Knowledge Sharing and Distance Learning for Sustainable Agriculture in the Asia Pacific Region: The Role of the Internet

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Abstract

Agriculture is of pre-eminent importance in the Asia Pacific region but is under threat from a number of sources. These include increased demand for food and fibre, complex new domestic and international economic and political forces and changing marketing regulations and requirements. Underlying all these is the rapidly deteriorating natural resource base upon which future productivity and farmer livelihoods depend. Knowledge and information are key requirements to enable farmers to deal with these challenges, particularly as new agricultural technologies are becoming more "knowledge intensive". Reaching farmers with these prerequisites has been problematic in the past but new information and communication technologies – primarily the Internet – are showing considerable promise. While this approach for directly reaching farmers in developing countries is still in its infancy, ICTs are proving that they can reach "knowledge intermediaries" whose role is to bridge the local and global agricultural knowledge systems. While there are several initiatives at the global, regional, national and the local levels all across the globe, these are proving to be much less than what is required to make a real difference and capitalize on the potential. The donor community can do much to facilitate progress but must consider some fundamental changes in its priorities and how it operates. It must rethink its current faith in the private sector, target institutional support more rationally, develop and follow a clearer strategy and provide more substantial and sustained support for Internet-based initiatives that take advantage of the real potential of this approach.

Media summary

The Internet may well provide a solution to the persistent problems associated with sharing knowledge and information with rural communities.

Key Words

Agricultural development, knowledge intermediaries, agricultural knowledge systems, distance learning, information and communication technologies (ICTs), Asian agriculture

Introduction

"Agriculture is an information-intensive industry. The sector draws upon an infinite number of sources of widely dispersed "locally contextualized knowledge" and a considerable body of research materials, and relies upon continuous flows of information from local, regional and world markets. The rise of Information and Communication Technologies (ICTs), with their wide variety and enormous number of applications, holds great promise for agricultural development" (Engelhard, 2000).

Agriculture is of pre-eminent importance in the Asia-Pacific region. "Rural development remains key to meeting global challenges of poverty reduction, economic growth, food security, and environment conservation, and in most cases agriculture must be the engine of growth for rural development" (Alex et. al., 2002). Despite ongoing industrialization and the rising importance of service and knowledge-based economies, agriculture continues to play a strategic role as a producer of food, as a provider of

employment and as a source of foreign exchange. In 1999, farm-gate agricultural production (including fisheries and forestry) accounted for 27% of the GDP of South Asian developing countries, and 14% of the GDP of East Asian and Pacific developing countries (World Bank, 2001). Perhaps more significantly, a majority of the workforce in developing Asia work in agriculture and this situation will continue for the foreseeable future. According to the ILO (2002), "Over the next 15-20 years the share of the agricultural labour force in the total economically active population will remain above 47% in South and East Asia." This largely rural and low-income majority is not only a driving force for developing Asian economies, but the social backbone of these societies as well (Woods et. al., 2002).

But the agricultural sector in many of the developing countries of Asia is facing a range of old and new challenges. Agriculture is changing and becoming more commercialized. In an increasingly globalized economy, Asian farmers are competing with farmers around the world for a share of the market. Agricultural markets are becoming more complex and demanding. Adding to the difficulties is the fact that Asia's natural resource base is deteriorating. Asian farmers must deal with shrinking arable land area and generally deteriorating land, water and other production resources.

Many would argue that the best response to these challenges involves more widespread adoption of modern sustainable agricultural practices. But it is realized that many of these, "New technological innovations are likely to be more knowledge-intensive, based on more efficient use of inputs with recommendations tailored to specific groups of farmers and narrowly defined production environments" (Alex et. al., 2002).

This raises the question of how best to make the required information and knowledge available to those who need it most. Until relatively recently, getting these to people in rural communities was difficult and costly. However, during the last decade, great progress has been made in the development and availability of new information services – even in remote rural areas. Information and communication technologies (ICTs) are offering new options to deliver information to farmers directly and indirectly through knowledge intermediaries. Many consider that these new digital technologies will revolutionize the way knowledge and information is shared.

