampered. In Sri Lanka, lack of support for rice breeding by technical authorities meant that villagers could not leverage their knowledge of new varieties.

Knowledge empowers individuals to action and work structures are important to ensure that action is productive. ICTs can influence poverty alleviation within several aspects of work structures: creating marketable skills among poor young workers; making it possible to impart literacy and numeracy to children of poor parents; and fighting against child malnutrition by ensuring information is available to the household, especially the mothers (Chowdhury, 2000). ICTs will ideally be reducing the information gap among various stakeholders so that knowledge and skills enable appropriate action for poverty reduction. ICTs can act at several levels – individual, collective and government levels.

Not all ICT projects are easily delivered or implemented in impoverished or remote areas, for both technical and operational reasons (Dymond and Oestmann, 2002). Studies have shown that the commitment to access information and the realisation of ICT is an important input that has been high among poor people (Kayani and Dymond, 1997). From a supplier point of view, poverty alleviation can also be achieved by wealth distribution, and creation of infrastructure that can be activated only by direct intervention of governments. Therefore, good governance is an important input for poverty alleviation and ICT has a role to play by disseminating information in impoverished areas.

Some studies have found that the education of women is the key to poverty reduction, but women still have less access to ICTs. With the right enabling environment, ICTs can provide a route for economic empowerment of women (Huyer and Mitter, 2003). Both Khasiani (2000) and Opoku-Mensah (2000) discuss women, ICT and governance issues and suggests that women lack the access to information compared to their male counterparts.

SSM as an analytic tool for ICT projects in developing countries

Soft systems methodology (SSM) was developed by Peter Checkland at the University of Lancaster in the 1960s (Checkland, 1981; Checkland and Scholes, 1990; Checkland and Holwell, 1998) and provides some lower level theoretical support to our framework. SSM applies system theory to information systems projects and recognises that many problem situations are 'soft' – that is, hard to define and with substantial social and political components. It is therefore a very useful lens through which to view ICT projects in developing countries, especially as it provides a number of analytical frameworks that can be applied at the project level. The action research approach of SSM is also compatible with ICT in developing countries as ICT is invariably an intervention in these circumstances. SSM has been widely used in information systems projects in many different settings in health, government and also the private sector. SSM has also been used in the development sector

(e.g. see Crawford and Swete-Kelly, 2005) as aid projects tend to typify 'messy' and 'soft' problem situations.

One very simple and elegant method of understanding influences in a project can be found in SSM – the use of root definitions. It is appealing because it considers the interrelationships between an intervention (transformation in SSM terms), customers, actors, owners and environmental constraints. We have used this analytic lens to analyse an ICT intervention in a Sri Lankan village and this underpins our explanation of the first two stages of our framework, described below.

A framework for ICT intervention and evaluation

The framework presented in this section is essentially a 'sensitising device' (Klein and Myers, 1999), which we developed to assist our own thinking about how ICTs can facilitate poverty reduction, using underpinning theories of social capital and knowledge management.

The model has four stages through which ICT interventions are possible. There are however, several iterations and interactions between stages. For instance, we would expect ICT capacity building to occur at the outset of the project, but remain a property of the project, resulting in eventual formation of social capital. For analytical purposes, we consider ICTs to encompass a broad definition of systematic development, use and integration into all or part of the business functions in an organisation or an individual process. Thus, our analysis also includes technology transfer projects, which may have a primary purpose other than ICT, but generally have an ICT component at the subproject level. This enables us to draw upon a broad and rich data set which further grounds the model.

