

Telecentres in Rural Asia: Towards a Success Model

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Abstract

The global digital divide threatens to deprive millions of people of the benefits that are attainable from having access to Information and Communication Technologies (ICTs). Most of these people live in rural parts of developing countries and they are unlikely ever to own their own computers. However, international aid agencies, governments and NGOs are becoming increasingly enthusiastic about the potential for generating rural development from community based telecentres. This report describes five telecentre projects that are concerned with bringing about social and economic development in rural communities in Asia. Existing success models from the field of Information Systems that relate to similar ICT based innovations in organisations, namely the Information Centre and End User Computing, are examined to establish how they might be adapted to the community based innovations represented by telecentres. A success model for telecentres is derived and applied to the five Asian projects. Results indicate that earlier research offers promise in understanding what leads to a successful community telecentre. In particular, the characteristics of communities emerge as the most potent influence on the success of community telecentres, yet are probably the least manageable. Suggestions for future research and implications for practice are drawn.

Introduction

The uneven global distribution of access to the internet has highlighted a digital divide that separates individuals who are able to gain access to computers and the internet from those who have no opportunity of doing so. The United Nations has noted in its Statement on Universal Access to Basic Communication and Information Services:

“The information and technology gap and related inequities between industrialised and developing nations are widening: a new type of poverty – information poverty – looms. Most developing countries, especially the least developed countries are not sharing in the communications revolution”. (UN, 1998)

A few statistics serve to highlight the alarming differences at either ends of the digital divide:

- All the developing countries of the world own a mere 4% of the world's computers,
- 75% of the world's 700 million telephone sets can be found in the nine richest countries,
- There are more web hosts in New York than in continental Africa; more hosts in Finland than in Latin America and the Caribbean combined,
- Tokyo alone has more telephones than the entire African continent,
- There were only 1 million internet subscribers on the entire African continent in 1999 compared with 15 million in the UK (World Bank, 1999).

Table 1 shows the gap in Internet access between the industrialised and developing worlds. More than 85 per cent of the world's internet users are in developed countries, which account for only about 22 per cent of the world's population.

Table 1. Internet access by region, selected regions, June 1999			
	People connected (millions)	Global percentage of people connected	Percentage of global population
Canada and USA	97.0	56.6	5.1
Europe	40.1	23.4	13.7
Asia and the Pacific*	27.0	15.8	56.2
Latin America	5.3	3.1	8.4
Africa	1.1	0.6	12.9
Middle East	0.9	0.5	3.6
	171.4	100	100
*Including Japan and Australia			
(Henry et. al, 1999)			

Drilling down into the access statistics reveals further levels of inequality within the developing countries that are least served. Typically, a high percentage of developing country residents live in rural areas. The proportion can rise to as much as 80 per cent of the population in the least developed countries and is estimated at 75% overall in Asia. Rural access to communication networks in developing countries is much more limited than in urban areas. Table 2 depicts teledensity levels across a range of countries based on comparative income levels. The data overestimates rural access because the "rest of country" includes everything except the largest city.

Table 2. Access to telecommunications, countries of different income categories, 1999			
Country classification	Teledensity (Telephone lines/100)		
	National	Urban	Rest of country
High income	46.0	52.9	43.8
Upper middle	13.7	25.7	11.5
Lower middle	9.7	22.1	7.2
Low income	2.5	6.5	2.3
(ITU, 1999)			

Unsurprisingly, the digital divide mirrors divides in other resources that have a more insidious effect, for example, access to education, health care, capital, shelter, employment, clean water and food. In the sense that the digital divide can be seen more as an absence of access to information than as an absence of access to technology, these other divides can arguably be seen as more of the result of an imbalance in access to information than as its cause. Information is critical to the social and economic activities that comprise the development process. If information is critical to development, then ICTs, as a means of sharing information, are a link in the chain of the development process itself (ILO, 2001).

The 2000 summit of the Group of Eight (G8) countries in Japan acknowledged the digital divide with its declaration of the “Okinawa Charter on the Global Information Society”. The Group established an international task force to assist developing countries to embrace the IT revolution (Japan Times, July 23 2000). The Group also declared that “bridging the digital divide in and among countries has assumed a critical importance on our respective national agendas” and it agreed to establish a Digital Opportunity Taskforce (dot force), whose task will include promoting improved connectivity, increasing access and lower costs. Japan’s own initiative announced at the same time was to extend \$US15 billion to developing countries over the coming five years to help narrow the digital divide

However, eliminating the problems that the digital divide represents requires more than the provision of access to technologies. According to the ILO, ICTs can contribute significantly to socio-economic development, but investments in them alone are not sufficient for development to occur (ILO, 2001). Put simply, telecommunications is a necessary but not sufficient condition for economic development (Schmandt et. al, 1990). Martin and McKeown suggest that the application of ICTs is not sufficient to address problems of rural areas without adherence to principles of integrated rural development. Unless there is minimal infrastructure development in transport, education, health, and social and cultural facilities, it is unlikely that investments from ICTs alone will enable rural areas to cross the threshold from decline to growth (Martin and McKeown, 1993).

One approach to the problems of the digital divide has been the community telecentre. Telecentres come with a variety of names, such as telecottages, or information shops, and no single definition serves to satisfy all of them. However, a common characteristic is a physical space that provides public community based access to ICTs for educational, personal, social and economic development. Telecentres are usually designed to provide a combination of ICT services, ranging from e-mail to full internet and World Wide Web connectivity (Harris et. al, 2001). Colle (2000) says there is great diversity in what is called a telecentre, and provides a set of key bi-polar variables associated with telecentres, summarised in table 3.

Table 3. Key Variables Associated with Telecentres	
<i>Narrow focus</i> Provides access to technology only	<i>Multipurpose</i> Provides services, e.g. training, development information
<i>Community-based</i> Represents a broad constituency	<i>Establishment</i> Top-down government or business organisation based
<i>Stand alone</i> Not associated with another institution	<i>Attached</i> Operates as part of another institution, e.g. school, government units
<i>Thematic</i> Specific to theme, e.g. education, health.	<i>Universal</i> Whole community needs
<i>Independent</i> Operates alone	<i>Networked</i> Works with other telecentres
<i>Public sector</i> Operated by a public body	<i>Private sector</i> Operated by a private body
<i>Profit oriented</i>	<i>Service oriented</i>

Operates as a business	Operates as a service
Public funded Funded by public funds	Privately funded Obtains funds privately
Commercial Charges clients for its services	Free Provides services for free
Urban	Rural
(From Colle, 2000)	

Telecentres provide an alternative to the model of one-to-one individual access to a computer that predominates in the developed world. As community resources, telecentres offer opportunities for development that are predicated on improved access to information for whole communities. The study of Community Informatics (CI) is emerging in part in response to the challenge of achieving economic and social development for communities through the use of ICTs. CI pays attention to physical communities and the design and implementation of technologies and applications, which enhance and promote their objectives. Studies in CI show how ICTs can help communities achieve their social, economic, political, or cultural goals (Gurstein, 2000).

Telecentres have been introduced to many communities throughout the developing world. Significant examples include the Acacia project that aims to empower sub-Saharan African communities with the ability to apply information and communication technologies to their own social and economic development. Acacia works in Mozambique, Senegal, South Africa, and Uganda, mainly with rural and disadvantaged communities, which often find themselves isolated from the ICT networks to which their urban counterparts increasingly have access (IDRC, http://www.idrc.ca/research/xacacia_e.html). The Pan Asia Networking Program (PAN) focuses on information-poor communities to determine how the least-developed countries and communities can best achieve sustainable and adequate national and local connectivity, participate in global network resources (internet), and develop local expertise in computer networking. Activities address community-level access to internet-remote areas in Asia and Latin America and incorporate questions of impact and sustainability of services in the context of communities that have minimal resources. PAN explores how the internet can help empower local populations, indigenous groups, and other communities (IDRC, http://www.idrc.ca/pan/projects_e.htm)

The introduction of a telecentre into a typical rural community in a developing country represents a substantial innovation for that community. For many rural dwellers, a community telecentre will be their first encounter with a computer. In one case of a telecentre introduced into a rural community in Malaysia, of 140 households surveyed, only one contained anybody who had even heard of the internet (Harris et al, 2001). Moreover, telecentres that seek to overcome the barriers to access to ICTs in rural areas of developing countries are mostly experimental. Currently, there is very little experience of the impact of such centres in the context of rural and remote areas in developing countries and there are many questions to be answered before embarking on ambitious and costly programmes at a national level (Ernberg, 1998). Given the novelty of access to ICTs and the shortage of guidelines for establishing and operating community telecentres, many research questions remain open as to how this type of innovation can bring about equitable access to information resources that

will lead to sustainable development among the most disadvantaged sections of the world's population.

The research reported here addresses such questions. Against the background of the digital divide and the impact of its effects among rural populations in developing countries, the report considers the rural telecentre as a particular kind of innovation in order to understand the extent to which existing theories in Information Systems (IS) can be applied to its adoption. By examining five case studies of rural telecentres in Asia, we will consider similar kinds of innovation from IS theory, namely the Information Centre and End User Computing, in order to advance the theory building that will be required to support and explain telecentre adoption and success in rural developing country settings. The analysis will attempt to scale up existing theories from the organisational level to the societal level. Table 4 suggests why this might be worthwhile and valid by suggesting that community-based access to ICTs is part of a continuum that includes IS as a discipline with an evolving field of theory closely aligned to the technology that its members promote.

