Overseas Development Institute

ICTs and Rural Development: Review of the Literature, Current Interventions and Opportunities for Action

Robert Chapman and Tom Slaymaker

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Acronyms

AKIS	Agricultural Knowledge and Information Systems
CKP	Community Knowledge Partnership
CLC	Community Learning Centre
CSR	Corporate Social Responsibility
FAO	Food and Agriculture Organisation of the United Nations
G8 DOTForce	Group of Eight Nations, Digital Opportunities Taskforce
HP	Hewlett Packard
ICTs	Information Communication Technologies
IDRC	International Development Research Centre
ITU	International Telecommunications Union
LLL	Local Linked Learning
MSSRF	M.S.Swaminathan Research Foundation
NGO	Non-Governmental Organisation
PRSP	Poverty reduction Strategy Paper
TFP	Total Factor Productivity
UNDP	United Nations Development Programme
UNESCO	United Nations Education Science and Culture Organisation
WAICENT	World Agricultural Information Center
WB	World Bank

Summary

Industrial society has moved into an era of advanced technological innovation, affecting the way developed countries run their businesses, their institutions and lead their lives. One of the areas in which these technological advances are dramatically influencing people's lives is information technology and telecommunications – hence the claim that we are in the midst of a 'digital revolution' that is driving us towards an 'information society'. As during previous societal revolutions based on technological advances there remain many countries and people that are largely unaffected by the changes that are taking place.

This paper investigates the role that information and communication technologies (ICTs) have to play in developing countries, focusing particularly on those rural areas that are currently least affected by the latest advances in the 'digital revolution'. Section one aims to look beyond the current 'digital divide' debate which focuses on information disparities to assess the potential role of ICTs in the context of current rural development paradigms. This section addresses the current divergence between the technology drivers and the potential beneficiaries in rural areas in developing countries, together with the opportunities arising from the continued convergence of ICTs, old and new. The section considers some alternative approaches that are being pioneered to harness ICTs for development goals including private sector, public sector and NGO-based initiatives. This leads on to a discussion of changing approaches to technology transfer drawing on lessons from agricultural extension experience to illustrate how ICTs could be harnessed for rural development.

This theme is further developed in Section 2, which focuses on how ICTs can play a more strategic role in rural development. It assesses the potential for pluralistic approaches to encourage widespread adoption of ICTs. The need for flexible and decentralised models for using ICTs is discussed in the context of 'content and control'. The challenge of achieving rural development goals by supporting knowledge and information systems is analysed through an epistemological perspective illustrated by case studies from the literature and the authors' research on the operation of these systems at the community level. The concept of building partnerships at the community level based around information exchange is explored, using ICTs to improve systems for the exchange of information sources that already exist locally and also providing established information intermediaries with the facilities to enhance their capacity for information sharing.

Responsibility for incorporating technological innovation in ICTs into development strategies has traditionally fallen to those with the mandate for infrastructure within governments and development agencies. This is largely due to the large scale and high costs of building telecommunication, electricity and to a certain extent broadcasting networks. As the technology becomes more powerful and more complex, with satellite-based and fibre optic cable networks encircling the globe with increasing density, the position of ICTs within this infrastructure mandate is unlikely to diminish. ICTs, however, also consist of a wide range of equipment nowadays that can be operated individually or within small, local networks that do not require vast infrastructure investments. Long lasting batteries, solar and wind-up power sources are now being used to enable ICTs to operate in remote areas. This paper focuses principally on the role of ICTs as flexible and powerful tools for social development through small scale strategic interventions, linking to, and extending beyond, formal and centralised systems operating on a larger scale. It is in this role as tools for social development that much of the experimentation at the community level is currently taking place, to harness the existing capacity of many 'off the shelf' ICT products to serve community development needs. This paper explores how ICTs could have a greater role in future

rural development strategies through the integration of available technologies and the diverse institutional and knowledge landscapes that exist in developing countries.

The paper concludes that there are numerous, well established barriers to improving information exchange. Knowledge capture, the high cost of information access and infrastructure constraints all affect the equitable distribution of information in rural areas. However, technological advances in ICTs have reduced the cost and increased the quantity and speed of information transfer dramatically. This is set to continue and the technologies are already being designed to accommodate a wide range of user choices. This flexibility points towards a potential for adaptation to the diverse needs of rural areas in developing countries that responds directly to the current paradigmatic emphasis on democratic decentralisation and pluralistic approaches, with participatory and demand-driven, market-based and diversified developmental change. The contradiction between the potential for ICTs to address the challenges faced by rural development and the current failure to harness them for this purpose is striking. To pursue 'universal access' and one size fits all applications to 'bridge the digital divide' is to ignore the real potential of ICTs to be used locally, in order to enable those individuals and institutions that are the priorities of rural development strategies to access the information that is relevant to their own multi-dimensional livelihoods. The need for a concerted effort to build knowledge partnerships and to engage the private sector and technology drivers in the pursuit of rural development goals is paramount if ICTs are to have a role in future strategies.

1 Introduction

There has been a recent surge of literature on the so-called 'digital divide' between developed and developing countries (Bridges, 2001; UNDP, 2001; World Bank, 1999; TDG, 2000; UN, 2000[1]). It is argued that the failure of the South to harness the benefits of the ongoing technological revolution in the North, places developing country populations at an ever increasing disadvantage in a globalising world (Bridges, 2001). While such generalised debate is useful in drawing attention to some of the major issues, the development challenges it presents can appear overwhelming. Furthermore, rather than highlighting priority areas for intervention, such facts and figures tend to obscure and oversimplify complex and long-standing development concerns. The aim here is to try and get beyond the hyperbole that surrounds the digital divide and examine some of the issues and implications from a *rural* development perspective.

The particular focus of this paper is information and communication technologies (Box 1). There is a substantial body of literature on the potential role of new technologies in development (see references above) and the fundamentals of these debates are well rehearsed. Transfer of technology debates have always been polarised between techno-optimists and techno-pessimists. However, while the former certainly often underestimate the complexity of development problems, the latter equally underestimate the flexibility of some of the technologies now available. Current debates on the potential role of ICTs tend to be constrained by an inherent mutual lack of understanding between the technology drivers and development agencies that find it difficult to establish common ground, especially when the technology and its implications for society are changing so rapidly. This apparent impasse raises some particular problems for development research, ICT applications in developing countries remain largely uninformed by recent developments in the wider development literature, and conversely many development agencies have failed to effectively mainstream strategies to harness the potential of ICTs.

Box 1 Definition of Information and Communication Technologies (ICTs)

ICTs are those technologies that can be used to interlink information technology devices such as personal computers with communication technologies such as telephones and their telecommunication networks. The PC and laptop with e-mail and Internet provides the best example. Michiels and Van Crowder (2001) have defined ICTs 'as a range of electronic technologies which when converged in new configurations are flexible, adaptable, enabling and capable of transforming organisations and redefining social relations'. The range of technologies is increasing all the time and 'there is a convergence between the new technologies and conventional media' (Michiels and Van Crowder, 2001:8). This rapid and ongoing convergence means that devices such as digital cameras, digital video cameras and players, personal digital assistants, slide projectors and mobile telephones are also compatible with more traditional media such as radio (digital, satellite), television (cable, digital, satellite). Thus most devices can now be linked to others to share and exchange information and allow it to be used in such a way that they can also be categorised as ICTs. Even books are being incorporated into ICTs either through the potential for informal web publishing or more formal digital book publishing with designated readers or 'e-books'. ICTs, therefore, are an expanding assembly of technologies that can be used to collect, store and share information between people using multiple devices and multiple media.

[1] Report of the High Level Panel on ICTs

The specific concern here is the potential role and importance of ICTs in support of *rural* development. Current ICT initiatives tend to focus on infrastructure development and the extension of information and communication services from the centre to the periphery (G8 DOTForce 2001, World Bank, 1999). However, visions of a network age of integrated information systems on a global scale seem far removed from the reality of rural areas in most developing countries which are far from becoming fully integrated in 'global information networks'. Instead the focus of this paper is on the potential for more *strategic* application of emerging ICTs to address the immediate challenges facing rural areas (FAO/WB, 2000, FAO/WAICENT/ SDR, 2000b; Richardson, 1997). In particular how far ICTs offer any new solutions to long-standing rural development problems and whether they can make a significant contribution to enhancing existing and ongoing initiatives.

The context of rural development has changed rapidly in recent years (Ashley and Maxwell, 2002) but some three-quarters of the world's poor still live in rural areas. Furthermore, although in decline, agriculture remains the direct and indirect base for the economic livelihoods of the majority of the world's population (IFAD, 2001). There is an extensive literature on the costs/benefits of recent changes for rural areas (see in particular Killick 2000 on the impact of economic reforms on the rural poor in Africa). Narratives of change range from extreme optimism to extreme pessimism, while on the one hand processes of globalisation imply potential increased growth, opportunities and income, on the other they imply potential increased inequality, risk, vulnerability and social instability. Managing processes of transition in rural areas to ensure these risks are minimised and potential benefits maximised, represents a huge challenge for rural development. It is clear however that successful future strategies must be characterised by greater flexibility and adaptability than those of the past (Ellis and Biggs, 2001).

International donor consensus on poverty reduction objectives belies the complexity of the challenges facing rural development. The central importance of agricultural growth in reducing rural poverty is well established (Irz et al., 2001) but important debates remain as to how best to 'create conditions of growth'. In particular establishing appropriate levels of public and private investment and achieving the right balance between market and public interest. Agricultural liberalisation continues apace but private sector alternatives have been slow to develop in many rural areas and donors are placing growing emphasis on the need for more sustainable, democratic and equitable growth (DFID, 2000; World Bank, 2001). In policy advice and dissemination this translates into a concern to harness private sector development towards poverty reduction objectives, e.g. more effective delivery of rural services, and provide social protection for marginalised and vulnerable groups. Further, it is increasingly recognised that, rather than running counter to market interests, the provision of basic public goods (social and environmental) can enhance market development. The need to 'make markets work for the poor' has led to a focus on building institutions to support markets and manage growth more effectively. In particular through improving market access for poor farmers, mitigating and managing market related risk and realising the comparative advantage of different parts of the rural/agricultural sector. Current emphasis on institutional reform is part of a broader, central, agenda of good governance, which encourages greater transparency, accountability and administrative efficiency based upon principles of participation and democracy. In rural areas this frequently manifests itself in programmes for democratic decentralisation.

The following sections outline the potential role and importance of ICTs in relation to some of the rural development challenges outlined above, in particular the shift to participatory approaches in rural development, and recent emphasis on good governance and democratic decentralisation. The importance of ICT infrastructure development for economic growth is well established but what is the potential for more strategic ICT interventions to promote social development goals and help

address equity concerns? While it is important to understand the complexity of the rural development context, and that ICTs are no ‘magic bullet’, it is equally important to appreciate the flexibility of some of these technologies to accommodate the specific demands of developing countries. It is only by combining an in-depth understanding of rural development issues, with improved understanding of the capabilities of ICTs, that donors can develop a more balanced assessment of the potential of ICTs to support rural development strategies.