Research methodology

In order to frame our research questions (which are grounded in the literature discussed in the previous sections), we propose a model based on our empirical findings. We consider ICT intervention, development and capacity building as an interlinked chain that contributes to social capital formation and poverty reduction. This model allows us to ask specific research questions at the individual and systems level and to draw on qualitative research conducted in developing countries over several years. Several development projects including ICT components constitute the data set for this paper. Over 30 organisations in six developing countries were studied, over 50 people were interviewed, and seven in-depth case studies were conducted. The data were categorised and analysed according to four stages presented in the model (see Figure 1).
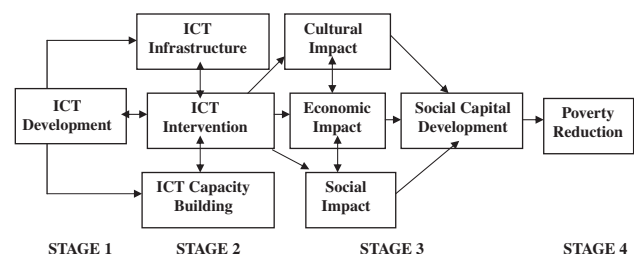

Figure 1 A Model of ICT intervention and evaluation.

For the first three stages (the fourth stage, poverty reduction, is a longer term aim and not illustrated by our data), we will illustrate the model by drawing on the authors' experiences in dealing with different types of development projects that include ICT components. For example, in Asia, we draw on the experiences of five rural villages in Sri Lanka, where a community was settled for agriculture and a massive irrigation project undertaken called the Mahavelli River diversion scheme, where ICTs and access to knowledge were a significant development agenda for dissemination of agricultural practices and other social services. We also draw upon a major World Bank-funded project in Science and Technology for Industrial Development project in Indonesia, which consisted of a number of subprojects, including rural electrification using solar power. In addition, extensive interviews were conducted to ascertain the conditions for diffusion and utilisation of various technologies in the Science and Technology Information project in Malaysia, information technology development in Laos and the Telecommunication Development project in Thailand. In addition to direct visits and observations, data were also collected by reports, field visits and interviews with government officials, research agencies and rural communities.

The data from all these sources form a rich pool of information and collective experience on which, we wish to develop this proposed model and draw conclusions.

Four integrated stages of this model are discussed below.

Stage 1 – The process of ICT development

By the process of ICT development, we mean the antecedents of a decision to implement an ICT intervention (this can be at the program or project level). This allows the consideration of strategic planning, needs analysis and requirements analysis. It also allows the consideration of how discourses about ICT development evolve. Questions of policy at various levels will also impact substantially on this ICT development stage. During this stage, we suggest that how power is exercised in the intervention be analysed. We suggest using root definitions (using the CATWOE mnemonic) and a stream of cultural enquiry (Checkland and Scholes, 1990).

An example is given below, giving a retrospective analysis of a project that aimed to give villagers access to computers in a rural Sri Lankan village closer to Polonaruwa, where ancient irrigation systems and agricultural activities prevailed. In terms of the Client (C) aspect of the CATWOE mnemonic, in the projects we experienced, IT interventions were focused on certain social groups and certain age groups. When we consider Actors (A), these actors tended not to be political leaders or government representatives, rather educators or entrepreneurs. From the Transformation (T) perspective, one of the key issues in the projects we have experienced was the issue of capacity of the actors to enact the transformation.

Significant barriers were experienced in terms of literacy, and also the ability to use computers. The World View, Weltanschuung (W) that made the Transformation meaningful in context, was very significant for this project, as the villagers world view of 'progress', as exemplified by the computers, was a necessary evil but a 'good thing' for

growth – thus there was ambivalence displayed. The role of 'Owners' of the project, those that could stop T, the transformation, was also critical. The entrepreneurial spirits of the village, who initiated the project, also guarded the technology for fear that misuse would mean that computers got damaged. From the perspective of the Environment (E), the lack of infrastructure was a major issue in the village – there was no telephone network in the village, and wireless connections using mobile networks were impossible due to dysfunction on the network (Table 1).

Stage 2 –The ICT intervention

Stage 2 has two components – the ICT infrastructure and ICT capacity building, which need to be considered in tandem with the ICT intervention itself. We have deliberately positioned these components together because of the consideration of the ICT infrastructure and ICT capacity building we view as essential to a successful ICT intervention.