Table 4. Information Systems as an Evolving Discipline				
Dominant Technology	Information Systems Locus	Work Group Focus	Dominant Referent Discipline	Scope
1960-70 MAINFRAME COMPUTERS	Electronic Data Processing	Clerical staff	Computer Science	THE ORGANISATION
1970-80 MINI COMPUTERS	Management Information Systems	Managers	Management	
1980-90 PERSONAL COMPUTERS	End-User Computing	Knowledge workers	Organisational Behaviour	
1990-2000 NETWORKS	Strategic Information Systems	Shareholders	Economics Marketing	
2000- THE INTERNET	Community Informatics	Citizens	Social Science	SOCIETY
Harris, 2001				

Table 4 models the evolving IS discipline by mapping its historical trajectory against that of ICTs. As Information Technology (IT) evolved over the period of time since it came into common use, the IS profession emerged as a forum for understanding the impact of IT upon the structures and communities who were its most prevalent users, as well as developing an understanding of how to optimise the effects of that use. In the process, IS relied upon varying referent disciplines from which it adapted its theoretical foundations and practices. At the turn of the millennium, IT has evolved into ICT and the scope of its use has stretched far beyond the original purposes of organisational data processing into a society-wide phenomenon whose full impact is still unfolding. Nevertheless, even though ICTs have consistently spread into new

categories of use and user, it is reasonable to suppose that certain underlying themes of adoption may have endured from one phase to the next.

In attempting to relate past theoretical frameworks to contemporary events, it is evident that some similarities exist and that they might be capable of pointing towards new or adapted theories for understanding and guiding the newer trends. In the case of the community telecentre, there would seem to be a parallel with the Information Centre (IC), as an organisational innovation of the 1980s which was concerned with the promotion of End User Computing (EUC). Just as the IC was designed to foster organisational improvement through the adoption of EUC, telecentres encourage and promote the use of ICT among their communities in order to cultivate community development. Accordingly, theories of IC and EUC adoption that were meant to explain how they could contribute towards organisational development might be useful for understanding how telecentre adoption can contribute towards community development.

Theoretical Background

Information Technology Diffusion

This section presents some important outcomes of IT adoption research that are considered relevant to the theme of community adoption of telecentre services. We start with a broad perspective of IT diffusion and then focus more closely onto research outcomes relating to the success of Information Centres and End User Computing, as these areas are considered to have potential for informing an understanding of telecentre adoption.

Cooper and Zmud (1990) present a stage model of IT implementation, which they define as an organisational effort directed toward diffusing appropriate information technology within a user community. The model has six stages, each with a process and a product, as follows:

Stage	Process	Product
Initiation	Active and/or passive scanning of organisational problems / opportunities and IT solutions are undertaken. Pressure to change evolves from either organisational need (pull) technological innovation (push), or both	A match is found between an IT solution and its application in the organisation
Adoption	Rational and political negotiations ensue to get organisational backing for implementation of the IT application.	A decision is reached to invest resources necessary to accommodate the implementation effort.
Adaptation	The IT application is developed, installed and maintained. Organisational procedures are revised and developed.	The IT application is available for use in the organisation

	Organisational members are trained both in the new procedures and in the application.	
Acceptance	Organisational members are induced to commit to IT application usage.	The IT application is employed in organisational work.
Routinisation	Usage of the IT application is encouraged as a normal activity	The organisation's governance systems are adjusted to account for the IT application; the IT application is no longer perceived as something out of the ordinary.
Infusion	Increased organisational effectiveness is obtained by using the IT application in amore comprehensive and integrative manner to support higher aspects of organisational work.	The IT application is used within the organisation to its fullest potential.

A comprehensive research model such as this provides a basis for recognising research questions which build upon prior research and which have a good probability of significantly enhancing an understanding of the implementation process as well as facilitating the interpretation of empirical results (Cooper and Zmud, 1990). The model can be used to assess the extent to which telecentre services have been taken up by a community and to gauge the level of maturity of a telecentre. In turn this can guide decision-making with regard to the actions that might be needed to ensure a telecentre reaches its optimum level of contribution towards community development.

Information Centre Success

In the specific cases of the innovations represented by the IC, previous research has highlighted a number of factors that have influenced their adoption. The IC emerged in the 1980s as the principal organisational response to the growth of EUC. The introduction of the IC as an organisational mechanism for the support of EUC was to ensure an appropriate response to EUC, by way of its voluntary adoption. Gunton (1986) contended that the role of the IC was to facilitate, co-ordinate, support, and control EUC, and to enable business professionals to increase their productivity and improve their decision-making capability. Gerrity and Rockart (1986) described the IC as a centrally located group of personnel to whom users can come for guidance concerning the selection and use of appropriate hardware, software and data. Christy and White (1987) categorised the role of the IC as promoting and encouraging EUC, and classified services provided to end-users into; training, problem-solving, hot-lines for rapid response to user problems and administrative/technical support for extraction of production data from databases.

Saarinen, Heikkila and Saaksjarvi (1988) pointed out that ICs that adopted strategies for accelerating the growth of EUC within their host organisations were more likely to be judged successful by their users than those that did not. The IC should aggressively pursue opportunities for EUC, and should adopt a perspective of creating

business value, more towards the transformation of business processes, helping users to perform completely different tasks than before through the use of computers, and providing benefit to the organisation at the rate of many orders of magnitude in excess of previous practices (Arnoudse and Whalen, 1989).

Bergeron, Rivard and De Serre (1990) examined some aspects of the role of the IC, which were thought to influence users' satisfaction with its services. Both the proximity and variety of services to users were found to be positively correlated with dimensions of end-user satisfaction, indicating the value of quick responses to requests for help. Users also seemed to prefer the more personalised service obtainable from ICs with fewer staff. The importance of the service approach was further highlighted by Franz (1991), who found that the display of helpful and caring attitudes by IC staff during their inter-actions with users significantly influenced those users' acceptance of the IC function. One finding was that end-users accept and use their ICs because of the quality interface they experience with the IC specialist. Although end-users expect IC personnel to possess expertise, their primary reason for changing over to the IC is the availability of a person at the IC site to consult with the end-user (Franz, 1991).

Magal (1991) further testifies to quality of services as a good predictor of IC success. His study listed three dimensions of users' satisfaction with their IC. These were; quality of user-developed applications, quality of service and user self-sufficiency. Magal (1991) concludes that an IC must provide services aimed at making end-users self-sufficient in developing quality applications. The means of achieving this emphasise the personal nature of IC services. As Gunton (1988) pointed out, IC personnel must have interpersonal skills; their business skills are generally more important than technical skills. Rainer and Carr's (1992) catalogue of services offered by ICs ranked the most frequently offered as consulting on user problems. They concluded that there was evidence that the focus of end-users appeared to be changing from how to *use* automation to how to *apply* computers and software to their business problems (original emphasis).

The study by Bergeron, Rivard and De Serre (1990) proposed a research model of user satisfaction with the IC, depicted in figure 1.

End User Computing Adoption

Apart from the support function of the IC, several other factors have been identified in relation to the diffusion, adoption and success of EUC in contributing towards organisational development. Many studies placed an emphasis on the influence of users' characteristics on user satisfaction with EUC, with satisfaction acting as a surrogate for success. These characteristics include demographic variables, attitudes, training and education, involvement with systems development, expectations for EUC and computer anxiety. The influence of individual characteristics on EUC adoption and success was noted by Yaverbaum (1988) who discovered that anxiety and fear are often associated with the introduction of new technology. Her prescription for overcoming this barrier was the provision of user support centres and computer education. Igbaria (1990) also found that computer anxiety affected attitudes toward

EUC, which in turn influenced satisfaction with EUC.

Additionally, research reported by Doll and Torkzadeh (1988) Torkzadeh and Doll (1991) and Etezadi-Amoli and Farhoomand (1996) emphasise the influence of application characteristics on user satisfaction with EUC. These characteristics include content, accuracy, format, ease of use, timeliness, security, quality of output, functionality and documentation. EUC satisfaction is again presented as a surrogate measure for EUC success. The underlying perspective of user satisfaction in these studies is that it is derived from the users' judgement of certain attributes of an individual system.

Rivard and Huff (1988), Amoroso and Cheney (1991) and Mirani and King (1994) highlight the influence of organisation characteristics on user satisfaction with EUC. These characteristics include the Data Processing (DP) department's readiness for change, degree of DP push (promotion of EUC), and goodness of fit between concepts which were labelled user pull (demand for EUC) and DP push. In addition, user satisfaction with independence from DP is included as well as user satisfaction with the environmental set-up. Perceived application backlog (of DP) is also examined and perceived helpfulness of EUC policies, EUC support and perceived organisational support of EUC application development. Mirani and King (1994) pointed out that providing end-users with appropriate types and level of support considerably enhances satisfaction with EUC. Therefore, the provision of EUC support appears to be critical to overall information systems and organisational effectiveness (Mirani and King, 1994).

A further group of research into EUC adoption can be traced to the theoretical perspectives provided by attitude theorists for explaining the psychological causes of social behaviour (Fishbein and Ajzen, 1975; Ajzen, 1985). The study by Igbaria (1990) is based directly on the Technology Acceptance Model (TAM) derived from Davis, Bagozzi and Warshaw (1989). The TAM is a specific derivation of the theories of reasoned action and planned behaviour by attitude theorists (Fishbein and Ajzen, 1975; Ajzen, 1985) as applied to the adoption of new technologies by their users. TAM research places less emphasis on EUC satisfaction as a surrogate measure for EUC success. Instead, acceptance or usage of the technology (microcomputers) by users becomes the dependent variable, and is used an indicator of EUC success. Harris (1999) found that attitudes toward microcomputers were the most immediate determinant of microcomputer usage. The study by Igbaria, Guimares and Davis (1995) confirmed the effects of external variables in the TAM on users' beliefs. Individual characteristics, organisational and system characteristics, were all found to influence the users' perceptions of the ease of use of microcomputers as well as their perceived usefulness.