2 Information Communication Technologies in the Context of Rural Development

2.1 Knowledge and rural development strategies

The power of knowledge for development was highlighted in the 1998/99 World Development Report (World Bank, 1999) which states that 'recognition of the importance of knowledge has gained momentum, and there is a renewed impetus to integrate knowledge into countries' development strategies'. It is variously argued that knowledge could be the key to development. It is very difficult to put a value on knowledge for development but analysis of cross-country variance in economic growth rates shows that variation cannot be explained in terms of accumulation of physical and human capital alone. Instead, the growth not accounted for by these factors of production, the so-called Solow residual, is attributed to growth in their productivity i.e. making better use of these factors of production. The importance of uneven distribution of knowledge in explaining variations in total factor productivity (TFP) is increasingly recognised. Human capital, including education, can be more clearly linked to growth, but for two countries with similar enrolment or attainment an important factor in releasing the full potential of the workforce is the country's openness to innovation and knowledge (World Bank, 1999:21). The power of knowledge for development can be greatly enhanced by ICTs if they are harnessed to improve access and break down barriers to knowledge because 'while education develops cognitive skills, information gives content to knowledge' (UNDP, 2001:35). In this sense the use of ICTs is integral to realising the potential of collective knowledge as the technologies themselves represent tools for achieving development and not merely the rewards of it (UNDP, 2001).

So how could the new technologies be harnessed for rural development goals? According to the World Bank (1998:156) 'recent development thinking has been based on the assumption that markets work well enough to ensure development and alleviate poverty. Our growing understanding of information constraints suggests that markets alone are often inadequate; societies also require policies and institutions to facilitate the acquisition, adaptation, and dissemination of knowledge, and to mitigate information failures, especially as they affect the poor'. This requires effective consideration to be taken of the role of knowledge in development in order to facilitate greater access to and use of ICTs through policy planning. UNDP's Human Development Report (2001) focused on the issue of technological transformation and its impact on development and further emphasised that, 'no individual, organisation, business or government can ignore these changes. The new terrain requires shifts in public policy – national and global – to harness today's technological transformations as tools for human development' (UNDP, 2001:27). Future rural development strategies will be dependent on these changes in policy planning and it is for this reason that the potential role of ICTs for rural development needs to be highlighted and discussed.

Policy processes that are aimed specifically at addressing poverty, such as PRSPs, have attempted to take a multi-sectoral approach. The importance of space rather than sector (Wiggins and Proctor, 2001) has also led to some investigation of approaches that integrate spatial issues into national strategies. In addressing the role of ICTs in rural development strategies, it is less a question of differentiating between spatial needs (rural versus urban) and more about differentiating between opportunities. The geographical context will be discussed later but it is clear that rural areas hold substantial human and natural potential to realise development goals (reduce inequality, reduce poverty, empowerment) by harnessing knowledge. It is unlikely that there are uses for ICTs that are exclusive to rural areas but the potential of ICTs to play a comparatively greater role (i.e. not just raising more people out of poverty but raising the poorest people out of poverty) in rural

development than elsewhere is a very real. ICTs have been recognised as having a role to play in broad-based, cross-sectoral poverty reduction strategies and universal access policies are being promoted to improve rural access to ICTs (Kenny et al., 2000). However, in order to better inform these policies there is a need to assess the potential role of ICTs for future rural development strategies in further detail. It is necessary to take a closer look at how the specific opportunities presented by the new and converging information and communication technologies can be harnessed to support the processes of rural development.

The WDR (1999) focuses on knowledge about technology (technical knowledge) and *knowledge gaps* that relate to the unequal distribution of technical knowledge. Knowledge about the qualitative aspects of economic production and the unequal distribution of qualitative information results in *information problems* that also contribute to underdevelopment. ICTs have the potential to address *both* these barriers to economic development by improving access to knowledge and information exchange, but understanding *how* ICTs can be used strategically to achieve this requires further assessment of both the technologies (Section 2) and the social, political and cultural context in which they could be used (Section 3). The strategic use of ICTs for poverty reduction will depend on developing the appropriate infrastructure to enable economic development and appropriate information content for the necessary social and human development to occur (Skuse, 2001). Further analysis of the existing ICT infrastructure, current approaches and proposals could help to inform future rural development strategies but not without a concomitant assessment of the diversity of information users and their knowledge requirements.

It is therefore important to remember that ICTs have emerged as an integral part of the current technological revolution, which is driving the world towards a knowledge economy. The societies and struggling economies that are the focus of rural development remain largely set apart from or at least a long way from becoming fully integrated in the global knowledge economy. It is important therefore to be aware that ICT development to-date has not been geared toward addressing the specific needs of these areas. Current approaches, which emphasise integration of technology and globalisation towards a network age in which everyone is more or less connected (UNDP, 2001), need to take account of the underlying constraints to integration of rural areas. Without understanding of these limitations it will continue to be difficult to take the initiative and act strategically on what is becoming increasingly recognised ‘Now that new technology makes (information) sharing much easier and cheaper than ever before, it is vital that these tools be used for the public good’ (World Bank, 1999:142).

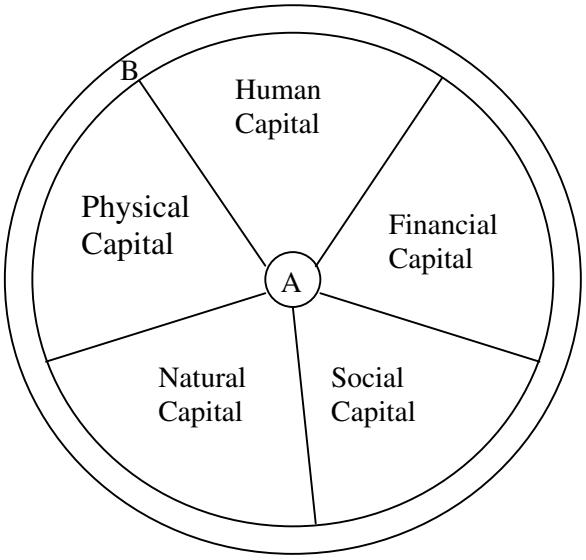
2.2 ICTs in rural areas

This section examines the role and importance of ICTs in relation to current and emerging rural development strategies. While the assertion that information is an important focus for future rural development strategies is not particularly contentious, defining the role that information should play is somewhat more challenging. It is not only a question of whose reality (Chambers, 1997) the information reflects but who is able to make use of that information and for what purpose? In the rural development context high priority is often given to information for policy makers, with other ‘decision makers’ a close second. Definition of the term ‘decision makers’ is left very open depending on the context of the discussion but all too often systems for information and communication fail to serve the needs of the poorest groups. Frequently, information is seen as useful to government, development agencies, service providers and for process monitoring and

evaluation (Baumann, 1999[2]). In discussing the role of ICTs, therefore, we are immediately restricted by a preconception of the role of information in development processes which forces considerations such as quality, delivery and efficiency to take precedence over flexibility, creativity and usability. In short, a narrow focus on the role of information leads to a more limited perception of the potential role of ICTs. Communication specialists by contrast recognise the potential of ICTs to support and enhance communication across a broad spectrum of actors and activities through the integration of a multimedia mechanism into daily processes. According to Ramirez (1998:38) 'Communication for development is about aiding different types of actors interested in understanding needs and assessing opportunities jointly; it is about providing them with the methods and media to reach common meaning, and about enabling them to negotiate with other actors with contrasting perceptions and interests'. The focus on the user that is prevalent in communication for development provides a useful basis for broadening the perception of the role of ICTs *beyond* improving the efficiency of information systems to deliver information from centralised sources and collecting better quality data for centralised analysis.

Information and communication activities are a fundamental element of any rural development activity. Rural areas are often characterised as information-poor and information provision has always been a central component of rural development initiatives. The rural poor typically lack access to information vital to their lives and livelihoods. Building upon the concept of *knowledge gaps* and *information problems*, a typology is proposed in figure 1 of information used by the rural poor to prioritise their livelihood activities and investment decisions more effectively.

Figure 1 Livelihood Information Wheel



- **A** is the core information that contributes to long-term **capacity building for decision-making** for appropriate livelihood strategies, usually through education and training, and technical support and assistance with problem solving.
- **B** is the information that relates predominantly to the local context and needs updating regularly for people to make **short-term decisions** regarding their immediate livelihood activities. It can also contribute to medium-term diversification and livelihood strategies.

These categories are not intended to represent two completely distinct types of information but rather the dual role that information can play in support of livelihoods over time. **Type A** represents information for long-term capacity building involving education, training and technical support appropriate for the livelihood development of individuals or groups. The provision of such information has been a key focus of agricultural extension, health and education initiatives over the years and essentially contributes to the enhancement of knowledge. It also improves understanding of systems and processes, which might affect the way assets are used in the longer term, and assists in the planning of livelihood strategies that effectively insure against stresses and shocks (management of risk, diversification). For example, without information about their rights and the

[2] Baumann, P. (1999) 'Information and Power: Implications for Process Monitoring - A Review of the Literature' ODI Working Paper 120. London: ODI.

structure and responsibilities of public institutions designed to support them, the poor would find it impossible to hold these institutions to account. **Type B** represents information for short-term decision-making that is used to maximise the potential of a particular asset at any one time, reduce vulnerability to shocks and respond to immediate needs. The poor typically lack information about markets for their produce, let alone information about alternative income-generating opportunities. Type B information would also include news relating to the weather and rural services etc.

Donors increasingly recognise the importance of 'making markets work for the poor' and attention to information and communication processes is of central importance in this respect. There is an extensive economic literature on the market value of information in decision-making and improving the quality and quantity of information available to the poor can significantly affect the sustainability, productivity and profitability of livelihood decisions (Chapman et al., forthcoming). The rural poor depend primarily on agriculture and related activities for their livelihood, agriculture provides the bulk of their income and their main source of nutrition (IFAD, 2001). Improved systems for the management and communication of agricultural information can help poor farmers make informed choices about the opportunities and constraints associated with agricultural development strategies (FAO, 1998). Tripp's (2001) assessment of future agricultural technology policies for rural development emphasises that most of the new technologies that will become available to farmers will be 'information-intensive', i.e. requiring increased levels of knowledge for appropriate management. In addition to basic technical knowledge, the rural poor need to be able to operate in increasingly sophisticated input and output markets. The potential of ICTs to support the improvement of currently inadequate extension and education services, and ensure farmers have access to reliable information about agricultural technologies and markets, is the subject of considerable interest (Zijp, 1994; FAO, 1998).

Improved systems of information and communication have a dual function; to supply the information required by the poor in order to pursue sustainable livelihood strategies, and to supply information required by institutions responsible for making decisions that affect those strategic livelihood options. Improving the quality and quantity of information available is necessary but not sufficient for improved decision-making. Decision-making is a political process and stakeholder participation in decision-making processes is crucially important. Improved information can enable people to better defend their interests and articulate their needs; it increases their bargaining power and ability to influence decision-making processes that affect them. Information thus has a catalytic role but the potential of ICTs to support and enhance processes of participation is largely dependent on reforming rural institutions and decision-making structures.

It is often assumed that once information exists it will be used in decision-making in a way that is consistent with policy objectives. The conversion of analysed data into knowledge is generally (mistakenly) regarded as uncontroversial. Post-structuralist philosophical arguments concerning the relation between the generation of information, knowledge and power, popularised by Foucault, have had a profound influence on development theory. Recognition that knowledge is embedded in structures of language and social action led to a growing interest in 'local truths', reflected in the development of participatory development methodologies in the 1980s and 1990s. These seek to understand how knowledge is acquired, transmitted, altered and integrated into conceptual systems, and how the 'horizon of development' varies among individuals and groups. Participatory methods draw heavily on the work of Habermas, whose theory of 'communicative reason' argues that consensus is the criterion which legitimates knowledge, and can only be arrived at through communication, social interaction, dialogue and mutual understanding. It is arguably essential that

Box 2 ICTs and livelihood assets

ICTs impact on livelihood assets in a number of ways depending on the local context in which they are introduced. Assuming open-access, community models such as telecentres (IDRC: Acacia Initiative, UNESCO: MCTs) and 'knowledge centres' (MSSRF) can be expected to have an impact on livelihood assets in the following ways:

Human Capital: Improved *access* to education and training through distance learning programmes, and education tools in a wide range of different formats. The potential to transfer digital content to remote locations easily in the form of text, images, video and radio combined with the vast storage capacity of PCs, CDs and DVDs reduces many of the costs associated with barriers to broad-based information access. The impact of increased information flow on human capital development will depend equally on the effective *translation* of material into different languages and appropriate formats for the intended users and their local cultural context.