ICT infrastructure

A great deal of ICT development literature cites appropriate infrastructure as both a barrier to success of ICT development projects, and a necessary part of all ICT development projects. The CATWOE analysis of the project in the previous section reveals that some consideration of whether the infrastructure could support the venture would have been very helpful, as a connection to the Internet was not possible with the current infrastructure and may have led to a reconsideration of what could be achieved. In another example, the educational project in the village Dutuwewava in Sri Lanka was feasible as there was electricity supply to the village; however, there was no telephone facility that makes it difficult to connect effectively with the rest of the world.

Consideration of infrastructure also leads to questions of resourcing. For instance, in the Indonesian Solar Electricity project, villagers were much exercised by the question of who was going to pay the maintenance bills of battery and other technical services. In the Education project in Dutuwewa in Sri Lanka, those who were in charge of the computers feared that computers consume lot of electricity and so were reluctant to make the computer available for potential users.

ICT intervention

Development agencies have long grappled with how best to implement an initiative on the ground, and there are many different models of how interventions should be carried out. Many models are of the participative action research variety, although this approach has been criticised, as it is claimed that this type of project is very open to capture by elite groups (Mansuri and Rao, 2004). This is very similar to the criticism of the social capital concepts.

For this reason, we think it is important in a model of ICT intervention and evaluation to include some consideration of power interests. For example, the recommended activity cycle practised by the UK Department for International Development (Dearden *et al.*, 2002) has an emphasis on continual feedback from stakeholders at all

Table 1 CATWOE Mnemonic applied to the ICT development process in a Sri Lankan village (adapted from Checkland and Scholes, 1990)

Element	Comment on ICT Development Context
C: 'Customers': the victims or beneficiaries of T	In rural villages that were studied, IT interventions are focused on certain social and age groups. Not all adults are proficient in English and will be able to interact with computers and computer software, so not all are beneficiaries. In one of the Sri Lankan village, the local temple had a private tuition programme where students can come to classes conducted by a private provider to learn basic computing.
A: 'Actors': those who would do T	The actors involved in the implementation are the entrepreneurs and educators who will take lead action. They are not necessarily the political leaders or government representative such as 'Grama Sevaka' appointed by the government who is the head men of the village. His blessing and support is, however, important to carry out activities in the village and he will be either disinterested or not concerned too much of the technology that he is not familiar with. The head man's primary focus is on the core economic activity of the village – for example agricultural products in place.
T: Transformation process: the conversion of input to output	The transformation that was desired was to give villagers access to a computer and the skills to use it. Some were quite fearful of trying out new technology and this was a barrier to use of the technology. For example, in one village where two computers were provided, the computers were kept at one of the villager's houses for safe keeping rather than use. Any attempt to move this computer to another location which is central for people to use or try out met with resistance from the person who took charge of the equipment. The fear was grounded on the belief that people will break it, who will repair if it breaks? Others are not ready to use it and if they do they have to pay a nominal amount to use it. As a result inputs rarely transformed into any usable outputs with tangible benefits. The presence of two computers in the village, however, is a symbolic social capital where villages felt that they were part of the rest of the world although there was no use out of the computers and information that it can deliver. The transformation process is also difficult due to the general level of education, where ICT education stands worlds apart from actual level of understanding. Villages require the information to unpack and present to them. They were very interested in relevant information such as how to improve agricultural productivity. Indeed in the same village people were enthusiastic about a bee-keeping project to be organised by Swedish Bee Keepers association – bringing wealth of knowledge and skills that can be put into practice immediately. Villagers view ICT as intangible knowledge and asset that can connect only for those who have knowledge to use it. As a result, two computers purchased for the village were left covered with a cloth over it, and served as a status symbol that indicates that the village now has educated people who can even use computers.
W: Weltanschuung: The World View that makes this T meaningful in context	There was an attempt to appreciate the ICT and belief among the villages that ICT is somehow a good thing and a necessary evil expense that needs to be made to increase growth.
O: Owners: those that could stop T	There were few people who were crucial to make others feel that the technology is accessible to them. Those who lead the project with entrepreneurial skills were somewhat guarding the technology for wrong reason. This form of knowledge distance did not assist the intervention process. Somehow trust, risk taking and other form of skills are needed for ICT intervention.
E: Environmental constraints: elements outside the system which it takes as given	The lack of ICT infrastructure and facility was a major problem. Technology cannot be put into full use. There was no telephone connection so that Internet facility can be provided. Even the mobile network is dysfunctional and had been a major constraint for simple connection. Unless such basic needs are met, meeting higher order needs become a dream rather than a reality.