Harris (2000) proposed a model of EUC success derived from a meta-analysis of earlier studies, and this is depicted in figure 2. The model synthesises a range of factors said to lead to positive outcomes as a result of deploying EUC technology. They are suggested to arise from a combination of factors relating to the individual user's characteristics, the application system in use and the organisation in which it is being used.

The IC can be seen as the mechanism used by organisations to adapt to the changes taking place in IT throughout the 1980s, as desktop personal computing became ubiquitous and EUC became the predominant form of computing. The concept of the knowledge worker gained common currency, whereby office work was characterised by the need to deal with information in a variety of different forms; within non-repetitive and unpredictable tasks; where there is a need to interact with individuals in a flexible manner and where outputs are judged by the timeliness and correctness of decisions (Gunton, 1988). The IC provided services that promoted the adoption of the EUC innovation, which targeted organisational development through the empowerment of knowledge workers making effective use of desktop computing.

Applying Theories of IC and EUC Adoption to Rural Telecentres

This section explores the opportunities for relating the theoretical perspectives of the innovations of IC and EUC adoption to the newer type of innovation represented by telecentres. Table 5 summarises some characteristics of the theories examined so far, and compares them to the corresponding characteristics of a theory for telecentre success.

Table 5. Characteristics of IT, IC and EUC Theories				
Theory	Scope	Focus	Outcome Variable	Unit of Analysis
Information Technology Diffusion	Organisation	Generic Information Technology	IT infusion, where the application is used to fullest potential	IT application
Information Centre Success	Organisation	Specific to IC services	User satisfaction with IC services in the promotion of EUC	The IC
End User Computing Adoption	Organisation	Specific to EUC	EUC success in terms of organisational effectiveness	EUC
Telecentre Success	Community	Specific to telecentre services	Telecentre success in terms of community development	The telecentre

Table 5 suggests the areas where the theories of IC and EUC success might be applicable to a theory of telecentre success and it also indicates where important differences exist between such theories. The following observations can be made and implications drawn:

1. The scope of a new theory of telecentre success needs to be extended beyond the organisation to that of the community. Community development is a new field for

IS practitioners and academics, who have traditionally been concerned with the organisational use of ICTs. An intimate understanding of organisations underlies the IS discipline, especially with regard to the design and application of methodologies for systems development and for the planning of activities necessary to exploit the strategic opportunities of ICTs. In the case of the IC and EUC, outcomes were often predicted in terms of the flatter organisation, with fewer levels of decision making, which was now pushed down organisational hierarchies towards ICT-empowered knowledge workers. Telecentres are designed to help communities achieve desirable developmental outcomes from the use of ICTs and if the IS profession is to participate in this application of ICTs, then it will be required to understand processes of community development as opposed to being familiar with organisational behaviour, management and marketing. The social complexities that exist even within relatively well-structured organisations are hugely magnified within much less formally structured communities.

2. The focus of the existing IC and EUC theories corresponds closely to that of telecentres, in that they represent innovations that are concerned with the adoption and diffusion of ICTs and that they were intended to promote the use of computers within their target audience. Telecentres do this by providing a range of services to community members, who are encouraged to use computers, perhaps not their own, but those that are provided in the centre. The services that the IC provided are similar to the services that telecentres provide, ranging from training in the use of the technology to assistance in finding and accessing useful information. However, whereas the IC was able to focus on the use of computers to manipulate information that was mostly internal to the organisation, telecentres address information that is mostly external to the community, i.e. that which can be found on the internet or which is specifically provided via the internet to the community from an outside agency. Moreover, whilst organisational EUC is concerned mainly with a restricted range of financial, marketing and operational data, telecentres potentially engage with information that is related to a much wider range of human activity; e.g. health, education, commerce and cultural activities.
3. The outcome variable for a telecentre is also the fullest use of its technology, as well as the satisfaction of its users, but these factors are now directed towards community development. Telecentre services are optionally utilised by community members, just as organisational members optionally used IC services. One difference though, is that telecentres may charge for their services, making it more critical that they are truly useful, otherwise they would not be used. The key aspect that remains common though is the optimal use of ICTs by a specific group of people towards a defined goal.
4. The unit of analysis becomes the telecentre, which is the IT application. In the structural conditions of rural telecentres in developing countries, the telecentre is the means through which the community engages with ICTs, as in the most common situation, users will be highly unlikely to possess their own computers. So EUC merges conceptually, and physically, with the services of the telecentre.

In addition to the above four observations with regard to the opportunities for relating the theoretical perspectives of previous innovations to telecentres, Colle (2000)

suggests some issues surrounding the diffusion of what he calls communication centres, which are worthy of inclusion in a discussion of a general theory of telecentre success. Some of the issues relate to what Markus and Soh (2001) describe as structural conditions, which impact how IT innovations are implemented in different countries or regions. Structural conditions differ from country to country, and even from location to location within country, but they are not necessarily related to dimensions of national culture. Therefore, valid explanations of differences in IT implementation activity require a careful assessment of relevant structural factors. For example, in the case of telecentres, the role of government policy and political leadership needs to be incorporated in order to account for the crucial impact that they have on a country's development activities, including appropriate regulatory environments. Also, the role that partnerships can play appears to be critical; particularly international agency partners and local champions Colle (2000). Colle also emphasises the need for participation by local communities in order to make telecentres understood, as, he says, the concept of participation in telecentre development is not absolutely clear. Additional issues relate to the planning of telecentre activities; their product mix; the localisation of knowledge and information resources; the nature of their start-up; the extent to which telecentres are networked among themselves; telecentre financing and evaluation (Colle, 2000).

Arising from the discussion of the role of the telecentre in bridging the digital divide, and from a review of previous theories relating to IT innovations, the following section describes research that proposes a research model of telecentre success. This is then tested against a description of five rural telecentre projects in Asia.

The Proposed Research Model

The Community Informatics literature reveals a variety of outcomes from CI projects. O'Neil (2001) summarises five outcomes that CI projects have targeted; enhancing strong democracy, increasing social capital, empowering individuals, revitalising sense of community, and providing economic development opportunities. In defining the dependent variable for rural telecentres in developing countries, these all have merit, but some are facilitating goals, e.g. democracy, empowerment, social capital and sense of community are valuable if they lead to something else. It is proposed here that the dependent variable should be relate more closely to what a community wants to achieve, or can be motivated to achieve, from its use of a telecentre, and that success outcomes should therefore be defined by the user community. The dependent variable of a model of telecentre success is proposed here as desirable development outcomes at the community level.

This is not the same as the user satisfaction construct in the models of IC and EUC success, which was used as a surrogate for other success related constructs. As McNamara puts it, access to communications is essential for the development of rural areas (McNamara, 1998). Focussing on developmental outcomes as the dependent variable unambiguously targets the prime purpose of telecentres. Although telecentres will target intermediary goals, and user satisfaction may be considered as such, as long as development does not occur then the telecentre is not fulfilling its primary purpose. Satisfaction may emerge from some aspect of the encounter with a telecentre service, but it has to lead to developmental outcomes for it be of lasting value.

Additionally, projects exist that are concerned with rural ICTs as demonstrator projects or awareness raising exercises, which have their value and which are often useful precursors to development-inducing telecentre implementations, but they are not to be confused with the true developmental goal of full bodied telecentres. As the World Bank points out, countries should ensure that (new ICTs) are extended to remote and rural areas (in order to) upgrade education systems, improve policy formation and execution and widen the range of new opportunities for businesses (World Bank, 1999). Richardson (1998) sees the internet in support of rural development in developing countries falling into five main areas; economic development for agricultural producers, community development, research/education, SME development and news media networks. The proposed model is shown in figure 3.

The proposed model of telecentre success incorporates the following independent variables:

Telecentre Characteristics

These variables are the equivalent of the IC characteristics in the Bergeron, Rivard and de Serre (1990) model of user satisfaction with the IC, though with appropriate modifications for the telecentre. The circumstances of project start up appears to influence the adoption process, depending on whether the project is instigated by an NGO, a government agency or a research institution. Adoption seems to be facilitated when a level of local ownership is established early in the life of the telecentre. The level and quality of services and the product mix that is offered by the telecentre is likely to influence its adoption by the host community. Just as with the IC, service and product delivery should be sensitive to community requirements. The closer the software tools match the needs of the community, the more likely they will be used. The use of suitable language has an impact. Telecentre financing is critical to viability and sustainability. The quality and responsiveness of management planning for maintaining suitable levels of service is important as well as the extent to which a telecentre is able to effectively network with other centres in order to share experiences, cross-fertilise ideas and promote joint learning.

In fulfilling the support role of the telecentre, staff provide training and assistance to community users. In addition, the role of the *infomediary* has been identified as an individual working in a telecentre and drawn from the community that the telecentre serves, who is capable of using computer and internet technologies in order to respond to requests from members of the community for information or for help in solving some problems that might yield to an internet enquiry. The term is drawn from the phrase *information mediator* and is sometimes characterised as a *knowledge broker*. In some instances, the infomediary will pro-actively seek information from the internet that he/she knows will be useful from their personal knowledge of the community, and will then broadcast or otherwise publicise that information throughout the community. In addition to the infomediary role, the style and mechanics of telecentre management are seen to be crucial factors in influencing telecentre outcomes.