Natural Capital: Improved *access* to institutions dealing with different aspects of natural resource management including administrative and legal information such as land records. Communication channels can be enhanced with appropriate authorities, landowners, government ministries and local government officials. The experiences of other individuals and communities can also be shared and the information used to compare strategies and develop local solutions to problem and conflict situations.

Financial Capital**:** Support and strengthening of the local financial institutions including micro-credit organisations to improve information provision on services and facilities available such as loans and savings schemes. Extended access to financial information can also improve *transparency* and more equitable service provision such as through highlighting excessive rates of interest charged by moneylenders. Community-based financial management such as savings schemes can also be introduced together with extended communication among a wider community of financial institutions.

Social Capital: Improved 'networking' both at the community level with existing networks and potentially amongst a much wider community. The ability to build new social networks at a regional and national level can help to bring benefits to existing networks and institutions at a local level such as CBOs, FOs etc. The reduction in the cost and time taken to travel to pursue social networking goals can also have a positive impact at a household level with family members spending less time away and less money on transport. Expanded social networks may also result in increased opportunities for employment both locally and away (potentially increasing rural-urban migration).

Physical Capital: *Access* to markets and market information helps to improve choices for the sale of goods on local markets according to enhanced information on prices, comparative supply and demand for products. In the longer-term new markets, techniques and processes for production, processing and marketing of products, both farm and non-farm can be explored.

Source: Chapman et al., forthcoming

the poor actively participate in the generation of development knowledge in order that it reflects or at least takes into account local truths. The potential of ICTs to enable articulation, sharing and storage of local knowledge within and between groups and to facilitate improved mutual understanding between development practitioners and beneficiaries at the 'project interface' (Long and Long, 1992) is considerable (see Section 2.3).

The potential of using ICTs to promote rural development lies partly in increasing market efficiency through addressing information gaps and blockages. But also in informing and strengthening the decision-making capacity of the rural poor and institutions that represent them. In particular

Box 3 Two-way information flows

ICTs are regarded as being able to improve and enhance two-way information flows and 'there is substantial evidence that without two-way information flows development efforts fail' (Zijp, 1994:16). This perspective is centred on the concept that development should be more participatory, allowing for the voices of the poor to be heard. The assumption being that information delivery from development agencies to rural communities represents an outdated mode of top-down development that was historically one-way. 'Two-way' has, therefore come to mean 'participatory' in the context of the debate surrounding the role of ICTs. However the role and potential of ICTs in support of rural development goes far beyond facilitating two-way flows of information between decision-makers and beneficiaries in a development project. The fact that 'rural groups can use video camcorders to present their needs and potential solutions more effectively to policy makers through the use of visual images' (Zijp, 1994:24) does not mean that the same technology cannot be applied to more localised (and even one-way) uses that could also benefit rural development. ICTs should not simply be considered as having potential where they can reinforce or support existing formal development relationships. They may also act as a catalyst for improved information sharing and greater participation more generally at the community level. The potential for this is acknowledged by the IDRC (1996)[3] which suggests that 'access to information and communication technologies (ICTs) implies access to channels and modes of communication that are not bound by language, culture or distance. New forms of social organisation and of productive activity emerge which, if nurtured could become transformational factors as important as the technology itself.' The multiple-access and catalytic potential of ICTs will be explored further in Sections 3 and 4.

Box 4 Information, data and knowledge

Defining information and knowledge can help to understand the relationship between them. In the context of economic analysis Machlup (1979, in Baumann, 1999:6) differentiates between information, data and knowledge as follows:

- Data refers to raw material such as facts and figures that could be collected by an information system.
- Information refers to analysed data, often presented in a form that is specifically designed for a given decision-making task, and transmitted to/received by decision makers.
- Knowledge refers to the subsequent absorption, assimilation, understanding and appreciation of that information.

These definitions are still useful in discussing the role of ICTs because they help to highlight the extent to which the technologies are facilitating the assimilation of data and information into modern social and cultural knowledge systems. ICTs can promote knowledge development not only by providing more information but by providing it more selectively and in a format that is easy to understand. The figures 4:1 could now be sent by text message directly to the phones of the fans of two competing football teams after a match. The appreciation of that information (which Machlup would define as data) as knowledge by the recipients will be almost instantaneous. ICTs in this case greatly accelerate the process of knowledge generation from data collection and the transmission of information not least because the user is able to determine very selectively what information is relevant. The role of ICTs in future rural development strategies is therefore dependent on users being able to select the information that is most relevant to their own social and cultural knowledge systems. Roling (1988:183) places particular emphasis on the role of the 'environment' in which knowledge is developed. The multi-media capabilities of ICTs offer the potential to move beyond databases towards the presentation of information in formats that are more appropriate and meaningful to local populations.

[3] http://www.idrc.ca quoted in Richardson (1997:9).

improving transparency, accountability and administrative efficiency of rural institutions of governance, promoting participation of the poor in decision-making processes and improving the efficiency and responsiveness of rural service delivery (Jafri et al., 2002). The following section describes some of the particular attributes of emerging ICTs in relation to the challenges facing rural development. While realisation of many of the potential benefits of technological change depends largely on concomitant political reforms, the former often plays a role in facilitating the latter.

2.3 Technological revolution

It is as part of a wider information technology revolution that the potential role of ICTs can be best understood.

The following time-line charts some of the highlights:

1947: Invention of the transistor and subsequently the computer
1959: Integrated circuits invented combining multiple transistors and as the number of transistors that could fit on a chip rose so the costs fell
1972: Invention of the first microprocessor
To the present: Computing power has increased by a factor of over 10,000 per dollar invested. The cost of voice transmission circuits has also fallen by a factor of over 10,000 with the development of fibre optics and wireless technology (World Bank, 1999:57).

The history of computing and communication developments can seem out of place in a discussion of future rural development strategies. However, understanding the revolutionary changes that are occurring in the technologies today may help to define strategies that can incorporate them in the future. The Internet is a very new and evident adaptation of the converging digital technologies. It has brought computing and communications together and its popularity is evident by the extent to which it has been adopted by society. However, it also brought with it a lot of hyperbole. To many people ICTs and the Internet are one and the same and there is a danger of a backlash of Internet fatigue. This does not mean that people will cease to use it but it may mean that there is considerable caution resulting from the over zealous risk taking of the Dot Com entrepreneurs. The Internet is, however, by no means the last or most important milestone on the technology timeline. Moore's law predicts that computing power will double every 18–24 months and Gilder's law predicts the doubling of communications power every six months. The changes in the next 20 years are likely to be even greater than in the last as the speed and quantity of information that can be processed and transmitted increases, and the costs of performing these tasks fall dramatically (UNDP, 2001:30). Responses to these changes could take two forms: passively adapting to use new technologies as they become available and integrating them through low risk strategies; or adapting the technologies themselves to development goals and ensuring they are 'used for the public good' through proactive and innovative strategies. It would be easy to advocate a proactive approach that actually harnesses the potential of ICTs for rural development but it is also necessary to investigate the current constraints and how such an approach might work in practice.

There are a number of public fora that are addressing the issue of how to harness ICTs for development on a global scale. The World Bank's infoDev programme, the G8 DOTForce, the UN ICT taskforce and the Global Knowledge Partnership are all working to build partnerships between civil society, the public and private sectors. The private sector is driving the ICT revolution and it is seen as a growing development imperative that developing countries are not left out of the latest societal revolution. However, to many in the private sector it is inevitable that knowledge gaps and information poverty will be the results of a growing 'digital divide'; it is the nature of incremental growth that those that are behind will fall further and further behind[4]. There is nothing inherent in the technologies that excludes particular user groups and to this extent the private sector cannot be expected to take on the risks of new markets when the pace of development is such that existing markets are highly competitive and potentially lucrative. The International Telecommunications Union (ITU) is working with a number of developing countries' governments and private sector organisations and within some of the programmes mentioned above to facilitate private sector investment in developing countries through legal and policy reforms. However, the pace of technological change (in ICTs) is such that the 'digital divide' is widening far faster[5] than the necessary legal and policy reforms are taking place. With the current recession in global telecommunications the ITU has recently suggested that even if some African countries liberalised their telecommunications sector they would have trouble giving away, let alone selling licences such as for fixed line networks. There are therefore very real limits both to the extent that the private sector can, and is willing, to invest in developing country markets. This is the primary constraint that is currently preventing ICTs from being harnessed fully and it is being addressed at the highest level. However, the constraints to private sector involvement are not insurmountable and legal and policy changes coupled with an improved investment climate has seen the rapid spread of private sector investment into certain emerging markets, e.g. mobile phones. The key is to find ways of incentivising the private sector to 'go the extra mile'. The World Bank in particular is working on ways to harness private sector investment for poverty reduction (see for example the recent WB Group Private Sector Development Strategy).

There are a number of approaches that are already attempting to work around existing constraints and learn more about the potential of ICTs for development. Many of these are working outside the formal market sector in that they are funded by international development agencies and government such as the telecentres set up by UNESCO, ITU and IDRC[6]. Many initiatives have similarly been working on a sectoral basis to incorporate ICTs into rural health, governance and agricultural programmes and whilst financial sustainability has been assessed it has not been a prerequisite for the projects operating with public funding. Owing to the comparative lack of involvement of the private sector (specifically the technology manufacturers and telecommunications operators) many projects have necessarily focussed on understanding how developing countries can use existing ICTs and how to overcome problems of making ICTs more accessible. There has been very little scope for adapting technologies to the wide diversity of developing country users although the need to do this has been widely recognised. The technology therefore continues to be designed without rural development priorities in mind. Instead, developing countries are experimenting with a plethora of different approaches to improving access to ICTs designed for use in the developed knowledge economies of the West.

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[4] A research team at the Australian National University in Canberra has recently developed a process called 'quantum entanglement' that can 'teleport' radio signals embedded in a laser beam at such high speeds that it is expected to 'revolutionise computing and communications within a decade.' Computers up to a billion times faster than at present are now possible.

[5] 'In 2001 more information can be sent over a single cable in a second than in 1997 was sent over the entire Internet in a month,' (UNDP, HDR, 2001, p.30).

[6] such as the Acacia (http://www.idrc.ca/acacia) and Pan Asia initiatives (http://www.panasia.org.sg/about)

Box 5 The Internet et al. genuine revolution or hype?

A typical encomium for the internet compares it to the invention of the printing press and predicts that our world will be revolutionised by it. But after the failure of the Dot Coms in 2001 this rhetoric has begun to weaken. Perhaps the internet will not necessarily transform every aspect of our lives. Perhaps it is much less important than the telephone or the train. The water-powered devices that transformed human labour in the fourteenth century probably seemed fairly impressive to contemporaries. Is there something distinctive about the new communication technologies that really merit all the uncritical promotion they have had in the last decade? Is the technological advance genuine, or does it just seem that way from the narrow perspective of the present? Despite the rhetoric, there is some reason to think that something new is happening here.

Human society can be transformed in two ways: by exchanging tasks formerly carried out by human beings for those using other sources of power and by exchanging face-to-face communication with remote communication. Early significant developments in the exchange of power were the invention of ploughing and the use of water and wind-power. However, it is probably correct to assume that the growth of steam and later electricity were the key elements in making this a dominant feature of existence in the developed world; the industrial revolution really was a revolution. The sign of this was that the changes were technical but the impact was social and economic.