stages in the cycle. The stakeholder analysis required at every stage includes the production of matrices of power and interests, readiness and power, and matrices of those who are supportive/antagonistic/constructive and destructive of the project. Dearden *et al.* (2002) point out that trying to describe winners and losers, as well as predicting hidden conflicts and interests, can alienate powerful groups.

The CATWOE analysis in the previous section provides a useful tool for clarifying roles in the project, and we feel this is critical for gaining an understanding of who might benefit and the groups involved in the change. For example, in the implementation of Malaysian Science and Technology Information Project , the expectation was that once the project was implemented people would use it for development purposes.

Stage 3 – Evaluation of the ICT intervention

We earlier defined ICT capacity building as the human capacity to utilise ICT. One problem for ICT interventions in developing countries is that lack of resident ICT skills and expertise may hinder sustained operation of implemented systems (Adam and Myers, 2003) and lack of information literacy hinders adoption (Lee, 2001). As participants use the ICT development, they should become part of a process of building human and intellectual capital, which in turn should increase total social capital.

The model shows that we expect an ICT intervention to have a social, cultural and economic impact and this in turn to impact on social capital.

Table 2 gives our adaptation of Huysman's (2004) dimensions of social capital for use with our model: an important consideration is how the ICT intervention has assisted with the formation of social capital. The ICT intervention, in most cases (but not always), consists of a network. As we are concerned with how knowledge might be built through the ICT intervention, increasing both human (ICT capacity building in the model) and social capital, we distinguish between how the ICT intervention might be used for information and communication (Pigg and Crank, 2004) and also knowledge. We also distinguish between social capital in the community and in the intervention.

The key feature in Huysman's (2004) formulation of dimensions from our perspective is the mapping between Nahapiet and Ghoshal's (1998) constructs and those of Adler and Kwon (2002). Nahapiet and Ghoshal's (1998) *structural* dimension consists of network ties (providing access to resources), the network configuration (including a consideration of efficiency of the network, weak ties, etc., and appropriable organisation where ties, norms and trust can be transferred from one setting to another.

These are interesting arguments to consider in the light of ICT networks and whether the degree of how sparse or closed the network is would operate in the same way. This largely depends on whether an ICT network can be conceptualised as a virtual facsimile of a human network in social capital terms, or whether its characteristics interact with social capital in a different way.

There are also some implicit assumptions in Table 2, which are open to further argument and debate. For instance, we assume that an intervention and a project are interchangeable terms, when in fact an intervention is likely to be a broader programme of a number of subprojects. For practical purposes, we have chosen the word project, assuming that people will use this framework at this level of analysis. We also assume that an intervention is likely to take the form of an ICT network from which information can be accessed, over which people can communicate, and from which knowledge can be transferred and created. This may not always be the case, depending on the intervention being analysed. The important thing about the framework, in our view, is that it brings together Adler and Kwon's (2002) and Nahapiet and Ghoshal's (1998) dimensions with a focus on information, communication and knowledge, both outside and inside the project.