Below, we will first take a closer look at the challenges facing agriculture in Asia and go on to discuss the information and knowledge farmers need to address them. We will then explore the potential, the approaches, and the associated realities of the new digital technologies – primarily the Internet – to provide rural communities with knowledge and information. Finally, we will provide some of our ideas on what the development community should do to make it possible for rural communities to realize the potential benefits.

Current issues in Asian agriculture

Given that the per capita availability of land in Asia-Pacific Region is one-sixth of that in the rest of the world and nearly three-fifths of the future increase in world population will occur in this Region, the future increases in food and agricultural production will have to be realized from the ever-shrinking and generally deteriorating land, water and other production resources. This is indeed an uphill task. (Singh, 2002)

The above quote, from FAO's 2002 report on "The State of Food and Agriculture in Asia and the Pacific" clearly illustrates some of the enormous challenges facing agriculture in Asia. There is no question that the region's population growth is high and it is expected to increase by 142% (South Asia) and 120% (East Asia and Pacific) by 2025 (Population Division, United Nations, 2001). According to projections by the International Food Policy Research Institute, by 2020 demand for cereals will grow by 50% and demand for meat will almost double in developing Asian countries. Similar demands will be placed on the production of non-food and export crops, such as cotton, rubber, and tropical fruits. Farmers in developing Asia will be expected to meet this additional demand (Rosegrant et. al., 2001).

This increased production will depend on an already overexploited natural resource base. Large areas of the most fertile agricultural land are being converted to non-agricultural uses through industrialization and

urbanization. What remains is threatened by degradation from erosion, nutrient mining, water logging and salinisation. Water availability per capita in the region is decreasing rapidly as urban, industrial, and agricultural users compete for this resource.

Adding to the woes of Asia's farmers is increasing pressure from both domestic and international political and economic forces. Globalisation means that Asian farmers must compete with farmers the world over for a share of the market. At home, farmers have seen the withdrawal of price supports, commodity protection, and government marketing programs, as well as a reduction in research and extension services. These factors result in serious distortions in global agricultural trade and make it difficult for developing countries to exploit their natural comparative advantages. In fact, developing country share in world agricultural exports has stagnated at 40 per cent during the last five years (SAARC, 2002).

As if this wasn't enough, the marketplace itself is growing in sophistication and complexity and requires farmers and other dealers in agricultural produce to learn new skills and business strategies. Consumers, both domestic and international are demanding assurances about the safety of the food they eat and the clothes they wear. They are also concerned with knowing more about the origins of their food and fibre and about the way they are produced.

As a result, many governments are imposing strict new laws on food safety and purity and mandating much more "traceability" for agricultural products. Produce is not traded unless it has been tested for agricultural chemical residues and its genetic makeup evaluated. Traceability is becoming a mainstream commercial requirement as well as a trade issue and will continue to be a key requirement for agriculture produce exporting to Japan, EU and the US. In fact, the introduction of EU General Food Law and the US Bioterrorism Act 2002 has made traceability a mandatory requirement for market access (Babria, 2003). And it is not just the export market in developed countries. Already there is considerable evidence that the demand for certified safe and traceable food will continue to rise for domestic production and supply (Gan, 2003).

Failure to meet standards or to be able to provide evidence of the origin and treatment of agricultural produce can mean serious seasonal financial losses and even exclusion from markets. Farmers, and dealers in agricultural produce who do not know how to meet the new requirements or how to grow produce that meets these stringent requirements will be hurt.

Information and knowledge needs of farmers

"Positive and sustainable development, including the eradication of poverty, requires the development and use of new knowledge. New knowledge is also required to provide a basis for development work that goes beyond the mere solving of acute problems. But the process of transforming knowledge – both new and existing – into actions that eradicate poverty is complicated, varies both across culture and within regions" (Dodsworth et al, 2003).

There is no doubt that much more can and should be done to support the millions of small farmers upon which the bulk of the world's population depends for food, fibre and economic development. Capital is critical and credit is notoriously limited for smallholder and subsistence farmers. National policies tend to ignore the needs of rural communities in favour of urban centres and industrial enterprises. Agricultural inputs are often hard to access, inferior or not available at the times needed. Water for agricultural purposes is increasingly diverted to urban areas and what is available is becoming prohibitively expensive. There is talk of a crisis in government extension services and support for extension has slowed dramatically and, "over the last decade stagnation or even dismantling of extension systems has been on the agenda" (LEISA, 2002).