The other key invention was the telephone; once individuals could communicate at long distance whole forms of social organisation became possible that would previously have been inconceivable. Arrangements were possible that would have been impractical via postal services, and information began to flow in new ways. The internet is the extension of this; but the key difference is that the telephone was essentially inter-personal as opposed to the internet which is impersonal. In other words it makes accessible a world of information that would simply not be accessible in any other way. Even if libraries were more widespread and had infinite budgets they could not make information accessible in the same way. The consequences are transforming; groups that would never form because of remoteness and cost can now be connected. This has had consequences for environmental activism and in turn for the transparency commitments of large enterprises. It also makes the rural/urban divide less and less relevant. The exchange of power is almost done; the revolution in communication is in progress.

Source: Blench (2002)

2.4 A diversity of approaches using flexible technologies

Some recent approaches have been particularly successful and innovative. Four different approaches can be identified from the more high profile and well-documented initiatives that are useful for understanding the diversity of technologies and how they could be used in future.

2.4.1 Profit for the poor

Grameen is seizing the mobile telecommunications technology for strategic market exploitation on behalf of the poorest. The Grameen Telecom telephone company recognised not only the potential for rural telephone services to provide a commercial service to rural communities in Bangladesh but also potential for the technology to help the poorest groups. Women who are often the most disadvantaged in rural communities in Bangladesh have been given mobile telephones to service the local village population although they are predominantly existing Grameen Bank borrowers (Bayes et al., 1999). Armed with a mobile phone and a list of useful numbers Grameen's telephone-ladies can make a comfortable living from charging users a small fee for making and receiving phone calls. Grameen seized upon the opportunity when it discovered that the GSM mobile licences were

not covered by agency restrictions applying to other rural telecommunication initiatives. Grameen Telecom is a not-for-profit company and owns 35% of Grameen Phone Ltd that has the nationwide licence for mobile phones in Bangladesh. The majority stakeholder in the parent company is a Norwegian telephone operating company and the remainder are Japanese and American investors. This innovative arrangement illustrates how closely social and rural development goals can be achieved by directing some of the profit from the urban mobile networks towards a not for profit application of the same technology. The equipment costs and rural network running costs are recouped through the telephone ladies who pay in instalments for the use of the equipment for their business. Professor Yunus, who founded the Grameen Bank and turned the concept of micro-credit into a reality for millions of poor rural women in Bangladesh, is conscious of the combined potential of ICTs and micro-credit stating that, '*We must see that information technology and telecommunication get there (to rural areas) very fast. If we are interested in eliminating poverty, you have the best chance ever in human history through telecommunication, through information technology, through micro-credit*.'

2.4.2 Developing markets

Hewlett Packard (HP) is a multinational high-tech company[7] and has decided to invest in the future of its business by learning more about developing country markets. The **e-inclusion** initiative incorporates a strategy for achieving long-term core business growth by serving the needs of developing countries. The strategy aims to develop profitable models for future ICT products and services that extend far beyond their existing and traditional markets. In order to better understand the needs and market opportunities in developing countries 'e-inclusion Solutions' forms partnerships with local companies and actors that are able to leverage HP's products and services for their business and community development purposes. The initial focus is on developing products for the agricultural sector to improve access to local markets and the efficiency of small farms. One partner in India is an agribusiness company called EID Parry, based in Tamil Nadu, that is using HP products to equip its sales points as small telecentres for farmers termed 'Parry's Corners'. Parry's Corners are run as businesses by farmers or their families and the company is developing a website that can be accessed in the centres to provide information on the full range of their products and services. The company also runs a sugar cane mill and is using ICTs to improve communications with the farmers contracted to supply sugar cane by providing greater access to extension advice and information on their accounts. '*As a company, HP has a vision of the future where technology is accessible to everyone in the world as a means to learn, work and benefit from information*.' (HP philanthropy page on website). *'Our mission is to close the gap between the technology-empowered communities and the technology-excluded communities on our planet by making it profitable to do so'* (e-inclusion Solutions).

HP's approach extends beyond a sense of 'Corporate Social Responsibility (CSR)' that has led many companies to establish programmes that benefit the local community and coordinate philanthropic activities more strategically. The global strategy explicitly targets 4bn low–income users as a potential market opportunity[8]. This approach, therefore, is based on a strategic vision of inventing the company's future by developing its core business in a way that accommodates the requirements of the majority of the world's population. This involves forming partnerships and learning lessons about markets that currently do not exist. It may not seem surprising that one of the world's largest high-tech companies is keen to emphasise the role of ICTs in future social development but what is perhaps surprising is the corporate emphasis on the fact that the future

[7] Total Assets of over $34bn and net earnings of $3.697 bn in 2000, Annual Report 2000.
[8] This approach has been termed B2:4B (business to four billion) which may develop if other companies follow suit.

requirements for its products and services globally are largely unknown. It is the acceptance of this fact that makes HP's approach stand out in the private sector as one that potentially frees HP designers to work by the ethos that 'we *will* design ICTs for the future needs of a global society that includes the 4bn low income users in developing countries. The alternative and perhaps prevalent approach amongst technology companies (and one that HP must also take to a certain extent) is that 'we *have* invented for the future needs of a global society, more specifically those who can afford it, and we *will* maximise our share of the market.' Perhaps HP's strategy is based on the belief that the market for ICTs is as big as they want it to be, and therefore rather than focusing on increasing their share of it they are looking to dominate in a vast new market in which they will be ahead of their competitors, if not on their own. They are not alone, however, in the perception that this is more than just a 'PR4PR' (poverty reduction for public relations) exercise and it has been called 'the most visionary step ever taken by an IT company.'[9]

2.4.3 Information catalysts

The MS Swaminathan Foundation (MSSRF) in Tamil Nadu, Southern India has been experimenting with ICTs as a means of facilitating development in poor rural communities. Funded by the IDRC, Swaminathan's *e-villages* have developed a novel approach to empowering people through increased access to information. Computer terminals (rather than telecentres) have been pre-loaded with a database of useful information relating to government services, such as agricultural extension, health and the police that contain the relevant contact details for each village. Ten villages have been requested to allocate a building with public access for the computer to be installed in and to identify a group of volunteers to run the village centre. In each case where the computers have been installed women have been encouraged to take control of the running of the centre, to provide information services to the village and to run training courses for other women. Support and daily information bulletins are provided by a central 'hub' located in the nearby town of Vilanur. The hub is staffed by trained IT personnel with support staff that are on hand to respond to requests for information and training from the villages. Training courses for up to 25 people can be held at the Vilanur hub and larger courses such as for making incense sticks and small scale paper production from banana leaves have been developed to facilitate livelihood diversification through small business activities. The daily information bulletins are sent by e-mail to the networked villages which receive a summary of the main news stories from the local news papers, the local weather report and prices, and are collected from local markets each morning. As the e-village experiment has developed, new approaches to the technology, such as solar power and spread spectrum masts, are being tested to establish the minimum running cost for the villages. Support is currently provided by the MSSRF through external funding, but it is expected that the villages will become self-supporting. Therefore if more villages can be connected their share of the cost of running the hub can be reduced. However, it is already a comparatively low cost approach to improving access to information for communities and individuals that are isolated not only geographically but also socially. Compared to telecenter models that can cost between $150-200,000 each to provide trained staff, multiple computer access points, printers, photocopiers, e-mail, telephone and web services and a purpose built centre in many cases, the e-villages provide a more localised and low-key service at a fraction of the cost.

The focus of the e-village concept is on enabling the villagers to access information that is useful to them for their daily lives and to discover opportunities for improving their income generation. The initial database and daily bulletins are intended only to act as catalysts, to reduce the sense of

[9] Kirkpatrick, D. (2001) 'Great Leap Forward: Looking for Profits in Poverty.' *Fortune magazine*. February 5th, 2001.

isolation, and to extend public information to those who need it most. The way information is then used and the benefits of improved access varies between villages and individuals, and requests for further information can be made to the hub or through the other channels that are opened up. The village database is, therefore, designed to be expanded to include a wide variety of information that has been collected and generated specifically for use within that community. The village centres are decentralised knowledge centres that can be developed to reflect local priorities and needs and perhaps more importantly, to integrate the ICTs and 'external' information sources at a pace that suits the specific local and cultural context. MSSRF has recognised that whilst there are obvious and immediate information gaps that can be filled (such as the daily news and market prices), using ICTs to their full potential in rural communities will require longer term integration into the communities themselves. This process of integration should not be considered as delaying the full benefits of the digital revolution, and therefore a constraint that needs to be overcome, but rather as a positive developmental process in itself that returns a sense of control to the community.

Villagers often discover uses for information that extend beyond what was originally intended. Agricultural prices, for example were collected and sent out to the villages based on the assumption that farmers would find it useful when dealing with middlemen that come to the villages to purchase their harvest. This information was also found to be useful to landless labourers, whose payment was often received in kind. The labourers were better able to determine whether the quantity of rice they received reflected the amount they could actually purchase according to the most recent market prices. MSSRF is therefore providing access to information as a catalyst for empowerment. The process of empowerment and the extent to which it occurs depends on the extent to which people can and do act on the information they have available. ICTs can make more information available but it is up to individuals to choose what is relevant to them and demand useful information. MSSRF is empowering people to make those demands. The most sophisticated technology in the most sophisticated markets are now wholeheartedly focused on one thing – giving the consumer choice. Digital television, for example, is transforming the most popular information medium to facilitate demand driven and consumer specific programming. The World Wide Web is an eclectic mix of information sources with some sites that are never visited and those that receive millions of hits a day, powered by search engines that guide people to the information that is relevant to them. The potential of ICTs in future rural development strategies is therefore not only to provide information that is relevant to developing communities but to empower them to choose and demand the information themselves.

2.4.4 Remote access

Worldspace Corporation has launched a digital Satellite radio service capable of broadcasting to over 4 bn people in Africa, Asia, the Middle East and Europe. The service includes a number of channels unique to Worldspace that are intended for regional listeners. The service provides rural areas with a far greater choice of channels than is usually available and there is a range of receivers available for both indoor and outdoor use. Worldspace is also developing a number of services aimed at addressing some of the developmental goals of the areas it covers. A distance education channel broadcasts education programmes and a mobile telekiosk is travelling throughout Africa to assess the demand for a range of services using information and communication technologies, including Worldspace radio, Internet telephone calls, VSAT telephony, web browsing and local broadcasting. Worldspace receivers can be connected to PCs and digital content from the Internet can be delivered directly without the need for a telephone line. Worldspace offers data downloads on a daily basis from a wide range of sources from the British Medical Journal to Africaonline news. Distance learning programmes can also use this facility to download course materials and

powerpoint presentations to be shown in the classrooms during the live teaching broadcasts. The potential to use this model to provide education services on a massive scale to the most remote and underdeveloped areas of the World is something that Worldspace is taking very seriously. The fundamental barrier is getting the Worldpace digital radio receivers to where they are needed but this applies to all other ICTs and usually at a greater cost. The difference is that Worldspace can deliver these services *now* at very low cost, even in the remotest areas. While global negotiations on telecommunications policies and pricing grind on, digital radio can already provide many of the services needed for rural development.