In the projects we had access to, although there was no direct increase in productivity through access to additional knowledge or information, the fact that people had the opportunity to collect few of those who had some knowledge of computers added to networking and formation of social capital by way of the collection of interest groups. There was also the belief that in the future there can be growth in human capital, as children's education will improve. Indeed, this was the main cause of formation of social capital. A meeting of nearly 300 villagers in Sri Lanka, who gathered to implement project activities, maintained that their prime interest is to educate the children and they would do any thing to support the activities. However, villages were not organised and did not have a clear plan and path to achieve the objective and were heavily reliant on outside help. There were few individuals who believed the action has to come from villages themselves, which is the basic fundamental building block for alleviation of poverty.

Stage 4 – Poverty reduction

This, in our view, is the final (if most contested) stage of an ICT intervention. We have developed a set of measures, shown in Table 3, that go beyond traditional measures of access to services, where we consider how the concept of access to information and knowledge contributes to a more relative and holistic view of poverty.

We are aware that poverty is a complex multi faceted issue with many different causes, and that Table 3 does not capture all the facets. Rather, we have attempted in Table 3 to formulate measures based on the idea that some poverty is caused by lack of access to information and knowledge, and other resources such as networks of contacts. The measures have been developed specifically for use with the framework in Table 3 and thus assume that an ICT network has been implemented.

Discussion

We should start this discussion by stating what the framework does not do. It does not claim to be a comprehensive framework that, in itself, will ensure a successful ICT intervention in a developing country. Aid agencies have built up a vast stock of techniques for intervening in various contexts in developing countries, and the framework here is simply a framework, rather than

Table 2 Dimensions of social capital from an information, communication and knowledge perspective

Dimension of social capital (Adler and Kwon, 2002)	*Community*			*Intervention*		
	Information	*Communication*	*Knowledge*	*Information*	*Communication*	*Knowledge*
Ability	Sources of information in the community	Most frequently used methods of communication – face-to-face, telephone, letters	Shared codes and language, shared narratives. (Nahapiet and Ghoshal, 1998) Education level, pre-existing computer literacy Example: the existing knowledge about dressmaking in a Sri Lankan village	Sources of information about the project Information *accessed* from the project network.	Methods of communication employed *about* the project Methods of communication that take place within the project.	Knowledge *applied* in the project Knowledge *created* in the project Knowledge transferred in the project
Opportunity	Accessibility of individuals that have information	Extent of community network accessed by an individual. How people communicate within the network	Accessibility of individuals who have knowledge. Those who are excluded from networks.	Information *potentially available* from the project network Number of individuals accessing the project network Status of individuals accessing the network	Individuals using the project network to communicate with their current network Individuals using the project network to communicate with an extended network	Individuals creating knowledge Individuals acquiring knowledge Individuals transferring knowledge Individuals using the network for social, cultural or economic gain Example: the need for dressmaking patterns in a Sri Lankan village
Motivation	Trust enabling the transfer of information (Nahapiet and Ghoshal, 1998)	Norms of communication. obligations and expectations with regard to communication. identification, respect, and generalised reciprocity. (Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002).	Community view of knowledge and its place in the community.	Information transmitted between individuals *about* the project, and perceptions of the project	Norms of communication that evolve over the project network. Trust, identification and reciprocity developed with respect to the project.	Individual and community perceptions about knowledge in the project. Example: a lack of trust of officials and fear of authority in a village in Indonesia

Table 3 Suggested holistic poverty measures for the framework

Holistic poverty measures	*Suggested implementation*
Extent to which the ICT development leads to increased access to education, health, government and financial services.	At the individual level – Investigate if information is accessed that can assist education and health. Investigate if information is accessed that assists connection with government services. Investigate if financial information or connections are made over the network. Investigate if knowledge is created or transferred about these areas, at the individual/group level.
To what extent does the social capital stock resulting from the ICT development lead to increased access to education, health, government and financial services?	Review social capital dimensions and see how information, communication and knowledge operate with regard to education, health and financial services.
To what extent does the ICT development lead to income earnings, via access to market prices and use of electronic markets and alternative markets made possible by access to the ICT network ?	Survey individuals and households on income earnings derived from direct or indirect use of the ICT development for access and use of markets.
To what extent does the ICT development lead to the average income earned individually and/or par household resulting from its use?	Survey individuals and households about average income and any earnings derived from use of the ICT development.
To what extent does the ICT development increase access, and sharing of local and non-local relevant and up-to-date information and knowledge?	Review social capital dimensions and see how information, communication and knowledge operate with regard to pre and post levels of social capital.