While addressing these and a host of other limiting factors could make a major contribution to the effort to overcome the challenges described in the previous section, it is maintained that a key underlying factor is related to information and knowledge. A common characteristic of many of these needed interventions is that they are "knowledge intensive". For example, a range of studies (Byerlee 1987; Pingali, Moya, and Velasco 1990; Byerlee and Pingali 1994; Pingali and Heisey, 1999) provide considerable evidence that,

instead of being based on improvements of traditional inputs such as seeds, fertilizers, and pesticides, future increases in agricultural productivity will be realized mainly through more efficient and more knowledgeable use of these inputs. As summed up in a LEISA editorial (2003), "Access to information is one of the most valuable resources in agricultural development. Today, the demand for agricultural information is stronger than ever. The increased market integration that is experienced by even the most remote farming communities greatly increases the pace of change. Events and developments far away from home have profound effects on the livelihoods of farmers. Information is needed."

World Bank (1998) classifies this needed information into two types. "Knowledge about technology, or know-how, and knowledge about attributes, or the characteristics of products, services, and institutions. Developing countries generally possess less of both kinds of knowledge than do industrial countries, and the poor less than the nonpoor. As the example of the green revolution of the 1950s and 1960s shows, both types of knowledge are critical for development."

And, both agricultural and non-agricultural knowledge needs must be addressed. Rural communities need to know much more about livelihood strategies, both on and off farm (Ram?rez and Richardson, 2002). They must learn how to evaluate their own information needs; and turn them into communication strategies and activities to access the services and knowledge they need (Wesseler & Brinkman, 2002).

Looking specifically at agricultural knowledge needs it appears that the most fundamental of these are concerned with agronomic practices, processing and marketing. A recent World Bank sponsored study (Khairnar, 2003) illustrates the breadth and depth of a successful farmer's knowledge and information needs quite well. It surveyed farmers in 3 Indian states to find out what they needed to know to succeed in today's agricultural environment. It found that farmers need to know, at a minimum, what to grow, when to grow, how to grow more, how to store and preserve their produce, when to sell, where to sell and at what price to sell. Additionally, competence in a diverse list of specific agronomic management skills was found to be a critical indicator of whether or not a farmer makes a profit. Farmers must know the optimum usage of fertilizer for higher productivity. They must know the principles of disease prevention, and in case of disease, curative measures. They must know how to manage available water including irrigation details like means, timing and quantity as well as how to conserve water through advanced irrigation technology. Knowledge about HYV seeds, including selection and quantity sown per hectare, were found to be important as well as being able to implement crop rotations to maintain soil quality. The ability to implement cost effective pest control practices, including correctly deciding if pesticide should be used, which pesticide should be used and responsible and economical application methods, were key characteristics of successful farmers.

The study also highlighted the business and marketing skills required. It found that that "farmers who understand market trends and market opportunities have a better chance of succeeding than those who do not." A key component of these skills involves a good understanding of new marketing rules and regulations and the knowledge required to meet strict new guidelines on food safety and traceability. At the very least it means knowing how to market produce that complies with national and/or international agrochemical maximum residue levels (MRLs). This means that farmers must be able to follow recommended chemical application practices and apply precise doses of chemicals only at the times and under the conditions prescribed. It will definitely mean knowing how to manage genetically modified crops and perhaps how to avoid cross-pollination of genetically modified and natural crops. It may also mean a need to learn about careful record keeping and documentation of production and postproduction practices followed.

And it is vital for farmers to know how to farm in a sustainable manner. "Agriculture is reaching the limits of available natural resources. Thus, future increases in agricultural production and rural income must derive from intensification, rather than area expansion or exploitation of additional natural resources. Knowledge — and related information, skills, technologies, and attitudes — will play a key role in the sustainable intensification of agriculture and success of rural development investments" (Alex et .al., 2002).