2.4.5 Diversity of approaches

There is a common theme running through these approaches, that information will act as a *catalyst* for development. All are also visionary in some way, working towards a better future for society. How this then develops into markets and demand for services is unknown and therefore the risks, to many, seem too high at present. However, without the pioneering approaches outlined above, and many more donor-funded and community-based experiments and pilot projects, the catalytic potential of using ICTs for development will remain unknown. Real innovation is required in harnessing the private sector's control of the design of ICTs for achieving greater catalytic effects towards development goals. Yunus claims that investing in IT and telecommunications is like starting the engine and only then can you think about accelerating. It needs to be understood that the process of learning how to use ICTs as information catalysts will take time and therefore should be included in future rural development strategies. The temptation to jump to a conclusion regarding the potential role of ICTs in future rural development strategies is high both for the techno-optimists and the techno-pessimists. Rather than looking for blanket solutions, current approaches would suggest that the new technology is flexible enough to be applied in many different ways to achieve rural development goals. The scope of this flexibility also needs to be further understood and the learning process could be part of future rural development strategies. Attention should be on the diversity of approaches that can have a catalytic impact on rural development. Therefore, rather than searching for, or waiting for *the* ICT application or package to prove it is worth taking seriously in future rural development strategies it is necessary to encourage broad-based learning through more coordinated integration of a wide range of ICTs into existing developmental and institutional processes. The learning processes themselves should be decentralised and localised but the use and promotion of a wide range of ICT options can be made through higher level strategies. This would help to facilitate the partnerships that will be required at the community level to be forthcoming and more easily developed. The potential for ICTs in future rural development strategies will depend on the ability of those strategies to transcend institutional boundaries and control, and therefore be inclusive of community level institutions, private sector organisations, NGOs and a variety of new and old media channels.

2.5 Introducing new technologies: lessons from extension

Technology transfer has been a longstanding issue in rural development. The key concerns relate to efficiency and effectiveness, how to translate the technology developed in one context into usable solutions in another. The process of technology transfer falters not at the micro-level pilot study or test plot but at the point when the technology is expected to be adopted and used both efficiently and effectively on a larger scale. According to UNDP (2001:33) many of the current ICT examples are just the beginning. Tapping the potential of these new technologies will depend on adaptations to the conditions in developing countries, especially for poor users. Much will depend on

innovations (technological, institutional, entrepreneurial) to create low-cost, easy to use devices and to set up access through public or market centres with affordable products. What lessons can be learned from agricultural extension, and efforts to extend the use of agricultural technology in developing countries?

It is worth remembering that ICTs are information technologies and not agricultural technologies. Agricultural extension systems have all too frequently underestimated the importance of free and open information flows relating to the introduction of new agricultural technologies. The main problem has been one of providing top-down information of limited local relevance to farmers who are also unable to ask questions or provide feedback to the extension services and research centres. These constraints have led extension services to focus on the importance of two-way information flows, together with a shift towards more participatory approaches in development more generally. The focus of attention on failing extension services in developing countries is occurring at a time when there is a recognition that globalisation and trade liberalisation is coinciding with the ICT revolution to create a peculiar climate of increased risks and opportunities for many developing countries. 'Knowledge and capital are at the centre of success within this new economic system. Yet some countries have yet to consider the value of making knowledge available through revived extension services' (Rivera, 2001).

Information is at the heart of future extension strategies and the Agricultural Knowledge and Information System (AKIS) (Roling, 1995; Rivera, 2001) adopted by the World Bank and the FAO (1998) puts farmers at the heart of the information exchange process. The emphasis therefore on improving the use of information, and placing farmers at the centre of the 'knowledge triangle' between extension, education and research, has been developed independently of more recent ICT experimentation. Faced with a crisis in extension and the raising of the stakes in rural development caused by structural influences such as globalisation, population growth, rural–urban migration, HIV/AIDS (Christoplos et al., 2001) and ongoing environmental degradation, the use of ICTs is seen by many as a pragmatic solution to the task in hand (e.g. VERCON and FarmNet, FAO, 1998). While other sectors struggle with the concept of using high-technology in rural development (e.g. in education, the African Virtual University has replicated many of the mistakes of top-down, limited user choice and feedback that has plagued extension efforts) it is possible that lessons from agricultural extension could help to illustrate how best to integrate new technologies into rural development strategies more broadly. At present the priority for extension is to use ICTs to serve agricultural development goals but with increasing recognition of the importance of the rural non-farm economy and the potential for livelihood diversification (Start, 2002) it is clear that even in this role ICTs could be used for broader rural development goals. While agricultural extension programmes will take time to integrate ICTs to address the specific challenges of raising agricultural production, many of the lessons of extension experience could usefully be applied in support of broader rural development goals. Examples include the importance of two-way information flows to provide users with ongoing support, improving feedback mechanisms between users and designers of the technology, avoidance of top-down and prescriptive approaches to technology transfer and the importance of local and contextual facilitation (Roling, 1995). Perhaps nowhere has information been used to greater catalytic effect than in the field of agricultural development, such as the rapid spread of some new varieties in West Africa (Blench, 1998) but also nowhere more than agricultural extension has the importance of context specific information been more underestimated.

The current development paradigm based on widespread agreement around the Millennium Goals has led to a focus on poverty reduction at the international and national levels of development planning e.g. through Poverty Reduction Strategy Papers (PRSPs). Rural development strategies are

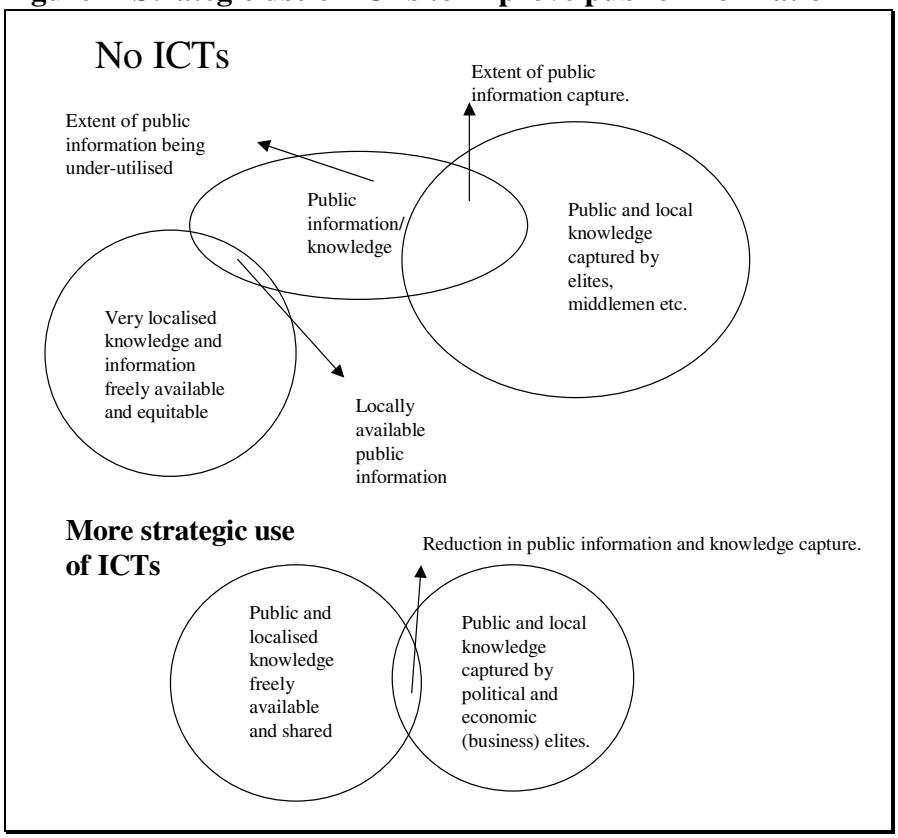
predominantly developed at the national or sub-national level and implemented by more geographically decentralised institutions although not necessarily politically decentralised. Where broader regional rural development strategies are used, it may be for a specific sector such as agriculture or a resource that requires strategic management planning such as fisheries, forests and other natural resources. Poverty is increasingly accepted to be multi-dimensional and therefore strategies at every level need to be more flexible to incorporate the heterogeneous contexts and livelihoods of the poor. In this context agricultural extension and rural development strategies need to avoid standardised, 'one-size fits all' approaches. The need, therefore, to develop differentiated rural development strategies has put greater emphasis on understanding the diversity of livelihood strategies especially among small scale family farms and the importance of non-farm income (Berdegué and Escobar, 2001). ICTs should not only be seen as a means of understanding the complexities of rural livelihood strategies better through improved data collection but also as a means of facilitating increasingly differentiated approaches to achieving rural development goals. The fact that ICTs are so flexible, and as convergence between them continues they become more so, could be used to benefit future rural development strategies if decentralisation of control over the ICTs and autonomy of the information system are permitted down to the local level.

One area where ICTs offer great potential is in increasing the flow of public good type information. Information can be defined as a public good when it is difficult to restrict, having 'low excludability', and when it keeps its value to individuals regardless of whether others also acquire it because it has 'low extractability'. In the context of agricultural extension public good type information includes weather forecasts, basic information on soils and cropping techniques, market prices and food safety etc., all of which ought to be available without restrictions or restrictive institutional controls (FAO/WB, 2000). Many of the financial problems faced by public sector extension services could be greatly alleviated by ICTs because their services rely on improving information transfer. The costs associated with verifying the quality of information and developing appropriate training packages remain, but in many cases these are being passed to the private sector. The costs relating to increasing the quantity and speed of information exchange are falling rapidly. Public good information, as defined for agricultural extension above, also covers a wide range of multi-sectoral information that is relevant to rural development goals. As public sector systems continue to face pressure to reform and the new paradigm toward market-driven reforms (Rivera, 2000:10) puts greater emphasis on private sector service delivery there remains a fundamental requirement for the exchange of information as a public good. Much of the infrastructure and service elements related to ICTs do fall into the private sector domain under the new paradigm but in many cases the technology is also available to be harnessed for vastly improved public information services. Lessons from recent developments in agricultural extension could therefore help to identify the role that the public sector should play in providing new information services or simply in fulfilling its responsibility to facilitate public information exchange in ways that have, until recently, been too expensive.

ICTs could be used strategically to reduce the amount of public information that is under-utilised or captured by local elites. Figure 2 illustrates how using ICTs more strategically could both increase the use of public information and reduce the amount of public information captured by political and business elites. Information sharing between communities can be improved through increasing access to public information at both local and national levels. A reduction in information exclusion at the local level could help to facilitate local empowerment and increase participation in rural development. As public information is made more available, the demand for information services may also develop markets for private ICT-related services. A focus on public information for rural development could therefore serve as a catalyst for dismantling the more entrenched knowledge capture that exists through private information networks. The alternative and perhaps most pertinent

issue regarding the use of ICTs to improve information access in poor rural communities is the danger of *increased* information capture by elites and a concomitant rise in information exclusion.

Figure 2 Strategic use of ICTs to improve public information



ICTs exist and are becoming increasingly affordable – a trend that is likely to continue. They are increasingly used in remote rural areas by elite groups, enabling them to access public information sources themselves without improving information access more widely. Public information can then become subject to rent-seeking and used to reinforce exploitative hierarchies. Whereas the opportunity to use ICTs strategically to improve broad-based access to much currently under-utilised public information exists, elite capture may limit the potential to reduce local information inequality. The problems of integrating the use of ICTs into local knowledge systems may in fact be solved far faster by those groups with an obvious rent-seeking opportunity to exploit them. Therefore, the barriers to improving information access need to be made more explicit in order to use ICTs strategically to reduce the risk of uneven rural development. The following section will consider how that might be done by building on existing systems to harness the potential of ICTs for rural development objectives. The focus of the next section is therefore on identifying ways to reduce information exclusion by understanding and supporting a wide range of local information systems and equitable information exchange networks (Nelson and Farrington, 1994:11).