Community Characteristics

These substitute for the organisation characteristics of the EUC success model. Telecentres serve communities as opposed to organisations. From observation during the research reported here, it has been realised that a variety of social factors influence the extent to which communities engage with and ultimately embrace telecentres as community resources (PANTLEG, 2000). Avgerou and Walsham (2000) have also pointed to the influence of contextual social factors on information systems in developing countries. It appears that the technology that is introduced is quickly embedded within these social factors and outcomes are a result of their interactions. Some of the social factors that have been observed to define outcomes of telecentres are:

- **Community Aspirations**
Experience suggests that technology cannot function successfully in the absence of some form of community ambition for a better life. Moreover, aspirations often need to be ignited, sometimes by an outside influence, and they need to be

kindled and re-kindled over time. The source of inspiration that sets off aspirations often changes during the adoption of the technology, sometimes to unexpected sources e.g. school children, and there are usually many different sources at any one time.

- Learning

The communities that have been observed in this research are all capable of learning new things, skills, ideas, and roles. They blend new information with pre-existing knowledge and build it into something of lasting, perhaps growing, value to themselves. Learning seems to take place at all levels of the community, and its impact is accelerated by the rapid spread of new and useful knowledge within the community. The pace of learning seems to accelerate as technology unfolds its capability and potential, further feeding the desire for new knowledge. People discover new knowledge and they teach each other. The learning that then occurs is usually deeper and more focused on real needs than the learning that is introduced from outside.

- Capacities

Learning often leads to expanded capacity, but this is of little value without the aspiration to take advantage of the extra capacity. The research has observed the pride that individuals take in the new roles and accomplishments that they have been able to achieve as a result of having their capacities expanded and their aspirations realised. It has also been noticed that the processes that are specifically designed to achieve it, e.g. training, do not always trigger capacity building. People seem to act as a result of a combination of circumstances, and if the right combination does not exist, any single factor in isolation may not be optimally effective. While it is probably a question of timing, the challenge is to be able to recognise the right time to engage with community capacities, i.e. when to trigger aspirations, or when to conduct training.

- Organisation

The extent to which a community is and remains organised seems to influence the use it can make of a telecentre. Community organisation in this context relates to the role of co-ordinating the dynamics of many social processes that occur simultaneously, towards a desirable result. Telecentre activities impact all sections of a community and they participate in many of the social processes that define its identity. Organisation then, is a function of harnessing the social dynamics of a community towards its own betterment, with, in our case, the introduction of new information. This usually requires some locus of community influence, but when new technologies are introduced this is often not the one occupied by the traditional leadership.

- Unity

Some of the stories derived from research experience depict a sense of unity of purpose within the community that transcends the many differences that usually exist within any body of people. Desirable results emerge from, and contribute to, the unity of those affected, engendering a camaraderie that further acts on aspirations, capacity building and organisation.

- Participation

Participation refers not only to the researcher-community relationships and the adoption of equality between them, but also to the inclusion of all sections of the community. Descriptions of the most desirable telecentre outcomes indicate a will to include rather than to exclude sections of the community. Relative advantage is a less appealing benefit than is the greater good. Pride and its spin-offs (aspirations and capacity expansion) are nearly always evident when outcomes have a wide, inclusive, impact. Individuals who achieve community-wide solutions earn respect and status. Those who exploit technology for selfish purposes lose it.

- Relationships

Research observations nearly always reveal one or more relationships that were important contributors to a beneficial outcome. Sometimes it appears within the researcher-community relationships, but more often (and more potently) it is a factor of the relationships that exist or which emerge within the community itself. Moreover, relationships seem to amplify the effects of the other factors mentioned here and the influence is recursive, so that good relationships breed aspirations and accomplishment, which in turn generate further good relationships.

- Personalities

Many stories of desirable telecentre outcomes indicate the presence of an individual within the community whose personality seemed to have an important role in the outcome. The IS literature refers to “champions” as opinion leaders in IT implementation and adoption (McConnell, 2000). Stories of positive developments from telecentre adoption often feature an individual’s action as a trigger to community adoption. Ernberg (1998) stated that “the need to find local champions who are motivated and able to drive the project, cannot be overstated”.

Information Characteristics

This variable recognises the application characteristics in the EUC success stream of research. Information should be useful and useable (Davis, Bagozzi and Warshaw (1989) as well as being local and relevant, according to Colle (2000) who argues that a telecentre that is designed to support community development should be aggressive and creative in localising its knowledge and information resources (Colle, 2000).

Structural Conditions

Developing country governments should formulate national strategies to narrow knowledge gaps, including those for technology acquisition and distribution, education and training and expanding access to technologies by de-regulation and privatisation (World Bank, 1999). The Bank goes on to say that societies require policies and institutions to facilitate the acquisition adaptation and dissemination of knowledge, saying that the appropriate course of action for any country will vary depending on the circumstances. Government policies and political leadership will determine the success of such policies. The participation of the major international donor and aid agencies such as the United Nations Development Programme (UNDP) or the Canadian Government’s International research Development Centre (IDRC) can heavily influence telecentre pilot projects and hence nation-wide roll-out programmes.

Individual Characteristics

The characteristics of individual telecentre users as an independent variable represent the individuals' characteristics in the EUC success stream of research. Their inclusion allows the model to take account of variables that have been demonstrated to influence the adoption of computer usage behaviour. They include; personality, demographics, computer anxiety, involvement with application development, expectations, training and education.

IT Implementation Stages

The stage model of IT implementation by Cooper and Zmud (1990) indicates a temporal dimension for the research model of telecentre success. Accordingly, it is included here to add a dimension within which the other independent variables operate over time. The stage model suggests that an IT innovation will take time to become fully integrated into the natural life of its user community. It is conjectured therefore that as a telecentre innovation proceeds through the various stages towards maturity, the factors that characterise the other independent variables will adjust accordingly.

Research Questions

The model proposes that the ability of telecentres to induce desirable community development will be a function of the telecentre characteristics; the characteristics of the community in which the telecentre is located; the characteristics of the information that the telecentre obtains and distributes; a variety of structural conditions relating to telecentres in the country or region in which the community is located; and the characteristics of the individuals who use the services of the telecentre.

The model allows the compilation of more detailed research questions that can help to explain how telecentre outcomes lead to desirable community development. A number of possible enquiries will serve this purpose, for example, by hypothesising the following:

Telecentre Characteristics:

- Telecentres that are started by community-based actors will achieve greater development outcomes than those started by outsiders;
- Telecentres with staff who pro-actively seek and disseminate useful information for the community will achieve greater development outcomes than passive staff who do not;
- Telecentres that actively network with other telecentres will achieve greater development outcomes than those that do not.

Community Characteristics:

- Communities with high development aspirations will achieve more desirable outcomes from their telecentres than communities with low development aspirations;
- Communities with greater capacity for learning will achieve more desirable outcomes from their telecentres than communities with low capacity for learning;
- Communities that foster harmonious internal relationships will achieve more desirable outcomes from their telecentres than communities that do not foster harmonious internal relationships.

Information Characteristics:

- Telecentres that distribute local information to their communities will induce more desirable development outcomes than telecentres that do not;
- Telecentres that distribute relevant information to their communities will induce more desirable development outcomes than telecentres that do not;
- Telecentres that distribute information that is usable by their communities will induce more desirable development outcomes than telecentres that do not.

Structural Conditions

- Government policies will influence the ability of telecentres to induce desirable development outcomes;
- Political leadership will influence the ability of telecentres to induce desirable development outcomes;
- Partnerships between telecentre implementation organisations and outside agencies influence the ability of telecentres to induce desirable development outcomes.

Individual Characteristics

- The personalities of telecentre users will influence their ability to achieve desirable development outcomes from their telecentre;
- The expectations of telecentre users will influence their ability to achieve desirable development outcomes from their telecentre;
- The training of telecentre users will influence their ability to achieve desirable development outcomes from their telecentre.

Method

The Case Studies

Cases are drawn from an initiative by the IDRC, the PANAsia Telecentre Learning and Evaluation Group (PANTLEG) consisting of five Asian telecentre projects that have received funding from the IDRC. The objective was to join the projects together in a closer partnership for mutual benefit (PANTLEG, 1999). The projects are as follows:

- e-Bario, Malaysia
- MS Swaminathan Research Foundation (MSSRF) Village Information Shops, India
- Foundation of Occupational Development (FOOD) Chennai, India
- Multipurpose Community Telecentres, Philippines
- Internet Information Centres, Mongolia

Case descriptions are drawn from evaluations that were conducted by PANTLEG members, i.e. the project leaders, plus an additional project member. This section provides a brief description of each project. Data collection took the form of interviews of project staff, telecentre operators and users.

*e-Bario*¹

This is a telecentre in Sarawak, which is one of the two Malaysian states on the island of Borneo. The State is characterised by its diffused population spread across hilly and forested terrain with an under-developed infrastructure. The research project's

¹ The author initiated this project.

objective is to understand how ICTs can be used to achieve sustainable human development in a remote area. A telecentre has been established which will serve as a community resource for the members of the community to use computers, connect to the internet, and use a variety of associated services that will affect sustainable social development of the community (Songan et al., 2000).