It is obvious that the knowledge needs of a farmer today are diverse and substantial and their success depends on making correct decisions based on good information and a thorough understanding of a range of principles. "The complex interaction of these decisions made in millions of rural households will ultimately define the form of rural development and progress towards alleviation of poverty, economic growth, food security, and the environment." (World Bank, 2001).

Communicating needed knowledge and information

Communications is the essence of extension, which seeks to provide knowledge and information for rural people to modify behavior in ways that provide sustainable benefits to them and society in general. New information and communications technologies (ICTs) provide alternative sources of information to rural people and open new vistas of possibilities for extension in development communications, rural telecommunications, and application of information technologies" (Alex et. al., 2002).

While vital, communicating the critically needed information and knowledge to rural communities and the equally important function of learning what they know and their assessments of new technologies is a problem that has plagued development efforts for decades. A CTA sponsored study stated that, "Without communication (this includes information and education as well), progress would be unimaginable. Without the exchange of information, no innovation would be able to spread. This may sound simple and straightforward. In reality, it is one of the hardest challenges that anyone involved in development processes has to face" (Wesseler & Brinkman, 2003). Or, as a World Bank (undated) report notes, "The appropriate mechanisms to organize and manage research and technology dissemination for knowledge-intensive agriculture is still being debated".

The concept of Agricultural Knowledge Systems (AKSs) may help to illustrate the problems. An agricultural knowledge system consists, "of the organizations, sources of knowledge, methods of communication, and behaviours surrounding an agricultural process" (Winrock, 2003). Farmers operate primarily in their own localized knowledge system comprised of diverse sources. These include family, friends, other farmers, extension agents, community organizations, private input suppliers, agribusinesses and cooperatives. This localized knowledge system is based on indigenous experience, knowledge and experimentation as well information and knowledge from the larger global knowledge system. The global knowledge system, "consists of national and international organizations in agriculture and rural development such as ministries, the CGIAR group, and NGOs" (Winrock, 2002).

Communication and information and knowledge flows between these two very different systems, while problematic, is critical. Farmers need access to information about new technologies, policies and market information that is outside their own localized system. Researchers and development workers need to know how their recommendations are received and farmers' reactions to new technologies.

The role of intermediaries in communication

"Knowledge intermediaries are important at both levels [national and international]. Key roles include converting research messages into a language that non-specialists can understand, putting research into context so its relevance becomes clearer, assembling research from different sources so differences of opinion and areas of consensus are made more explicit, playing a multiplier role in spreading research messages more widely and getting them to audiences that researches cannot reach, connecting different communities with different languages and worldviews, providing a channel for communicating feedback to researchers and (potentially) for articulating demand and connecting the local to the national and the global" (Dodsworth, 2003).

The use of intermediaries to disseminate important agricultural information to farmers has been an integral part of agricultural development strategies for years and agricultural research, extension, and development organizations – public or private, for-profit or non-forprofit – are all part of an overall agricultural knowledge system linked by information and communication. These organizations and their agents, referred to as "knowledge intermediaries or "knowledge brokers", are in the critical business of providing knowledge as a product or service. (Winrock, 2002).

Traditionally, the intermediary role has been played by government extension agencies. But, "Today national extension systems are in dire straits with resources being cut to a minimum. Many extension workers have been laid off or have left for opportunities elsewhere and the ones who remain often lack the basics for their work like transport and access to information. Staff morale is often low due to the inability to perform their task well combined with continuous criticism from outsiders who often do not understand the impossible working conditions of the extension staff" (LEISA, 2002).

In response to this situation, the last decade has seen a proliferation of new information suppliers in addition to the traditional government extension agencies. As reported by Berdegu? and Escobar (2001), at the same time that research and extension agencies were experiencing a general decline, "new institutional actors began to appear with greater force in developing regions. These include private sector firms, NGOs, universities and research institutes, foundations, farmers organizations, new ministries for environment, social welfare and science and technology, agroindustries, and, more recently, local governments at the regional and municipal levels." The study goes on to give an example of four rural districts in Kenya where there was active involvement of over 30 different organizations in each district, "from local community groups to seed suppliers, to NGOs, to traders, to official research and extension programs and institutes. All of them providing farmers with services of direct importance for agricultural innovation at the local level."