Box 6 Piracy, intellectual property and the digital divide

An aspect of digital technology that distinguishes it from other classes of technology is the relative ease and cheapness with which it can be copied. Intellectual property, notably software but also data compilations, games, music, video etc. can be multiplied many thousandfold; the limiting factor is the cost of labour, not usually the cost of materials. Digital piracy is not unknown in the developed world, but the feedback loops between the capability of new technologies and the legal and moral pressure that can be exerted by large companies to use them fairly are quite short. Similarly, although pirate software circulates widely in the developed world, policing of likely outlets such as car-boot sales, is reasonably effective.

In other areas, attitudes to piracy are conditioned by two main factors; the size and capacity of the computer-literate population and the overall wealth of the country. Where the demand is high but incomes are low, piracy will be widespread. Kazakhstan and Cambodia are prime examples, states where digital piracy is tolerated or even openly encouraged by the state. In Phnom Penh, for example, prestigious stores on main streets have stocks of software, music and videos[10] that are entirely pirated. The reason for this is that the state has no political will to prevent it; indeed, the government probably makes use of pirated software in its own offices. Microsoft and the large music companies will no doubt have protested to the government; but the likely size of the legal market is so small and the difficulties of enforcement so great that they have effectively given up, whatever their publicity departments say. Some countries are in an interesting transitional stage, Thailand for example. Thailand used to be a world capital for pirate software, but now the majority of software on sale is legitimate. Nonetheless, pirate software *is* still for sale; but the Government of Thailand has successfully been encouraged by large companies to press retailers to carry legal software.

The interesting consequence of this is many developing countries have been able to 'go digital' at relatively low cost; a fraction of the capital costs of switching to modern agronomic techniques or establishing heavy industry. Informationising an economy is all about skills development and only very marginally about capital inputs. Moreover, training costs are very low; many individuals can and do teach themselves about computers in a way that would be impossible for electronics manufacture or fertiliser packages. An interesting side-effect in many developing economies is the growth of a digital divide along gender lines; with no collective structures in place the tendency is for young males to become computer-literate and to dominate the new economy.

Developing economies do not have an entrenched culture of information dissemination that slows down acceptance of new technology and constrains the way it is used. In the developed world, the book, a relatively ancient analogue device, has been the model for much electronic information dissemination. The linear narratives of books and their inability to link to other sources of information are formal devices that are only now being overcome. So a huge and resistant bloc of book-readers has continued to insist on hard-copies of material that would much better be retained in strictly electronic form. Such groups do not exist in developing countries and it is therefore much easier to develop and distribute purely digital media[11]. CD-ROMs of informational and statistical material are available in the high-street for very low prices in a way that is still rare in the developed world. This shows that the digital divide cuts both ways; that developing countries can be information-rich, like socks, which are cotton-rich.

It would be inappropriate to officially endorse piracy, but easy to see why it is often tolerated; it makes information available and provides tools for its processing and dissemination that would never occur in strictly legal regimes. The arms race between large content providers and pirates in the developed world will continue as technologies and tastes evolve. Digital piracy will continue in small economies with relatively literate populations.

Source: Blench (2002)

[10] For connoisseurs of irony, the software pirates seem to have taken on board the rhetoric of development; at least their discs are sometimes labelled 'solution provider for the poor'.

[11] This is becoming increasingly true in the developed world; witness the recent explosion of ring-tones and images for mobile phones distributed and conceived in purely digital terms. Part of the reason may be that analogue devices such as printed material are increasingly unfamiliar to typical mobile-phone users.

3 Using ICTs More Strategically for Rural Development

3.1 Relinquishing control (of the information and the technology)

This leads us on to the crucial issues of content and control. In order to ensure local appropriation of the technology it is important to decentralise control over the technologies (Michiels and Crowder, 2000). The problem then arises that control over content will also need to be relinquished to some extent to ensure the technologies are used efficiently, capitalising on indigenous information system requirements and resources. With an over emphasis on sharing external knowledge and information inherent in most ICT related initiatives there seems to be less willingness to provide them as a catalyst for development without dictating how they should be used and for what purposes. This is as much to do with development processes and the need for agencies to implement activities with clearly defined, and often sector-specific goals, as it is to do with any inherent feature of ICTs. As extension has learned to recognise the importance of facilitating increased farmer choices for adopting new technologies, ICTs could also be promoted as open and flexible to enhance information exchange in rural areas based on locally defined priorities. In fact ICTs such as the Internet have been specifically designed to be open and decentralised tools for people to share information and communicate more freely.

What then are the most obvious barriers to local adoption of ICTs through rural development programmes?

1. Sector-specific or target driven projects: ICTs introduced for a specific purpose can exclude/alienate other sections of the community and institutions that have a greater role in local information and knowledge systems. For example a programme on breast feeding may 'reach' the target audience of 50% of mothers within a certain age group or area, but the extent to which the programme is acted upon (as with recent evaluations of the impact of aids awareness raising programmes) may be limited by the institutional context in which the ICTs and the information is controlled.
2. Presumption of modernity: Much of the technology is so new to development agencies, let alone rural communities, that it is difficult to avoid equating access to modern equipment with existing social hierarchies. This will always lead to elements of 'control' (even without rent-seeking opportunities) as a means of raising or reinforcing an individual's status. Those with a higher status because they are educated are likely to be given preferential access on the assumption that they are more likely to treat the equipment properly and learn how to use it more easily (Gyandoot and Swaminathan have deliberately tried to overcome this tendency by making PC and touch screen information booths available for the poorest to access).
3. Cost and quality: Very few ICTs in use in rural development programmes in developing countries have been designed for that purpose. The result is that the technology is often too expensive and too fragile to be really used freely for public access. Just as offices in the North do not open their doors in the evening and make their employees' PCs available to the general public (e.g. as moonlighting cyber-cafes), so project-specific ICTs will often be safeguarded as such. Increasingly portable, lightweight, robust and cheap ICTs such as mobile phones are reducing this but problems of infrastructure such as electricity and telecommunications networks need to be addressed. The development of more flexible ICTs for rural development based on low unit and running cost, high portability and information outreach potential would greatly reduce the tendency towards restrictive control.

The MSSRF catalyst model specifically aims to address the issues of content and control in order to empower the most marginalised groups directly by giving them access to the ICTs. In fact, in recognising the potential for 'modern' equipment to raise an individual's status the women who have been selected to run the information centres in their villages have been those who had the most to gain from the increased status. The Grameen phone similarly targets marginalised women (e.g. widows) in rural areas to run the mobile phone service and found that they were very quick to learn how to use the mobile phone and charging equipment. Much of the underlying difficulties of running the mobile phone service require numeracy which is much less of a problem than the level of literacy required to run an information centre. The telephone ladies also receive support from the local Grameen Bank office that helps to ensure the telephone charges are fully covered. MSSRF has also *centralised* the provision of much of the external information that requires skills in searching and liaising with national and international information sources. The support to the users is isolated from control of both the ICTs and the information that they are used to provide. The devolved control of both the technology and the information exchanged is a clear element of these two approaches that are designed specifically to maximise the potential of ICTs to empower the poorest within rural communities.

3.2 Encouraging participation and demand-driven ICT use

In order to integrate ICT use into local knowledge and information systems the underlying control and local ownership discussed above needs to be developed by encouraging active participation. Local radio stations for example recognise that their popularity stems from engendering a sense of proximity with the listening community that other media cannot achieve. The most significant way to achieve this is through the use of local languages and dialects that are for some the only language that they understand and for others their preferred language for discussions on local issues. Simli (Friendship) Radio operating in Northern Ghana[12] also actively promotes community involvement in its programme content and develops its schedule according to the priorities established through a close relationship with its listeners. The programme schedule consists of basic education, health and agriculture. The programme producers use a range of resources for the agricultural programme such as the local University Department and Animal Research Institute, extension officers and NGOs. However, the producers spend at least 12 days a month recording in the villages to ensure the programmes are both appropriate to local communities and topical for the kinds of activities and problems that are occurring at that particular time of year. The cross-cutting nature of the local radio programmes aims to address different groups in the community at different times, when they are most able to find the time to listen and arrange to listen in groups. Group listening helps both to stimulate discussion and to maximise the use of the radios available. Educational programmes therefore, target children, through 'schools for life' classes for 8–12 year olds in the afternoon and adult learning programmes are broadcast in the evenings. The schools for life classes also specifically target those falling outside the formal education system that are often working as farm-hands and baby sitters. The radio station has built over 200 schools for classes of up to 25 children, with a minimum of 50% girls in each class, and a further 200 official schools are used in the afternoons for these radio based classes. 50 officers are employed to mobilise teachers and local communities and encourage students to join the classes which last 9 months and provide basic literacy skills, often at a faster rate than standard classes.

The station also produces tailor made courses on income generating and diversifying activities or subjects of special interest. Programmes on a range of subjects such as bee-keeping, compost

[12] As part of the Ghanaian Danish Community Programme funded by Danida.

making, agro-forestry for local species, preservation of local crops have been requested and research and extension sources will be used to provide programme material. The station has developed sufficient links with potential information sources that it is able to make requests for information through some research and extension staff. However, the FAO and other organisations have also been experimenting with connecting rural 'community' radio stations both with each other through networks (e.g. AMARC) and to the Internet (such as in Mali). This is a further example of the convergence of ICTs but also illustrates how old and new media can be combined to capitalise on the local level integration that has been necessary to establish the old media's role in the communities' knowledge and information systems. The presentation of research material, for example, in the programmes themselves also requires a great deal of skill in understanding local preferences. An ODI research project on soil and water conservation recently experimented with disseminating some of its findings through local radio broadcasts in six local languages in Northern Ghana. The radio producers in this case decided to translate the research findings into messages that could be presented through a radio play[13].

In order to integrate ICTs into cross-sectoral rural development strategies it is increasingly important to understand the local context into which information is expected to be made available and used. Although a radio play may or may not achieve the best impact possible, it is important that local institutions and existing systems develop ways of improving information exchange using ICTs in a participatory manner. The process of learning how to stimulate the demand for information from local communities is provided by first hand training and capacity building (for both the producers and the listeners) in the example of community radio. Technical training may be required on 'how' to use ICTs but participatory, experiential learning through existing local institutions, such as schools and community radio, will enable local communities to establish 'what' to use them for and generate their own demand.

The Gyandoot Project in Madhya Pradesh, India has linked 35 kiosks in the Dhar District together and to the district headquarters of the local government. The kiosks consist of a networked computer and printer and have been set up by the State government and located in the offices of local government (village panchayats) or private sector entrepreneurs. Hindi software and touchscreen applications are designed to encourage access by poor rural dwellers and stimulate the demand for services that will make the kiosks sustainable. Despite developing a comprehensive set of information based services such as for providing government documentation and certificates directly, commodity prices, news and marketing, and advisory services (health, education, agriculture) access by the poorest groups such as low castes remains relatively low. It is inevitable that marginalised groups will find it difficult to participate and demand information from newly established sources especially where there is a cost for services, however small. The demand for services is likely to develop with use and different models of implementation are likely to attract different users. The private sector kiosks, for example, focus more on commercial activities such as photocopying than the Gyandoot information services and are more likely to service the needs of local businesses and entrepreneurs. The Gyandoot information service brings the local district government into greater contact with the rural community and the popularity of the complaints service is one example of how the demand for information encourages greater participation from individuals. Gyandoot could generate greater demand for information services as more people are made aware of the services and then decide for themselves whether or not Gyandoot provides a facility through which they feel able to demand information that is relevant to their local context (Jafri, 2002).

[13] The programme evaluation report is expected shortly which should give an indication of whether any of the messages on improved soil and water techniques have been taken up.