The settlement of Bario with a population of around 1,000 people is inaccessible by road, and is normally reached by a 20-seat aircraft operated by the Malaysian Airline Rural Air Service from the coastal town of Miri. The community is predominantly made up by people of the Kelabit ethnic group, one of Sarawak's smallest among its 26 or so identifiable ethnic minorities. Forested mountains surround the plain in which the residents cultivate wet rice. People in the older part of the settlement live in a traditional longhouse, containing two communal areas that run the length of the building. One contains a kitchen space for each household whereas the other is used for formal occasions involving the whole community. In between, each household has its own private living apartments. Longhouses are the traditional form of dwelling on Borneo island.

An initial survey indicated that the community placed most importance on information relating to agricultural, medical and religious practices. Information technology, job opportunities, government policies and family matters rated slightly less important. Current patterns of information actually received were dominated by religious information, with agricultural and family matters ranking next. Most information that is sent outside of the community concerned families, with religious information ranking closely behind. Relatives were the major source of information. In this respect, face-to-face contacts outweigh all others as channels of incoming information, with the radio, church congregation and community meetings ranking about equally next. (Harris et. al, 2001)

Initially, a computer laboratory of 10 PCs was set up in the junior secondary school and a teaching programme for IT literacy installed. This has been extended to interested community members after school hours. Subsequently, a temporary telecentre was established in the local lodge, which is a common meeting house for the community, pending the construction of a custom-designed building to house the telecentre. The telecentre was equipped with four PCs and two printers. Bario is off-grid for electricity supply and in both the school and the telecentre, additional electricity generators were provided to augment existing supplies. All equipment had to be flown in by chartered aircraft. Telekom Malaysia has partnered with the research project and has installed VSAT (Very Small Aperture Terminal) satellite equipment to connect the computers in the telecentre to the internet. The researchers organised a symposium for community members and other Kelabit people in order to identify and prioritise suitable information systems for use the Bario people.

E-Bario has attracted considerable public attention, mainly because of the remoteness of Bario and the unique nature of the community's culture. Although the community has been sensitised to the value of ICTS, significant development outcomes are yet to be achieved. At the time of writing, it is probably too early to expect any major impact on the community, who need more time to mobilise local resources into development-inducing activities that make full use of the telecentre.

MSSRF operates an extensive programme introducing the benefits of emerging technologies to the rural poor. The project takes the view that to be of use to farm families, the generic information found in the internet should be rendered into locality-specific knowledge that rural people can act on. The Foundation's approach to the dissemination of new technologies in rural areas is premised on the statement of its founder, Professor M.S.Swaminathan: "whatever a poor family can gain benefit from, the rich can also gain benefit; but the reverse does not happen" (personal communication). Thus, involvement of the ultra-poor in rural areas (there are over 300 million of them in South Asia) in managing the use of ICTs was considered essential for the success of this project.

The project was started in 1998 in Pondicherry in South India. The level of poverty is high in rural areas there, where about 21% of the resident families have less than US\$1 per day as family income. The objectives of the project are:

- To set up of villages information shops that enable rural families to access a basket of modern information and communication technologies
- To train educated youth and women in rural areas in operating information shops
- To train rural youth in the organisation and maintenance of a system that generates locally relevant information from generic information
- To maintain update and disseminate information on entitlements to rural families using an appropriate blend of modern and existing channels of communication
- To conduct impact assessments based on surveys, participatory rural appraisal, and other appropriate methods of data gathering
- To build a model of information dissemination and exchange in rural areas that uses advanced information and communication technologies.

A value addition centre was set up as an information hub in the village of Villianur, located in the western part of the Pondicherry region. A wireless hub was placed here and dial-up accounts to the Internet were also established. This became the project headquarters, as well as an interface for the public and the government offices in the locality. Additional village centres were then set up in places where the community offered secure space, free of cost. A total of five such village centres were set up during the initial project period. One of these is a village on the coast with 98% of the population involved in fishing. The total population of the 5 villages is approximately 13,400 with about 47% illiteracy.

In each village centre, a group of individuals identified by the community took charge of daily operations. They function as volunteers without receiving regular payments from the project. The village centre volunteers were trained in PC operations and in using the data/voice network. The project staff have implemented many locally useful databases. Much of the information is accessed from local sources, on the web or otherwise. All of them are transformed into locally useful material, in various formats (voice/digital audio, in some cases) and in the local language, Tamil, spoken by 98% of the population.

The centres receive an average of 12 visitors per day. The asset-less, ultra-poor families are among the major users. About 18% of the users are women. The pattern of usage indicates that educational purposes (such as use of CD-ROMs) and accessing government data are the two most important uses of this system. There have been

many instances where local residents have derived benefits from the use of data and information derived from this network. E.g.:

- Price information related to grain sales: this is the most important benefit according to every farmer as it helps him/her with better negotiating position in dealing with price-fixing middlemen.
- A fishing hamlet receives information on wave heights downloaded twice daily from the US Naval Oceanographic laboratory satellite. This is considered by the fishermen to be life-saving information.

(MSSREF, 2000)

In many ways, this project is exemplary for rural telecentres. The technological implementations are innovative and the communities have been fully mobilised towards making good use of it. Project staff are also committed.

Foundation of Occupational Development (FOOD) Chennai, India

This project is concerned with the lack of communications in rural India, in which the majority of the population live, and the lack of opportunity for NGOs and other development agencies to make effective use of contemporary ICTs. Due to the lack of exposure to developments in the field of social & sustainable development and cost-effective appropriate technologies, development organisations working in rural areas are conducting their activities through conventional practices with little or no technology input.

The project is based in Chennai, south India, with the goal of increasing the capability of NGOs and Community Based Organisations (CBOs) through electronic media as one of the options to spread development into remote areas. The project established a remote area electronic networking capability using packet radio modems in 10 remote sites, one of which is featured in this research. This was to enable NGOs, CBOs, and other development organisations working in remote, rural and tribal areas to network with other organisations within the region and with national and international NGOs and partner organisations. The technology used consists of wireless radios coupled with packet radio modems connected to a sub-host computer running TCP/IP host software. The packet radio network is used for accessing external databases, sharing data, electronic mail, bulletin board services, and newsgroups by interconnecting a series of packet radio sub-hosts to the Internet gateway host in Chennai.

Specific objectives included:

- To provide electronic networking capability in remote areas without access to information, thus strengthening the role of local NGOs as a knowledge-broker
- To offer e-mail, bulletin board and conferencing services
- To establish internet services and act as an Internet Service Provider
- To promote original and innovative networking solutions to specific development problems in the region
- To pilot practical networking activities that could create replicable results and have potential for application throughout the region.

The most significant characteristic of this project was its innovative adaptation of technologies that could provide information and networking capability to relatively remote communities in southern India. The wireless radio modem technologies that

were utilised achieved a cost-effective means of communication and internet access. This has helped NGOs and CBOs working in these rural and remote areas to develop community based applications that are contributing to their social and economic development. The community featured in this research used the facilities to establish a herbal cultivation business, obtaining the information they needed from the internet and using it to market their products. The community had previously been engaged in catching snakes, but was encouraged to switch to a more sustainable occupation.
(FOOD)

This project has achieved a focused and stable outcome, with sound technology and capable and committed community members to maintain it.

Multipurpose Community Telecentres, Philippines²

This project is being run in four farming and fishing villages in northern Mindanao, southern Philippines. The purpose is to develop and test a pilot information and communication system encompassing people, organisation, infrastructure and processes that will support rural communities in achieving sustainable development. Activities are as follows:

- To identify specific information and communication needs of the people in rural villages where ICTs can facilitate in obtaining solutions to these identified needs
- To establish the availability of local resources and local commitment to serve rural communication needs by encouraging the local population to participate in developing a conceptual framework of, developing operating, and maintaining a MCT
- To design, establish and experiment with the operation of four MCTs in four villages (in Agusan Norte and Lanao del Norte provinces) in Mindanao by building on the physical infrastructure (village public calling office) established by the Department of Transportation and Communication through its Municipal Telephone Project
- To develop the needed content and information services through the collaboration of public, private and civil society organisations which have information and/or expertise in health, agriculture, education, livelihood and rural enterprises
- To develop the capability of the local population and partners in developing indigenous information applications, and in operating, managing and maintaining a MCT
- To determine the enabling factors (ownership, legal, financial, operational, and technical issues) that relate to the sustainable operation of a MCT
- To determine the impact of MCTs in the village life and in neighbouring villages
- To document the process of setting up a MCT, including the concerns which relate to its sustainable operations, to deliver practical guidelines for expanding MCT site coverage in Mindanao, in particular, and in the country, in general.

The project aims to develop and harness people's capability to use ICTs to create and use information for rural development. Implementation is by the Philippine Council for Health Research and Development of the Department of Science and Technology. UNESCO and the IDRC provide support. The villages provide space for the MCT, staff, utilities and other supplies. Partner information providers from government and

² The author conducted a paid evaluation of this project for the IDRC.

other institutions deliver information to the MCTs. Each MCT is staffed by at least 10 volunteers, trained in computing, the internet and web development. MCT services include word-processing, printing, training and coaching, and information referral services. Each MCT is expected to serve a cluster of five or more other villages.

The primary output of this project is a model of operation for MCTs, in the form of guidelines, how-to materials, technical specifications and a sustainability plan, that will guide the local people and programme managers in expanding MCT operation to the rest of the country. The other outputs are information services that will be provided by the MCTs to enable the local people to have access to information resources and people with the right information thus mobilising them into positive action. It is also expected that local capability is developed in terms of co-operative organisation, technical expertise on important subject matters as health, agriculture, education, rural enterprises, information and communication technology. (Project documentation).