Limiting the effectiveness of both traditional and new knowledge intermediaries is that they often lack the skills, knowledge and experience required to help their clients respond to the new complex challenges and needs. "These challenges place a heavy demand on training and personnel management for extension systems, which must have staff qualified in natural resource management, marketing, and use of new technologies and able to work with rural youth, women, and disadvantaged groups. The new extensionist will often need to be one-third management specialist, one-third communications specialist, and one-third technical specialist" (Alex et. al., 2002).

It is clear that education and training of knowledge intermediaries is a priority and that current efforts are not up to the task. More and more evidence is being gathered indicating that part of the crisis in extension is a result of a crisis in the agricultural education and training systems of many developing countries (Gasperini, 2000). In fact, Lindley (1998) maintains that, "Poor quality training of agricultural professionals, technicians and producers has been identified as part of the global food security problem."

The potential of Internet-based information, communication and educational tools to support agricultural development

"ICTs are proving their value in helping to deliver information to and from intermediary information providers such as universities, government offices, telecenters, NGOs and libraries. Some of the most successful ICT for development projects are focused on supporting the work of intermediaries who are relaying information to and from farmers and others at the grassroots level who do not themselves have access to the technology" (Morrow, 2002).

The Internet, and its associated applications, offers numerous advantages over more traditional mechanisms for information dissemination and knowledge development. It is fast, it allows for interactivity, is independent of time and geography and offers almost unlimited amounts of information on almost any subject. "The unfolding information technology and communication revolution is reaching further into rural areas providing new options for supplying information to farmers, both directly and indirectly through extension agents, agribusinesses, and other intermediaries" (Alex et. al., 2002). In recognition of this great potential, the integration of ICTs into development activities and projects is becoming a priority for many donors (Dodsworth, 2003; Winrock, 2002, Marker, et. al (2002), 2002; IDRC, 2003).

But it is also important to keep in mind the realities associated with access to this resource. Although access and Internet use is growing in the Asia Pacific region and is expected to reach to at least 240 million by 2005 (Digital Plays, 2002), a closer look at the numbers shows that the digital divide, the gap between the information haves and have-nots, is a major factor in the region. Only about 6% of Asia's

population has access to the Internet. Table 1 provides some indication of the scale of the digital divide between richer and poorer regions of the world.

Table 1: Internet World Usage Statistics (Internet Usage and Population for 233 Countries and Regions)

World Regions	Population (2003 Est.)	Usage, (Year 2000)	Internet Usage, Latest Data	Growth (2000-2003)	% Population (Penetration)	% of Users
Africa	879,855,500	4,514,400	8,073,500	78.8 %	0.9 %	1.2 %
Asia	3,590,196,700	114,303,000	210,902,651	84.5 %	5.9 %	30.9 %
Europe	?722,509,070	103,096,493	199,527,277	93.5 %	27.6 %	29.2 %
Middle East	259,318,000	5,272,300	12,019,600	128.0 %	4.6 %	1.8 %
North America	323,488,300	108,096,800	201,339,798	86.3 %	62.2%	29.5%
Latin America / Caribbean	541,366,100	18,068,000	35,465,667	96.3 %	6.6 %	5.2 %
Oceania	31,528,840	7,619,500	15,090,100	98,0 %	47.9 %	2.2 %
WORLD?TOTAL	6,348,262,510	360,970,493	682,418,593	89.1 %	10.7 %	100.0 %

(Internet World Stats, 2003)

Looking specifically at Asia, the statistics are even more discouraging. The region has countries at every stage of development and, as Table 2 illustrates, the divide between countries within the region is striking. Leaving out Asia's 7 most developed and urbanized countries (Hong Kong, S. Korea, Singapore, Taiwan, Japan, Malaysia, Macao) Internet penetration is less than 3%. And it is these lesser developed countries that are characterized by being largely rural and agrarian. "In almost all the developing countries, the Internet is available in metropolitan urban areas, where service providers have their markets. Although there are still problems of access to solve in urban centres, it is in the rural areas that the divide makes itself felt most acutely. Therefore, the critical issue is the provision and appropriation by local communities of ICTs as a development tool for rural areas. It is these communities, struggling at the margins of weak or emerging economies, who most need knowledge resources and economic opportunities" (Jayaweera, 2001).