a handbook for intervention. Rather, the framework presented here is a 'sensitising device' (Klein and Myers, 1999), to assist some deeper thought about how social and human capital, knowledge theories and SSM could be utilised in such ICT interventions. We are particularly interested in harnessing the potential positives of the social capital concept, but also compensating for its negatives by analysing power in an intervention. We also feel it is important to develop theoretical perspectives on how poverty might be reduced by using ICTs, however tenuous the link might seem. The 'poor cannot eat technology' (Skuse, 2000) and mindful use of technology is what we hope this framework encourages.

The contribution of knowledge management perspectives to the framework is to give us a deeper understanding of the role of knowledge and how it assists social capital formation in a development situation. While we are by no means the first to consider knowledge in tandem with social capital (see Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; Huysman, 2004), we make a contribution by mapping social capital dimensions to information, communication and knowledge to both the intervention itself and the community around it – and distinguishing between the two. Thus, we provide a route to evaluate social capital formation both within and without the intervention, from the perspective of information, communication and knowledge. This has the potential to enable a much better understanding of the contributions of ICTs in developing countries in future. From our perspective, the access to knowledge that ICTs enable, which in turn can lead to the formation of human and social capital, is the primary contribution that ICTs can make towards poverty reduction.

In our view, there are also two interesting additional peripheral questions that arise from the framework that require future theoretical development by IS researchers. One is the effect of ICT networks on corruption in a country: if ICT networks extend networks of people, provide information to people in a uniformly democratic manner, and give access to information and knowledge hitherto hidden, one might reasonably expect an ICT intervention, in the right circumstances, to reduce corruption. However, the experience of corruption in developed countries gives no cause for optimism here. The second question is how the physical IT infrastructure influences social capital formation. For instance, a mobile/cell phone, a particular e-mail package or web interface may encourage certain types of communication, information, and knowledge creation and transfer. The area of ICTs and poverty reduction seem a largely untapped area of research in information systems, yet, increasing globalisation and an awareness of our linked destinies makes it a very important area of research in the future. We view it as important that research on ICT as an enabler should encompass social concerns as well as economic ones, and that information systems researchers do not use their expertise for only technological purposes. This is especially important when it comes to developing countries, as ICTs are key enablers of access to increased economic and social opportunities.

Conclusions

The framework presented in this paper comes from a collaboration between two researchers from developing countries and a researcher from a developed one. All authors have experience of implementing ICT interventions

in communities. While we do not claim it as a comprehensive model of 'how' to do an ICT intervention, it does have some basis in practical experience. We were primarily concerned, however, with a lack of theoretical underpinning that seems to exist in the area of research on ICTs and poverty reduction, and identified both social capital theories and knowledge management theories as one way to provide that underpinning (there are almost certainly others). The inclusion of root definitions and a cultural stream of enquiry (Checkland and Scholes, 1990), carried out at the ICT development stage, compensates to some degree for the criticism of social capital as ignoring power issues and provides a practical way of dealing with the issue.

Thus we would locate our theoretical contribution as relating social capital and knowledge theories for ICT and developing countries, particularly considering social capital along communication, information and knowledge dimensions relevant to ICT interventions. The framework also makes a practical contribution by grounding the theoretical aspects in what could be considered stages in an ICT intervention. We also make a contribution by considering how ICTs might contribute to social capital dimensions of information, knowledge and communication within and outside an ICT intervention. These dimensions then flow into some practical measures of how improved information and knowledge might impact on poverty reduction. It is our hope that fellow researchers find this framework useful, and that it deepens our scholarly debate about the utility of ICTs in developing countries.

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