This project has achieved considerable levels of co-ordination between various government agencies and other institutions to establish telecentres that are operable and adequately supported. The communities are yet to be fully mobilised to make effective use of them, yet all indicators are that this will happen.

Internet Information Centres, Mongolia

The purpose of this project is to deliver Internet access to rural areas in Mongolia. Mongolia has about 1.57 million square kilometres of territory and only 2.4 million inhabitants. Nearly one-fourth of the population lives in the capital city Ulaanbaatar. Most of the remainder are engaged in a nomadic life-style, herding livestock across the grasslands. The telecommunications infrastructure is under developed, especially in rural areas, and the telephone network is based mostly on obsolete Russian technology. The project covers 4 provinces; Erdenet, Khovd, Dornod and Umnugovi representing the north, west, east and south part of Mongolia respectively. At the time of the research, telecentres had been established in Erdenet and Dornod provinces. They are connected to the Internet via VSAT satellite system at a speed of up to 64Kbps.

The main sponsors of this project are the Open Society Institute (OSI) in Mongolia, sponsored by the Soros Foundation, and Datacom Co.Ltd. of Mongolia. The IDRC are also in support. The project has established telecentres, known as Public Internet Centers (PICs), which provide free internet connections to secondary schools, local government offices and NGOs. These are requirements are stipulated by the project sponsors. The PICs serve their members, who can be NGOs, such as local women's group. The local library is one of the members of the PIC's Board of Management.

Whilst NGOs enjoy subsidised usage, business users are charged for internet access. Secondary schools and local government offices are being connected through radio modems. The PIC works closely with local government offices as they provide support by way of accommodation for the PIC. The PICs provides the following facilities and services to their members and customers:

- internet room with 6 PCs, modems and related equipment

- Dial-up access with 6 ports
- Internet access
- Email
- Fax service
- Web hosting and design
- Local telephone service

The price for these services varies according to the type of service and to the users. Several problems have been encountered:

- The electricity in rural areas is not stable and power outages occur frequently, requiring installation of a generator.
- The rural telephone network is still based on the old Russian technology. The telephone connection is unreliable and its speed is low.
- Language is a problem as most documents on the Internet are in English
- The PC penetration is very low in rural areas, so computer literacy is also very low compared to the urban population.

This project has achieved reliable and well-managed telecentre implementations that have alerted their communities to the potential of the internet. There is some evidence that they are being used to achieve desirable community-based developmental outcomes, but most use at the time of writing was for lower level achievements of literacy training and communications.

Table 6 summarises the salient features of the case projects.

Table 6. Background Information on the Telecentre Cases

	e-Bario – Malaysia	MS Swaminathan Research Foundation, (MSSRF) Village Information Shops	Foundation of Occupational Development, (FOOD) Chennai, India	Multipurpose Community Telecentres, Philippines.	Internet Information Centres, Mongolia.
Location	Central Northern Highlands in the East Malaysian State of Sarawak, on the Island of Borneo.	The Union Territory of Pondicherry, in southern India. The MSSRF in Chennai, Tamil Nadu.		Four villages along the northern coast of the island of Mindanao, southern Philippines.	Three centres in northern Mongolia, in Choibolsan, Dornod and Ulan Baatar.
Project sponsors*	Malaysian Institute of Microelectronics (MIMOS)	MSSRF	FOOD	Philippine Government	Mongolian Government, SOROS Foundation
Project description	A research project involving a school computer laboratory and community telecentre for social and economic development.	Research into community telecentres in six rural villages.	A rural village community telecentre.	Pilot community telecentres for social and economic development in rural communities.	Internet centres in two small towns supported by one in the capital.
Distinguishing characteristics	Bario is a remote community of around 1,000 people who make up the traditional home of one of the smaller ethnic groups in Sarawak. Access is practical by air only as no roads lead in from the outside.	A hub and spoke model of information delivery, between one “value addition centre” and satellite community telecentres. All locations are rural.	One telecentre in a rural tribal community in a relatively remote location in Tamil Nadu.	Typical small rural Philippine communities, include a coastal location. Information provided mostly by government agencies, with training and other support by local institutions.	Mixed models of telecentre design, one in mining town which is supported by the mine, another sponsored by the Soros Foundation in a remote town, and the centre in the capital supporting NGOs and providing public internet access.
Technology	Ten computers in the school laboratory, four in the telecentre. VSAT internet access. Locally generated electricity.	Three to four computers in the telecentres, linked by wireless and land line communications.	Land line telephone and four computers.	Three to four computers per centre, landline telephone dial connection to the internet.	Four to six computers in the outstation centres, more in the capital. VSAT connections to the internet.

* All projects are funded by the Canadian Government’s International Development Research Centre (IDRC)

Findings

Table 7 summarises the telecentre projects in terms of the developmental outcomes that have been achieved so far, along with an evaluation of each project against the independent variables in the research model. However, the individual characteristics of telecentre users have not been assessed as yet, so there is no data to report against these variables. For most of the projects some such data is available community-wide and for the MSSRF project, some demographics are known for telecentre users.

Table 7. Project Outcomes

	e-Bario, Malaysia	MS Swaminathan Research Foundation, (MSSRF) Village Information Shops, India	Foundation of Occupational Development, (FOOD) Chennai, India	Multipurpose Community Telecentres, Philippines.	Internet Information Centres, Mongolia.
PROJECT OUTCOMES	At an early stage still, so development outcomes are limited to higher levels of IT literacy within the school and among some of the community plus improved social communications via e-mail, which are important for this isolated community.	Communities are enjoying considerable benefits associated with a range of commercial, employment, educational and health gains as well as social well being.	The community has re-focused its commercial livelihood from unsustainable snake catching to more sustainable herb cultivation utilising the telecentre for product development and marketing activities.	Significant developmental gains are yet to emerge, but the conditions are ripe for this to happen.	Mostly confined to improved communications, although there is evidence that community members are beginning to exploit the telecentres for higher-level benefits.
INDEPENDENT VARIABLES					
Telecentre Characteristics					
Start-up	Research organisation	Research organisation	NGO	Government	NGO/Private organisation
Staff	Local recruit	Locally recruited volunteers	Locally recruited volunteers	Local school pupil volunteers	Local paid management and volunteer staff
Location	Central community lodging house (temporary)	Central, provided by the community	Central, provided by the community	Central, provided by the community	Central, shared with government establishment
Services / Product mix	Development oriented communications and information provision planned in conjunction with the community.	Development oriented, devised by the community and project staff. Communications and information provision.	Communications and commercial information concerned with a single activity, herb cultivation, that the community specialises in.	Development oriented information provision, supplied by government and other agencies in a help desk arrangement that responds to community requests.	Mostly communications and web site development.
Software tools	e-mail, internet, word-processing	E-mail, internet, spreadsheets, databases, word-processing, graphics, audio.	E-mail, internet, databases.	E-mail, internet, word-processing.	E-mail, internet, word-processing.
Budget / Financing	Research funding and government grant.	Research funding and government grant.	Research funding and income generating	Research funding.	Donor agency and income generation
Planning	Research based with community participation	Research based with community participation.	Locally by a community based NGO	Research based with community co-operation	By the NGO/Private organisation partnership
Networking	Minimal as yet.	Between themselves, within the five telecentres.	Focuses on their prime commercial activity.	Within the project's four telecentres.	Minimal as yet.

Community Characteristics

Aspirations	High	High	High	Low, as yet un-ignited	Low to medium, to be ignited
Learning	Willing and anxious to learn, taking place rapidly	Advanced. Pioneering with local script, multimedia and wireless and solar technology.	Capable. Focused on specific needs.	Slow but willing.	Willing but restricted to small groups.
Capacities	High, with diaspora support.	Highly motivated.	Proficient at what they need to know for their specialised need.	Latent but probably high.	Not fully exploited but probably high.
Organisation	Loose but locally focused.	Considerable.	Sufficient.	Burgeoning.	Proficient but with potential.
Unity	Traditionally tight but emphasises consensus finding.	Sufficient, maintained with help of project staff.	Sufficiently for tight focus on specific requirements.	Considerable.	Diverse across various stakeholders.
Participation	Community has equal rights with project.	Shared responsibilities, but transiting towards the communities.	Self-governing.	Began as collaborative more than participatory, but changing.	Consultative and rather passive.
Relationships	Close and deep, based on common ethnic background and extensive extended family relationships.	Complex, with a variety of social strata, including those based on caste.	Tight and focussed. Based on common ethnic affiliation, locally differentiated as "tribal" peoples.	Close and co-operative, based around community belonging.	Varied and scattered throughout a range of stakeholders.
Personalities	Influential champions within the community have consistently supported the project, adding to its community acceptance.	Influence of young, capable volunteers is based on their achievements with the technology and the community contribution they make.	Individuals specialists with particular roles that support community use of the telecentre.	Influential local leadership support plays a positive role in community acceptance.	Local management and volunteers encourage usage.

Information Characteristics

Local	Not much yet, but there is a community-generated development agenda that focuses on local information.	Extensive local and regional information databases.	Almost entirely local, relating to the cultivation and marketing of local herbal products.	Not much yet, information provision began much as a top-down programme, with some local consultation.	Little, but developing as local web sites get under way.
Relevant	Not yet, but expected.	Highly relevant to local needs and with varied topics.	Highly relevant to local needs, but limited in range of topics.	Not much of local relevance.	Not much of local relevance.
Useable	Not provided yet, but targeted to be so. Language will be an issue.	Distributed in local Tamil script, some available in sound files for those who cannot read. Also visual.	Local script and tightly focussed on the needs of the main commercial activity.	Some, but not much.	Language is an issue, and there is not much available anyway.