Table 2: Internet Usage for Asia (Internet Users & Population Statistics for 35 countries and regions in Asia)

Asia	Population	Users (Year 2000	Internet Usage,	Growth (2000-2003	% Population	% of

	(2003 Est.)	)	Latest Data	)	(Penetration)	Users
More developed countries (Hong Kong, S. Korea, Singapore, Taiwan, Japan, Malaysia, Macao)	233,682,700	79,623,000	111,871,251	40.50%	47.87%	53.3%
Less developed countries (25 countries)	3,356,514,000	34,680,000	99,031,000	185.56%	2.95%	46.70%

(Internet World Stats, 2003)

Given this situation it is obvious that, "For many regions, direct use of ICTs by farmers – with the exception of the cell phone – may take decades" (Winrock, 2002). It is also obvious that failure to capitalize on the potential will adversely affect rural development efforts. "How to bring this new crop of technologies within affordable reach of smallholders in developing countries is among the most actively debated issues in the international development community. The lack of bare essentials—literacy, social and physical capital, electrical power, and physical infrastructure—in poor regions is a significant challenge in mainstreaming ICTs in the service of smallholder agriculture. However, this challenge needs to be met. Leaving the poor out of the technology loop can leave them irretrievably, and unnecessarily, behind" (Chowdhury, 2001).

The answer may well rest in part with the knowledge intermediaries discussed earlier. The majority of these individuals already have access to Internet-based knowledge and information and the basic computer literacy required to make use of it. "Users of Internet are mainly urban research and training centres, but it is also used by agronomic centres, farmers' associations, local radio stations and newspapers" (Wessler and Brinkman, 2002). "Local intermediary organizations are significantly more likely to have the organizational capacity, human capacity, and access to the necessary infrastructure to take advantage of ICTs to deliver needed services to the rural poor" (Winrock, 2002).

One example providing evidence that an approach focusing on knowledge intermediaries can work is an educational program conducted by the Asia Pacific Regional Technology Centre (APRTC). APRTC is a non-profit organization headquartered in Bangkok Thailand and focuses on the documented need for in-service training to overcome deficiencies in general (pre-service) education. Its agLe@rn program takes advantage of Internet-based eLearning approaches to address the continuing educational needs of agricultural knowledge intermediaries – particularly in the areas of sustainable agriculture and natural resource management. It carries out its work in collaboration with a range of multi-sectoral partners and targets multi-sectoral clients (APRTC, 2001). In its first 3 years of operation, APRTC ran 31 offerings of 7 online courses. This represented some 900 learning opportunities for participants from 20 Asian and 17 African countries. A recent survey of APRTC alumni (Raab and Abdon, 2003) provided clear evidence that its eLearning approach was working, that participants valued the information and knowledge gained through the courses and that they were actively sharing their new knowledge with farmers, colleagues and students.

What is needed to move forward – Some recommendations

"The international donor community has seen a surge of interest in recent years in integrating ICTs, including Internet technologies, into social and economic aid programs. Given that there is still little sound research on how the knowledge economy works in the North, that aid resources remain limited, and

knowing the extraordinary gaps that characterize the connectivity of most populations in the rural South, few see these interventions as substitutes for traditional development, or as a magic bullet to address rural poverty. At the same time, IDRC advances the belief that the ability of communities in the South to make progress in poverty reduction – rural and urban – will be linked in no short measure to abilities to harness ICTs for development purposes" (IDRC, 2003).

We are now at a very interesting and critical point in time with regard to taking advantage of the Internet in support of rural development. It has generated a considerable amount of enthusiasm and interest and most of the major donor and development agencies have come out strongly in their, at least vocal, support. There is widespread agreement about the need to improve Internet access in developing countries and make innovative use of it for information exchange and knowledge development. But the "road map" for achieving this goal is still far from clear. While the rhetoric is certainly audible and plentiful, support for ICT-enabled efforts focused on agricultural and rural development do not appear to be well thought out, coordinated or resourced.