3.3 Harnessing ICTs through existing systems: Integrating knowledge systems

The lessons from experience with agricultural extension systems in rural development has led to an appreciation of pluralistic approaches to introducing new technology that are both participatory and sustainable (Rivera, 2001). This is based on a realisation that there is a need for flexibility within the extension system that corresponds to the contextual diversity of agricultural production, processing and marketing in developing countries. The development of more participatory approaches such as Farmer Field Schools (Coldevin, 2000) is based on a recognition that farmers themselves are best able to benefit from a learning environment if they have control over the information and how it is exchanged between them. This shift away from prescriptive and didactic approaches to encouraging learning through a process of facilitation mirrors the paradigmatic changes that have occurred in rural development more broadly. The emphasis on multi-dimensional poverty and a recognition that the poor often operate multiple livelihood strategies according to their requisite assets (Ashley and Carney, 1999) stems from an earlier populist movement that challenged the supposed superiority of Western Scientific Knowledge over Indigenous Knowledge systems. There is a danger that current debates on digital information disparities over-emphasise the importance of global knowledge sharing and under-estimate the importance of local knowledge sharing. The concern for 'bridging the digital divide' is often validated by emphasising the potential to 'unleash the power of the Internet' or indeed the information super highway. Rural areas in developing countries are categorised as the information 'have-nots' compared to the wired-up information 'haves' in the first world megalopolis. But just as there are small tracks and unpaved roads serving many rural transport needs so there are local knowledge and information networks that operate on a comparable scale in relation to the metaphorical information super highway. Understanding the exact nature of these local information systems is less important than acknowledging their existence and recognising that using ICTs strategically will mean facilitating their own indigenous development through pluralistic approaches.

Locally relevant information, as discussed above, is most likely to stimulate the demand for information services that is essential for ICTs to be used to their full potential. ICTs have the capacity to transcend physical distance and to provide communication between extended communities and integration with wider social and economic networks. The increases in processing speed and reductions in cost that are driving the digital revolution are based on a presumption of unsatisfied *demand* for information. As the capacity to supply more information, at a reduced cost, grows so the demand for information is seen to rise as the 'information' society develops. The transformational changes to society and the economy that result from shifting towards an information society are dependent on the one hand upon the starting point at which information takes a significantly greater role in society. The basis for using ICTs is therefore to provide more information at a reduced cost as part of a process of change. Rural development interventions are formed around alternative mechanisms for managing the processes of change that are perceived by planners to be necessary for economic development. These processes, however, rely on concepts of knowledge that are likely to differ from those prevailing at a local and community level. For example, in an economic context, rural areas are often diagnosed as suffering from 'lack of information' especially relating to the functioning of markets and market opportunities (World Bank, 1999). This perspective is synchronous with neoliberal concerns over globalisation and integration. To assume that ICTs can help provide useful and 'developmental' information simply by transcending physical distance at a greater speed and reduced cost is to ignore essential phenomenological concerns that highlight alternatives to positivism (Johnson et al., 1994:439). The point at which a shift occurs to using more information as a result of being integrated into a wider information society (using ICTs) can only really be assessed by understanding the role that

information currently plays in relation to the locally prevailing, rather than more generally hegemonic, knowledge systems.

To establish the role of ICTs in supporting and building the capacity of indigenous knowledge systems, the mechanisms for information sharing must initially be assessed within the local context. This requires considerable participation in the design of ICT interventions not just to establish the most appropriate content and interface but also the institutions responsible for the operation of any underlying networks. Without an initial investment in understanding how information is used locally it is unlikely that ICTs will represent an opportunity to increase these flows of information, let alone introduce and integrate smoothly external information relating to processes of change that stem from a different epistemology. The point at which information becomes used more widely and adopted within social and economic institutional structures is unlikely to be dependent solely on the increased quantity of external information reaching rural areas. The stimulating factor is more likely to be the increase in information choices that build on existing systems of information exchange. In this way the multiple realities of both the poverty context and livelihoods in rural areas can be supported through a diverse array of information, managed and transmitted through local information systems. ICTs have the potential to initiate new rural networks of information exchange but their use in the first instance will need to be determined locally, according to local choices.

A study of the potential for using the Internet to assist in the provision of agricultural support services in East Africa assessed the potential for integrating ICTs into existing communication systems in Tanzania, Uganda and Kenya[14]. A process of Local Linked Learning (LLL) has been developed to assist farmers, NGOs, governments and donors build their capacity to share information amongst each other and between different levels in the context of decentralisation. The LLL process is intended to improve information choices at the local level and build more 'effective demand by farmers on government research and extension services.' This is also dependent on increased participation from stakeholders at every level to channel this demand for information through existing organisations, especially those operating at the community level. Workshops were held to develop Communication Action Plans that were focused on both improving access to the Internet and understanding the constraints that stakeholders experienced in using information made available in this way. These processes of participation and planning help to identify the barriers to increased use of information through ICTs at an early stage so that the network and technology investment can be tailored more specifically to local requirements. Even where relatively small scale telecommunications networks and other technology investment is required the early participation and locally owned processes of design will help to identify where capacity building and technical support should be focused. Inevitably the integration of ICTs and improved information sharing, such as through LLL, will take time but the level of participation and the inclusion of a balanced range of stakeholders in the planning process should facilitate the integration of ICTs into existing information and communication systems. One important element of the LLL diagnostic study was to consider how any IT related network could itself be linked to existing communication systems especially at the local level. The concept of using radio to bridge the District and village level information gaps builds on the development of a more fully integrated (and ICT supported) network between national and district levels. In the context of the study in East Africa the existing ICT infrastructure was also assessed to establish the cost and sustainability of any new network as well as the relative capacity of those institutions that may be able to benefit from access to the Internet.

[14] TDG/ISG 2000 Internet use and diagnostic study – East Africa, unpublished report for CTA.

The problem with ICT infrastructure in many countries is the uneven development of networks in rural and urban areas. The high-density populations in urban areas provide more profitable sustainability models than sparsely populated rural areas where the costs per line are substantially higher. This has led some to call for a reorientation in ICT infrastructure planning to redress this imbalance and consider rural areas as the ‘first mile of connectivity’ for development purposes rather than the last (Richardson and Paisley, 1998). This would provide an opportunity for increased participation by rural areas in development projects and greater integration of rural areas into wider regional and national development. It is the same processes that have led to an emphasis on rural telecommunications that are raising the issues of the potential of ICTs more generally in rural areas as the synergies between the capabilities of the technologies available and the objectives of rural development increase. The technical expertise required to develop telecommunications systems in rural areas also demands greater collaboration between development practitioners and telecommunication experts to facilitate appropriate participation in network design. A rural telecom network in North West Ghana, for example, was successfully installed and operating with high demand except that telephone usage fell far below the anticipated levels in certain areas. Instead of a ‘rural client-oriented approach’ the phone booths had been installed according to primarily technical and political criteria. When consulted, users in the areas where phones were underutilised expressed high levels of concern that their calls could not be made in private, requiring not only doors for the booths but input into where the booths are located in more socially appropriate locations (Richardson and Paisley, 1998).

ICTs are becoming increasingly mobile and portable and therefore participation in decisions such as the location of technologies within local knowledge systems will need to be decentralised further to ensure widespread access and sharing at the community level. Technical priorities for locating ICTs in a particular location are likely to decrease as power sources, ICTs and information networks can be established almost anywhere. Political priorities, however, as in the example above may not necessarily diminish at the same rate and processes of decentralisation will need to focus on delinking technical and political factors in designing ICT interventions at the community level. Encouraging participation in rural development processes such as agricultural research has itself been part of a wider shift towards empowerment to achieve social and political goals and encourage more decentralised decision-making. The problem that has often been highlighted with participation, for example in agricultural technology, is that it takes place in an alternative epistemology based on a test plot where the interface and choices available are narrowly defined (Farrington et al., 1994). Just as participation in agricultural technology is actually intended to stimulate experimentation and adoption so stakeholders in ICT projects need to be encouraged to experiment and adopt according to their own knowledge system. The flexibility of ICTs to be used for locally determined uses makes this process of participation and experimentation even more important if they are to be adopted and used to their full potential.

Finally, such an epistemological approach can help ICTs to be used in a way that allows different knowledge systems to operate alongside each other causing the 'battlefields of knowledge' (Long and Long, 1992) to pacify at least where digitisation opens up opportunities for greater sharing and understanding between different knowledge systems. Conflicts will inevitably remain between certain groups but the 'potential' of ICTs to be used for greater sharing of information from a wide variety of sources is inherent in their design, with the world wide web in particular being designed as a decentralised networking tool (Berners Lee, 1999). In many ways the efforts of designers in creating many modern consumer electronics have been focused most recently on reducing the overtly technical aspects of their products so that usability and flexibility take priority over pure functionality. The simplification of the user interface for a whole range of ICTs, championed by Negroponte in 'Being Digital' (1995), is a process that has contributed significantly to the adoption

of many ICTs and in providing increased flexibility for alternative user choices has already catered for the alternative epistemologies that co-exist in developing countries. This process now needs to incorporate an even greater range of user requirements, some similar and some different from those already identified and it needs to continue to assess ICTs in the context of alternative epistemic requirements and adapt them accordingly. In recognising that the World's poor are not one homogenous group it is evident that the 'digital divide' cannot be bridged by a single 'universal' application for the poor especially when the digital revolution itself has been fuelled by the increasing flexibility of the technologies to suit the user's way of life.

3.4 Community knowledge partnerships

In the short term, strategies for integrating ICTs into rural development need to focus on widespread, cross-sectoral local adoption. ICTs remain relatively new in many rural areas and there is a fundamental issue of increasing access to potentially useful technologies. As discussed above this will require a plethora of approaches to correspond to the complex multi-dimensional livelihoods of the poor in rural areas. To promote knowledge as a catalyst for development, ICTs could be used as flexible tools for supporting and capacity building across a wide range of innovative institutional partnerships. There have been a number of experiments by international organisations such as the FAO, UNESCO and IDRC and national governments (India, Brazil) and NGOs such as M.S.Swaminathan Foundation that aim to improve information provision through the use of ICTs. The approach advocated by the authors is to build on these through the development of community knowledge partnerships (CKPs) that can extend existing information networks such as by connecting local radio to the Internet, and make new linkages such as by providing audio-visual and radio programmes to community centres and schools for adult learning. The partnerships approach emphasises the potential to share the responsibility for the provision of information widely through innovative and decentralised institutional relationships. These will necessarily include a broad range of user groups and partners, as indicated in Box 7. The process of developing CKPs can be locally driven based on local choices and priorities and to reflect the local context in which information flows. However, rather than develop according to historic institutional barriers to information flows, a range of ICTs must be made available to ensure that even the most marginalised groups can find a way of improving their access to and choice of information relevant to their livelihoods. Both public and private sector partnerships can be developed to this end with government, academic, mass media, and market based information sources. The range of information sources available should be used strategically to support those partnerships that promote information access and use amongst the most marginalised groups. ICTs therefore need to be presented as options, alternative means for increased communication and information exchange that correspond to local priorities.

Box 7 Definition of Community Knowledge Partnerships (CKPs)

Community Knowledge Partnerships (CKPs) are two-way information linkages designed to overcome existing gaps and blockages within community information systems. They aim to integrate ICTs into local knowledge systems strategically so that both internal and external information can be harnessed by a wide range of user groups for development goals. The range of partnerships will be context specific but could include:

- Rural and agricultural services e.g. government extension, private sector suppliers (inputs and extension services), local markets, national and international.
- Schools, research institutes – local, national, regional and international
- Health centres – local, national and international.
- Libraries, Book publishers – regional and international (90% of the information on Africa is held in libraries outside Africa).
- Media – local, national, international, e.g. newspapers, community radio, television.