Useful	Expected to contribute to key areas of community concern: commerce, culture, education, and health.	Extremely useful, making significant contributions to community well-being in education, health, and commerce.	Extremely useful, making significant contributions to community well being in the form of commerce.	Not to a great extent yet.	Not much yet.
Structural Conditions					
Government policies	Supportive. Malaysia is pursuing ICTs aggressively for its national development.	Initially a hindrance, but lately coming round to the extent of the project forming a partnership with local government to extend its activities to new areas.	Neutral.	Supportive and instrumental to project inception, but telecommunications problems arose due to the transition in the regulatory environment.	Newly supportive in the telecommunications regulatory environment.
Political leadership	Substantive support for ICTs in general and also for rural ICTs, from the top.	Not a significant feature at the pilot stage.	Not a significant feature.	Important for the project as government is anxious to develop Mindanao.	Not a significant feature.
Partnerships	Instrumental with the IDRC for inception, later with quasi-government institution for extended support.	Funding and learning with IDRC project partners, also other source of external funding for MSSRF.	Not so important, as mostly self-sufficient.	Important funding and learning from the IDRC.	Significant funding from the Soros Foundation, plus learning from the IDRC.
Individual Characteristics					
Personality	<p>Most of these factors have not been systematically measured at the individual level among the telecentre users. Some demographic data is available for some of the communities.</p>				
Demographics					
Computer Anxiety					
Involvement					
Expectations					
Training					
Education					
IT Implementation Stages					
	Adoption	Routinisation	Routinisation	Adaptation	Adaptation

Discussion

Research Outcomes

The research has set out to achieve greater understanding of the factors that influence telecentre success with reference to examples in rural Asia, where success is indicated by positive and desirable developmental outcomes for the communities that are served by the telecentres.

We begin with the projects that have achieved the latest stage on the IT implementation model (in this instance, routinisation), and which have probably the most significant development outcomes, the MSSRF project and the FOOD project. The following observations can be made. Firstly, it is important to keep in mind that the projects have been running for different times and at different paces, so that additional outcomes for the later projects might be expected in the fullness of time. However, examination of table 7 suggests that some community characteristics and some information characteristics might differentiate the better achieving projects from the others and that those characteristics could be argued to have been instrumental in achieving this result.

In both the MSSRF and FOOD telecentre projects the aspirations of the communities seem to have been harnessed in a positive way, propelling them towards positive outcomes with their telecentres. Observations of the telecentre volunteer staff indicate a deep sense of motivation and pride in what they are able to achieve and the enthusiasm of the community is evident in the manner in which they describe the operation of their telecentres. Such encounters also testify to the rate of learning that the communities have displayed through, for example, the ease with which the semi-literate volunteers are able to work with a western keyboard in entering Tamil script. Community capacities are clearly elevated and are sustained by the capability of the communities to organise and operate effective services from their telecentres. The other important contributor is the characteristics of the information that the telecentres provide to the communities. Examples include local databases of families that live below the government's poverty line, which entitles them to certain government support schemes. The centres have sought this information from the local government, made it available to the communities and the staff seek out those families who are entitled to benefit and help them to claim it. Information is useable by the local population as much of it is distributed in hard copy, or posted on notice-boards in visible locations and is mostly presented in the local Tamil script.

The projects that have achieved the next latest stage on the IT implementation model (adaptation), the Philippines Multipurpose Community telecentres and the Mongolian Internet Centres, depict strengths in the government policies variable, compared to the other projects. The Philippine project is operated by a government agency and therefore enjoys access to high government officers. The Mongolian project is closely allied to government offices at the local level, even providing subsidised services to them at one stage. It seems likely that this close affiliation will lead to additional support to compensate for external funding drying up.

The final project, e-Barrio, is strong on the community factors, but is held back by the structural conditions relating to its isolation. All equipment has to be flown in,

communications are difficult, individual households and government offices generate their own electricity, and technical support is distant. Nevertheless, the community is motivated, united and highly resourceful (a pre-condition for survival) and there are grounds for optimism in supposing that the telecentre will make a substantial contribution to community well being.

Overall, the findings indicate some promise for the model of telecentre success to be able to account for the outcomes of telecentre innovations. Insofar as all the centres provide public e-mail, there is a minimum achievable level of success associated with that, which may or may not translate into desirable development outcomes. All the communities taking part in the research are rural, some are remote and isolated, but all are with rudimentary communications, so any improvement in communications will represent a desirable outcome. Whilst such outcomes can be praised, they are insufficient testimony to the full promise of ICTs for rural development that is being held out by the promoters of such innovations. The model will be useful when it can be shown to be capable of differentiating between those telecentres that only provide improvements in communications from those that precipitate more profound developmental outcomes, as in the MSSRF and FOOD projects. That the other three projects have yet to demonstrate such outcomes is not a criticism, as the time scales are different, but the model may be helpful in indicating the variables that they need to address in order to progress to higher orders of developmental outcome.

Conclusion

Theory Building

A general theory of telecentre success is urgently required. International aid agencies, governments and NGOs the world over are becoming more enthusiastic about the perceived potential for inducing social and economic development at community level through the deployment of ICTs. As the technology becomes more approachable, cheaper and powerful, so this enthusiasm is further fed. Moreover, as stories begin to emerge of the successes that some pilot projects have experienced, there is a danger that more institutions and individuals begin to accept that hitherto marginalised communities need only be given access to technology in order to share in the benefits of a wired society and the information age. The time is now right to stake stock of the experience obtained from such pilot projects and begin to make sense of what is working and why it is working. Furthermore, there is also a danger in assuming that the lessons learned from pilot projects that exist under intense scrutiny and lavish resources can be easily extrapolated into wider implementations without a full understanding of the difference between pilots and live roll-outs.

It is contended that earlier research in IS can inform the newer styles of ICT use that telecentres represent. It is not necessary for the development community to climb the same learning curve that organisational computing climbed as practitioners can see where previous experiences can guide their own ICT-promoting activities. The opportunity exists for development professionals to short cut the learning that they will have to make for ICTs to be applied successfully to the problems of the poor. Similarly, IS professionals should recognise a new constituency for their expertise, development practice, in which admittedly the context is vastly different from the

traditional organisational context, but where many of the principals might be applicable.

In the absence of more detailed research, it is only possible to conjecture at this early stage of theory building in telecentre success issues, but the findings so far might seem to suggest that the community characteristic variables are the most potent in predicting telecentre success in terms of desirable development outcomes for communities. In many ways, the variables that have been identified so far point to the concept of social capital, which refers to the quality and depth of relationships between people in a community (Coleman, 1988). According to Putnam (1995), in a community with a substantial stock of social capital, networks of civic engagement foster sturdy norms of generalised reciprocity and encourage the emergence of social trust. Such networks facilitate co-ordination and communication, amplify reputations, and thus allow dilemmas of collective action to be resolved. Networks of civic engagement embody past success at collaboration, which can serve as a cultural template for future collaboration. Additionally, dense networks of interaction broaden the participants' sense of self, converting an individualistic perspective into a community perspective that fosters collective benefits. The relationship between community telecentres and the social capital of the community needs further research in order to understand the interactions and their impact on each other.

Much of the experience from implementing information systems in organisational settings indicates that whilst technology is necessary for the transformational opportunities that are available, of itself, technology is insufficient. A model of innovation success must reveal what else is required for technology to achieve its potential within the circumstances that it is being applied. The IC and EUC theories of success addressed the multiple variables that are involved in achieving success with these innovations. A first step towards such a model for telecentres is proposed here. Further research will illuminate its limitations and strengthen its potential.

Limitations of the Research

Most of the data in the findings section is derived from short evaluation visits of four to five days to the project sites. However, these were conducted by a group of between 7 to 12 experienced individuals with a common purpose and with no vested interests. Detailed reports of each evaluation were recorded and they included quantified data where available. The research is limited to the five telecentre projects, involving 14 communities, a small sample and selected for the research only as they all receive funding from the IDRC.

Implications for Practice

The findings suggest some practical lessons that might be of use by development professionals, donor agencies and governments involved with development-oriented telecentres as innovations within communities. The lessons relate to how project managers engage with each of the postulated independent variables. To a certain extent, telecentre characteristics and information characteristics are relatively mechanical in nature in that a telecentre has to be well managed and it has to provide information to its community that will be put to good use. Mechanisms for accomplishing these outcomes are reasonably prescriptive. Suitable methods for

telecentre management are relatively simple and universally applicable. Techniques for eliciting information needs may be a little more demanding, as this requires intimate knowledge of the user community. Nevertheless, there is a wealth of practical experience in the Social Sciences and Information Systems fields to guide this task. The structural conditions surrounding telecentre innovations are likely to be less tractable, being subject to external influences and agencies. The individual characteristics of the user community are only partially likely to yield to the actions of telecentre staff or promoters. Computer anxiety is known to be diminished by training and user involvement and expectations can be managed to a degree.