The authors have a considerable amount of experience in the application of ICTs for agricultural development as well with the work of various donor and development agencies in this effort. While in no way comprehensive or complete, they would like to offer their personal recommendations for realizing the potential of this powerful medium.

Recommendation 1: Rethink current faith in the ability of the private sector to adequately serve the rural sector.

A common characteristic of most current approaches is that they are based largely on the assumption that the private sector can do it all. The thinking seems to be that all that is needed to close the digital divide is to make the policy environment for investments in ICTs and their applications more favourable and continue to support pilot initiatives to show what can be accomplished. While it is not surprising that this is a popular concept, in reality it does not stand up to close scrutiny.

This approach may have had some success in urban environments where economies of scale make the potential returns on investment much more appealing but it is doubtful whether this same model will be equally effective in rural settings. As Southwood (2003) so aptly puts it, "Not surprisingly, it has proved extremely difficult to get the crosshairs on the target when the social needs are great and the markets (with users who can pay) are tiny. Doing good and doing business can overlap but they are not always the same thing." In fact, the commodification of knowledge and information may not be in the best interests of society at all, in either rural or urban settings. If these are only available to the elite few who can afford the price then the divide between rich and poor will not only remain but grow. Winrock (2002) cautions that while, in general, reliance on the private sector is a good approach, "information and access to it closely resemble a public good threatened with undersupply by market failures".

Recommendation 2: Target public sector and donor funding towards the most efficient and effective agencies and organizations.

These concerns regarding private sector involvement in the effort imply that the public sector – particularly the major donors – must take responsibility for much of the financial requirements. Particularly given the "pre-market" developing community circumstances that characterize Asia's rural sector, public funding is perhaps the only way to "make" the market. Early investments made in community-based ICTs help to stimulate awareness, engender new skill development and build a market for the eventual development of commercial ICT based services (IDRC, 2003). This social investment approach is entirely consistent with the model followed in early Internet development in Europe and North America where early developments was underwritten by governments and universities. "Increasingly, this can be understood as a role for international development agencies to play in tandem with the private sector and interested public institutions" (IDRC, 2003).

Correctly targeting these funds is critical. Internet-based initiatives, by their very nature, are characterized by speed, change and innovativeness. It is therefore maintained that they are best carried out by

organizations who are adaptable, can respond quickly to change, have low levels of bureaucracy and value efficiency. These are characteristics that are not often associated with governments or traditional well established development agencies where bureaucracy is an art, overhead costs are exorbitant and entrenched staff rarely possess the specific skills and knowledge required to conceptualize and implement activities in the field. Unfortunately this is where the bulk of current donor funding seems to wind up and where it is used to facilitate policy level dialogues and token, short term support for pilot "proof of concept" projects. Considerably more effort needs to be made to support local and regional and international civil society organizations with public funds and to support their collaboration.

Recommendation 3: Develop and follow a clear strategy for promoting and supporting ICT-based information sharing and knowledge development in rural communities.

A key USAID-sponsored study (Winrock, 2003) pointed out clearly that most donor-supported efforts to date are "cautious experiments" rather than major programs and experience has only been gained through the results of a collection of pilot projects. Marker, et. al (2002)recognize that, "There is considerable overlap among initiatives, and coordination and information sharing are often weak", and that "If the international community is to help developing countries mainstream ICTs as tools of poverty reduction and the International Development Targets, it must organise itself more effectively to do so."

It appears that public donor funding has not been directed by any sort of coherent strategy based on what works and what doesn't. While this may have been an acceptable approach in the past it is now high time for the lessons learned to be critically evaluated and an agreed upon strategy developed and followed. This is not to say that new innovative initiatives should be ignored but rather that the "investment portfolio" be structured with a greater proportion of funding being given to projects and programs that have proven themselves in the past. As Flor (2001) suggests, "The small, spontaneous but fragmented initiatives among private agencies and nongovernmental organizations to bridge the Digital Divide should not only be encouraged and facilitated but be mainstreamed and coordinated."

Recommendation 4: Provide sustained and substantial support for Internet-based initiatives.