An emphasis on supporting existing community based institutions and extending information flows between them could usefully be based on improving access to public information, in the first instance. Extending the reach of public information could help to provide strategic focus to ICT initiatives whilst not restricting them unnecessarily to any particular sector-specific focus. This would help to overcome the under utilisation of public information in many areas and harness cross-sectoral development efforts. Therefore in promoting CKPs, different ICTs will be used because they are appropriate for a particular group of users rather than according to distinctions based on the information being transferred by those controlling the information flow. Agricultural information provides a useful example that can be provided in a number of ways. Tripp (2001:95) emphasises the relative importance of farmer-to-farmer information exchange, for example, in accessing and utilising public seed varieties when compared with formal extension systems. Public information such as market prices can be shared through newspapers, on a notice-board, on a screen or over the radio. Illiterate farmers working in the fields may prefer the market information over the radio whereas some may be able to access prices over the Internet. The same information therefore could be accessed by different groups of users using different ICTs and it is necessary to promote partnerships that respond to the equitable exchange of information whilst at the same time empowering the different groups through an increase in information choices. Many of these choices will be based on cost in the short term and therefore focusing on information that is a public good, and should be made freely available, will help to understand information priorities for existing information rather than attempt to use ICTs to introduce whole new information systems for which the demand cannot yet be ascertained. CKPs, therefore, should focus on understanding and overcoming the blockages to the free flow of information using ICTs, where appropriate, to provide more equitable access and widespread sharing of information.

The flows of information that result from CKPs are ‘two way’ so that feedback such as through community radio actually contributes to the supply of information being exchanged. Public information such as weather reports can appear to be unidirectional from the meteorological centre to the listeners or readers of the report. However, through a partnerships approach the style and format of the weather report, together with locally specific detailed preferences for the type, timing and presentation of the information can be subject to local community input, assessment and control. ICTs can play a role both in extending the outreach potential of community knowledge partnerships to marginalised groups and in providing a flexible response to the mode of information sharing, from voice to pictures and text. There have been many experiments such as through communication for development, extension education and national education curricula to assess alternative approaches to sharing knowledge. ICTs represent an opportunity to extend the reach of

information networks but through local partnerships they could perhaps more importantly be used to build the capacity of existing networks. The collective experiences of those involved in using knowledge for development needs to be coordinated to promote the use of ICTs for rural development as a means of developing a range of cross-sectoral information choices, based on equitable, community based knowledge partnerships.

A number of simple approaches to ICTs are being developed in this way and the opportunities for experimentation and creative adoption of ICTs are likely to grow as the technologies become increasingly flexible. In Ghana a community radio station established with assistance from UNESCO (Radio Peace) broadcasts a special programme to the local fishing communities targeting the fishermen in the morning with a weather report and for discussion programmes on the day when they are all ashore and mending their nets. The women who are traditionally involved in the fish processing and marketing have also requested dedicated programmes on new processing techniques, credit and accounting. In India the honey bee network provides a forum for documenting and sharing indigenous technology and provides access to funding for entrepreneurs to develop the technologies through innovative business models whilst retaining local rights to intellectual property and patents. There are also some concerted efforts to integrate ICTs into broad-based community. Examples include Ghana's Community Learning Centres (CLC)[15] that have been operating since 1996 and more recently UNESCO's focus on developing community multimedia centres to combine 'local media, especially radio, by local people in local languages with ICT applications in a wide range of social, economic and cultural areas.' These hope to build on the experiences of established multi-purpose community telecentres such as in Mindanao in the Philippines where partnerships between local barangay communities and various government, private sector, community and academic information sources were developed using a range of ICTs. In these and many other examples the development of knowledge partnerships was far from simple when faced with the local constraints to information exchange at the community level. However, through a combination of dedicated local champions or intermediaries (Richardson, 1997; Mundy, 2001; Akakpo, 2001) and a cross-sectoral approach incorporating a range of local priorities such as health, education and agriculture the potential of ICTs has begun to show itself as a means of facilitating flexible approaches to address the multidimensional complex developmental needs of the poor. The strategic use of ICTs to develop CKPs in rural areas could ensure that both the knowledge and empowerment that result from increased information exchange are shared more equitably.

[15] Funded by USAID and operated by the Academy for Education Development. Akakpo, J. and Fontaine, M. (2001) Ghana's Community Learning Centres, Commonwealth of Learning.

4 Conclusions

4.1 The potential role of ICTs for rural development

The importance of knowledge for development is well recognised (World Bank, 1999). Knowledge is a central foundation of human and economic development. Technological revolution in ICTs in the North has led to the emergence of a knowledge economy but the inability of developing countries to maximise the benefits of this revolution is a significant barrier to their participation in this knowledge economy. Knowledge transfer through education and training has been a central concern of rural development initiatives over the years. Recent developments in ICTs offer great potential to support and enhance education and training for development. Given the particular constraints to education and training in rural areas it is here that the potential impact of ICTs on knowledge development is greatest.

Information and communication activities are a fundamental element of any rural development activity. While education and training develop cognitive skills, it is information that gives content to knowledge. The importance of information for development is undoubted but important issues surround whose reality the information reflects, who is able to make use of that information and for what purpose. Rural information systems have traditionally focused on supplying information to the rural poor and supplying information about rural areas to policy makers, but it is now recognised that past systems have been largely ineffective in addressing the needs of the rural poor. The extension of agricultural information in particular is evolving beyond merely transmitting messages (although this is still important). It is becoming more open, more participatory and more demand-driven, involving interactivity, negotiation and two-way information exchanges. There is a new emphasis on the acquisition of information and enabling the rural poor to request information specific to their particular livelihood needs. Communication specialists increasingly recognise the enormous potential of ICTs to support and enhance these changes.

In debates about the role and potential of ICTs for rural development, it is useful to distinguish between *knowledge gaps* that refer to unequal distribution of technical knowledge and *information problems*, both of which contribute to underdevelopment. ICTs have the potential to address both these barriers to rural development by facilitating improved knowledge sharing and information exchange. However effective application of these technologies requires greater understanding of both the potential of the technologies in question and the social, political and cultural context in which they could be used. Current debates on the potential role of ICTs for rural development tend to be constrained by an inherent mutual lack of understanding between technology drivers and development agencies. As a result, ICT applications in developing countries remain largely uninformed by recent developments in the wider development literature and conversely many development agencies have failed to effectively mainstream strategies to harness the potential of ICTs.

It is argued in this paper that although techno-optimists often underestimate the complexity of development problems, many development agencies equally underestimate the flexibility of some of the technologies currently available to accommodate specific developing country problems. ‘Digital divide’ type debates tend to focus on large-scale infrastructure development and the extension of information and communication services from the centre to the periphery. However rural areas in most developing countries are far from becoming integrated in ‘global knowledge partnerships’. Instead, this paper has focused on the potential for more strategic application of

emerging ICTs to the immediate challenges facing rural areas. In particular the potential contribution of ICTs to enhancing existing and ongoing rural development initiatives.

ICTs have the potential to support and enhance rural development initiatives in the following key areas:

1. Managing, storing, and sharing information

ICTs offer unprecedented information storage capacity, increases in processing power and speed, coupled with dramatic reductions in costs. ICTs can facilitate the improvement of existing information management processes by improving ease of access, transparency, accountability, efficiency, speed of delivery and providing new information sharing opportunities through affordability, availability and ease of use. ICTs can help address good governance concerns of greater administrative efficiency by improving existing formal information systems operated by local government and development agencies and also facilitate improved cataloguing, storing and sharing of locally relevant information. The extended multi-media capabilities of new technologies offer the potential for storage and presentation of information in formats more appropriate to local contexts and therefore encourage greater integration of different information systems. Above all ICTs offer potential for decentralisation of information systems, decreasing dependency and empowering the rural poor by devolving control over information and knowledge.

2. Access to more information, especially public information.

The context of rural development has changed rapidly in recent years. Globalisation and continuing liberalisation of agriculture have substantially changed the *market* and *institutional* environment in rural areas. In order to be able to cope with and adapt to these changes the rural poor require improved access to information regarding market opportunities and information about their rights and the roles and responsibilities of institutions supposedly designed to benefit them. In terms of market opportunities, emerging agricultural technologies are increasingly information intensive and the rural poor must now cope with increasingly sophisticated input and output markets. Most smallholders and the rural institutions that represent them are ill equipped to cope with the vagaries of the open market. Improving the information management and decision-making capacity of these institutions is essential if they are to 'make markets work for the poor'. ICTs offer huge potential in support of improved education and training and need to be harnessed to build long term decision-making capacity in rural areas. ICTs can also support improved provision of short-term information required by the rural poor for livelihood strategies.

Furthermore the poor are increasingly expected to take on responsibility for management and financing of rural services e.g. water supplies and to participate in recently decentralised systems of governance. In order to participate effectively the poor require more and better information about their rights and the roles, responsibilities, structure and services of institutions supposedly designed to benefit them. ICTs offer considerable potential to increase the benefits and reduce the opportunity costs of participation.

3. Creating linkages for partnerships in information sharing (mutual, two-way, participatory).

As noted above ICTs can help empower the poor to take control of their knowledge environment. This can lead to improved sharing of information locally resulting in greater choices for livelihood strategies e.g. cataloguing and sharing experience between farmers. Local information exchange can help the rural poor organise as groups, articulate needs, defend interests and increase bargaining

power. ICTs can help pro-poor institutions listen to the poor, engage in more meaningful dialogue and build consensus and mutual understanding around development objectives. ICTs provide practical opportunities for improved information exchange between different groups and new and innovative knowledge partnerships.

Constraints

There are clearly constraints to the application of ICTs in rural development and many of these reflect long-standing development problems

1. Knowledge capture and power structures causing blockages/ controlling information exchange.

The relation between generation of information, knowledge and power are well established in development theory. Knowledge and information capture by local elites, large-scale commercial farmers, and traders etc. can serve to perpetuate existing inequalities. It is essential therefore to identify existing and potential information blockages and design ICT interventions strategically to overcome them. One way of achieving this is to focus in the first instance on improving access to basic public information resources, which are currently under-utilised and relatively uncontentious.

2. Private information and the cost of access.

The economic value of information in decision-making is well established. Information is therefore fundamental in economic transactions and different economic agents are prepared to pay for information that is relevant to them. However free flow of information is a critical factor underlying the efficient functioning of markets. Addressing inequitable access to information should be a key concern in order to 'make markets work for the poor'.

Existing opportunities:

It is often assumed that there is free access to public information. This is simply not true in many developing countries due to the inadequacies of existing information systems. Flows of public information can now be improved at vastly reduced costs particularly through the use of ICTs. Freeing up the vast amounts of freely available, and largely apolitical, public information resources could have enormous potential benefits, especially in rural areas, which are currently least well served. Harnessing currently under-utilised public information resources can provide a catalyst for rural development through the improved cooperation and exchange between groups and improved efficiency of markets and institutions.

Public information resources can be used more and made more available by focusing on adapting ICTs to help overcome many of the prevailing information problems in rural areas:

- Technological: infrastructure constraints.
- Cultural interface: content and format appropriate for local contexts.
- Institutional: decentralised control and capacity building for devolved management of information resources.

Improving the enabling environment for Community Knowledge Partnerships (CKPs):

- Mainstreaming information and communication activities at the policy level in rural development planning.
- Decentralising control over information resources and new technologies.
- Providing all relevant information that is freely available as a public good.
- Improving information sharing at the local level through improved choices and multi-level engagement of the private sector in the design of more appropriate applications.
- Encouraging partnerships for local appropriation of the technology and content with the necessary training and support.
- Integrating ICTs into local knowledge and information systems in order to address locally identified knowledge gaps and information problems.

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