However, the characteristics of the community that uses the telecentre are much less likely to be subject to influence by the activities of telecentre staff, management or project promoters. Various techniques of community development have demonstrated their capacity for igniting community aspirations, e.g. Future Search Conferences (Weisbord and Janoff, 2000) and Appreciative Inquiry (Hammond, 1996) but it is not known that such techniques have been utilised to induce development aspirations in connection with the promotion of telecentre services. As it appears that community characteristics might be the most potent factor in influencing telecentre success and are simultaneously the least manageable, practitioners face a considerable challenge in achieving success with their telecentres innovations. Moreover, due to their structural conditions, all the projects described here required a variety of innovation technical solutions involving wireless internet access, including satellite and radio and electricity provision, requiring diesel generators, solar panels and battery power. The challenges of putting this technology together in less than perfect surroundings, whilst wholly necessary, tends to divert project officers from other critical path factors such as the community characteristics highlighted here.

It is expected that continuing research will generate the knowledge that is required to assist ICT innovations in development and that more communities who might not otherwise dream of being able to use computers and the internet can begin to share in the benefits that are now taken for granted by the fortunate minority for whom this is a regular daily activity. Previous research into the adoption ICT innovations that resemble those that are now taking place in a few rural communities throughout the developing world appears to be capable of guiding such activities towards fruitful outcomes.

References

Ajzen I., From Intentions to Actions: A Theory of Planned Behaviour, in Action Control: From Cognition to Behavior, Kuhl, J. and Beckman J. (eds), 1985.

Amoroso, DL. and Cheney, PH., Testing a Causal Model of End-User Application Effectiveness, Journal of Management Information Systems, Summer 1991.

Arnoudse, DM., and Whalen, JD. The Information Centre of the 1990s, Information Management, 1-07-60, 1989.

Avgerou, C. and G. Walsham (Eds.) (2000) Information Technology in Context: Studies from the Perspective of Developing Countries, Ashgate, London.

Bergeron, F., Rivard, S. and De Serre, L., Investigating the Support Role of the Information Centre, MIS Quarterly, September 1990.

Christy, DP. and White, CE., Structure and Function of Information Centres: Case Studies of Six Organisations, Information and Management Vol. 13, 1987.

Coleman, JS., Social Capital in the Creation of Human Capital, American Journal of Sociology (Supplement), 1988. 95-120.

Colle, R. Communication Shops and Telecentres in developing Countries, in Gurstein, M. ed. Community Informatics: Enabling Communities with Information and Communications Technologies, Idea Group Publishing, Hershey, USA, 2000.

Cooper, RB. and Zmud RW., Information Technology Implementation Research: A Technological Diffusion Approach, Management Science Vol 36, No. 2, pp 123-139 1990.

Davis, FD., Bagozzi, P., and Warshaw, PR., User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, Management Science, Vol. 35, No. 8 pps. 982-1003, 1989.

Doll, WJ. and Torkzadeh, G., The Measurement of End-User Computing Satisfaction, MIS Quarterly, June 1988.

Ernberg, J., Empowering Communities in the Information Society: An International Perspective. In Richardson, D. and Paisley, L. (eds.) The First Mile of Connectivity. Advancing Telecommunications for Rural Development through a Participatory Communication Approach, Food and Agriculture Organization of the United Nations, Rome, 1998.

Etezadi-Amoli, J., and Farhoomand, AF., A Structural Model of End User Computing Satisfaction and User Performance. Information and Management, Volume 30, pp 65-73, 1996.

Fishbein, M and Ajzen, I Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research, Addison- Wesley, Reading, Massachusetts, 1975.

FOOD, Foundation Of Occupational Development, Chennai, Tamil Nadu, India (<http://www.xlweb.com/food/wireless/>).

Franz, CR., A Descriptive Model for End-User Acceptance of Information Centres, *Information Resources Management Journal*, Fall 1991.

Gerrity, TP., and Rockart, JF., End-User Computing: Are You a Leader or a Laggard?, *Sloan Management Review*, Summer 1986.

Gunton, T., *End User Focus*, Business Information Technology Series, Prentice Hall International (UK) 1988.

Gurstein, M., *Community Informatics, Enabling Communities with Information and Communications Technologies*, Idea Group Publishing, Hershey, USA, 2000.

Hammond, S.A., *The Thin Book of Appreciative Inquiry*, CSS Publishing, 1996.

Harris R.W., Attitudes Towards End-User Computing: A Structural Equation Model, *Behaviour and Information Technology*, Vol. 18 No. 2 1999 109-125.

Harris R.W., Schools of Thought in Research into End-User Computing Success, *Journal of End-User Computing*, Vol.12, No. 1 2000, 26-36.

Harris, R.W., Bala, P., Songan, P., Khoo E., Challenges And Opportunities In Introducing Information and Communication Technologies To The Kelabit Community of North Central Borneo, *New Media and Society*, Vol. 3, No. 3, September 2001.

Harris, R.W., Information and Communication Technologies for Rural Development in Asia: Methodologies for Systems Design and Evaluation, in Marshall, S., Taylor, W., and Yu, X., (eds.) *Proceedings, Conference on Information Technology in Regional Areas*, Central Queensland University, September 2001.

Henry, D. et al. *The Emerging Digital Economy II*. Washington, DC. U.S. Department of Commerce, June 1999.

Igbaria, M. End-User Computing Effectiveness: A Structural Equation Model *Omega* Vol.18:6, pp.637-652,1990.

Igbaria, M., Guimaraes, T. and Davis, GB., Testing the Determinants of Microcomputer Usage via a Structural Equation Model, *Journal of Management Information Systems*, Volume 11, No. 4, pps. 87-114, 1995.

ILO. International Labour Organisation, *World Employment Report 2001*.

ITU, The International Telecommunication Union. *World Telecommunication Development Report 1998*. Geneva: ITU, 1999.

Magal, SR. A Model for Evaluating Information Centre Success , *Journal of*

Management Information Systems, Summer 1991.

Markus, ML. and Soh, C., Structural Influences on Global E-Commerce Activity, forthcoming, Journal of Global Information Management, 2001

Martin, WJ. and McKeown, SF., "The Potential of Information and Telecommunications Technologies for Rural Development". Information Society, Vol. 9, No. 2, April-June 1993, p. 145.

McConnell, S., A Champion in Our Midst: Lessons Learned from the Impacts of NGOs' Use of the Internet, Electronic Journal of Information Systems in Developing Countries, Vol. 2. <http://www.is.cityu.edu.hk/ejisdc/ejisdc.htm>

McNamara, K., The Role of Telecentres in Fostering Universal Access and Rural Development, Rural Development and Universal Access, International Telecommunications Union, Regional Seminar for Central European Countries, Proceedings, 1998.

Mirani, R., and King, WR., Impacts of End-User and Information Centre Characteristics on End-User Computing Support, Journal of Management Information Systems, Vol. 11 No. 1 Summer, 1994.

MSSRF, MS Swaminathan Research Foundation, Assessment of Impact of Information Technology on Rural Areas of India, Terminal Report for the IDRC, 2000.

O'Neil, D., Merging Theory with Practice: Toward an Evaluation Framework for Community Informatics, Internet Research 2.0: INTERconnections, The Second International Conference of the Association of Internet Researchers, October 10-14, 2001, University of Minnesota, Minneapolis-St.Paul Minnesota, USA .

PANTLEG, PANAsia Telecentre Learning and Evaluation Group (PANTLEG), Research Support Project #100579, IDRC, http://www.idrc.ca/pan/pr100579_e.htm 1999.

PANTLEG, PANAsia Telecentre Learning and Evaluation Group, Revealing the Soul of a Project: Stories as Evaluation, IDRC, 2000.

Putnam, RD., Bowling Alone: America's Declining Social Capital, Journal of Democracy 6: 1, January 1995, 65-78. Available at http://muse.jhu.edu/demo/journal_of_democracy/v006/putnam.html

Richardson, D. The Internet and Rural Development, The First Mile of Connectivity. Advancing telecommunications for rural development through a participatory communication approach, Food and Agriculture Organisation of the United Nations, Rome, 1998.

Rivard, S., and Huff, SL., Factors of Success for End-User Computing, Communications of the ACM, Vol 31, No. 5, 552-561, 1988.

Saarinen, T., Heikkila, J., and Saaksjarvi, M., Strategies for Managing End-User Computing Journal of Systems Management, August 1988.

Schmandt, Jurgen, Frederick Williams, Robert H. Wilson, and Sharon Strover. Telecommunications and Rural Development: A Study of Business and Public Service Applications. Austin: University of Texas at Austin, 1990.

Songan, P., Harris, R.W., Bala, P., Khoo E., Awareness And Usage Of Information Technology In A Rural Community Of Bario, Sarawak, Proceedings, Sixth Biennial Borneo Research Conference 2000, 10-14 July 2000, Kuching Sarawak

Torkzadeh, GT., and Doll, WJ, Test-Retest Reliability of the End-User Computing Satisfaction Instrument, Decision Sciences, Vol. 22. pp. 26-37, 1991.

United Nations Administrative Committee on Coordination (ACC), "Statement on Universal Access to Basic Communication and Information Services," April 1997. Quoted in ITU: World Telecommunication Development Report, 1998, p. 10.

Weisbord, M. and Janoff, S., Future Search: An Action Guide to Finding Common Ground in Organizations and Communities, Berret-Koehler, San Francisco, 2000.

World Bank Development Report, Knowledge for Development, The World Bank, Washington DC, 1999.

World Development Report, Knowledge for Development, World Bank, Washington, DC, 1999.

Yaverbaum, GJ. Critical Factors in the User Environment: An Experimental Study of Users, Organisations and Tasks, MIS Quarterly, March 1988.