It is not hard to identify numerous very effective independent projects currently being implemented by private agencies and non-governmental organizations. A good place to get an overview of digitally enabled development projects is the Digital Dividend Project Clearinghouse (http://wriws1.digitaldividend.org/wri/app/index.jsp). Its database provides probably the best insights about where experimentation with ICTs is occurring and contains some 800 records of projects providing access, services, or enabling tools to underserved populations in developing countries – many of them related to agriculture.

For these initiatives to live up to their potential, they will need substantial levels of financial support which must be maintained over a long time frame. As IDRC (2003) points out, "The community-based introduction of ICTs takes time to become established in developing communities. In most developing communities, it will take longer (3-5 years) than most donors have in mind for ICTs to actually become established and for a sustainability path to be identified and concluded." And this is just the time required to identify the path to sustainability. Real sustainability will require considerably more time.

Recommendation 5: Support initiatives that take the fullest advantage of the global nature of ICTs

Looking over the ICT-enable projects listed in such databases as the Digital Dividend Clearinghouse or USAID's DOT-COM Alliance (http://www.dot-com-alliance.com/), it is clear that he majority of the projects currently being supported are limited to single countries or even single villages in a country. However, one of the most exciting and powerful characteristics of Internet-based information and knowledge initiatives is that they allow, perhaps for the first time in history, almost complete freedom from the traditional constraints imposed by geographical isolation. It therefore makes much more sense to look for ways to support cross cutting projects that connect villages, countries and regions. The authors therefore wholeheartedly support the recommendation of Flor (2001) that, "A regional approach to program development should be adopted since ICT and poverty alleviation transcend national borders." He goes

on to make the good suggestion that efforts be made to develop viable ICT Poverty Alleviation programs that are coordinated across agencies in the best spirit of networking, to ensure proper focus in resource use and synergy in development efforts.

Summary and Conclusions

"We used to think of capital as the scarce factor in production and of the transfer of capital as the key instrument of growth. Knowledge is now as, if not more, important a factor in development, and this trend is set to intensify. In the next century, knowledge accumulation and application will drive development processes and will create unprecedented opportunities for growth and poverty reduction. But there are significant risks of increasing inequality between and within nations." J. Wolfensohn, President, World Bank (in Alex et. al., 2002).

The urgent need to improve Internet access in developing countries and make use of it for information exchange and knowledge development is clear. Not doing so will result in widening existing digital divides thereby excluding significant numbers of the global population from the opportunities it offers. Specifically, failure to take advantage of this tremendous resource will put Asian farmers at a disadvantage with their better informed and better connected and educated competitors in other regions. Asia's small farmers are particularly vulnerable and if their knowledge and information needs are ignored, it will have serious negative repercussions for society as whole and most Asian economies.

The constraints and challenges are real and substantial, particularly in using this approach to reach farmers directly, and it will be many years before this dream becomes a reality. In the meantime, Internet technologies are proving themselves as powerful tools for getting information to knowledge intermediaries and upgrading their knowledge and skills. The key role of these individuals as important bridges between the global and local agricultural knowledge systems and positive agents of change is not in question.

A major component of the effort to address the problems and realize the potential will be sincere, major and focused support by governments, and more importantly donors and international development agencies. Specific recommendations to these organizations that are felt to be critical for progress include:

- Rethink current faith in the ability of the private sector to adequately serve the rural sector.
- Target public sector and donor funding towards the most efficient and effective agencies and organizations.
- Develop and follow a clear strategy for promoting and supporting ICT-based information sharing and knowledge development in rural communities.
- Provide sustained and substantial support for Internet-based initiatives.
- Support initiatives that take the fullest advantage of the global nature of ICTs

The potential of the Internet as a development tool is becoming more and more accepted. With sustained and greater investments in rural ICT infrastructure, training, content development and supportive government and donor actions, it is entirely possible to remove the current disadvantages rural communities now face. But it is dangerous to wait too long and actions need to be taken now. The digital divide will not go away and the longer we wait the greater the distance those on the disadvantaged side of the divide will need to cover. Failure to address the divide will condemn them to continued poverty and isolation.

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