

A Critical Evaluation  
of the Status of eLearning Adoption  
for Agriculture in Asia

A Dissertation Submitted to  
the Graduate School of Life and Environmental Sciences,  
the University of Tsukuba  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy in Agricultural Science  
(Doctoral Program in Advanced Agricultural Technology and Sciences)

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# Chapter 1. Introduction

## 1.1 Statement of the Problem

*[e-learning] has the capacity to enhance learning and expand access to education and training in agriculture and natural resource management at the global, regional and local levels.*

Atkinson, Beniast and Rao, n.d.

This statement aptly captures the author's experience gained from several years of using eLearning to address the continuing educational needs of agricultural professionals and educators who support and serve the farmers and the farming communities. New Information and Communication Technologies (ICTs) are proving their ability to overcome traditional constraints to getting essential knowledge out to those who need it most. These technologies can eliminate geographical isolation and provide inexpensive and efficient ways to cultivate knowledge about complex agricultural issues. They are revolutionizing the way information and knowledge is managed and support the generation of new technologies for farmers. They empower smaller organizations and individuals who had not previously had a way to contribute to the global knowledge base. Now, agricultural researchers from even the smallest and poorest countries are publishing and sharing information with peers around the world.

eLearning is arguably one of the most important ICT applications for facilitating the construction and validation of agricultural knowledge by geographically dispersed learners and experts. Learners from the Asian agriculture sector who had the opportunity

to experience an eLearning course confirmed that the interaction with other learners and experts in other countries and regions is one of the strengths of this approach.

Knowing from experience how powerful a tool eLearning can be in support of agricultural development and yet seeing that it was not being used more widely was a major factor in my wanting to look into the situation more closely. Why, given all the potential advantages of this approach, was there such limited adoption?

This study is an attempt to find an answer to this basic question and find out more about why there has been such limited adoption of eLearning by major agriculture development and educational institutions in the Asian region.

## 1.2 Objectives of the Study

This study focuses on characterizing agricultural eLearning in Asia and documenting the extent of and barriers to adoption. The goal is to use this information to develop strategies and actions that could be taken to overcome barriers and increase the application of this approach in support of agricultural development in the Asian region.

Providing answers to the following questions will guide this inquiry:

What are the factors influencing the adoption of eLearning? Do the size, mandate, training experience and type of organization influence adoption of eLearning? Does the target audience variable and context affect the decision making process? How about environmental conditions and the characteristics of the technology? What is the relative importance of the various factors in influencing adoption decisions?

These broad questions are elaborated in the following hypotheses. Substantiating evidence from the literature is provided for each hypothesis.

H1. A number of intrinsic institutional characteristics determine the degree to which an organization is able and willing to adopt eLearning

Numerous studies have noted the relationship between a range of institutional characteristics. Elgort (2005) concluded that “Adoption of e-learning in the university context is influenced by a number of factors, including organizational, socio-cultural, intra- and interpersonal factors, to mention a few.

Other factors have been identified by Nichols and Anderson (2005), who stated that, “e-learning pedagogies are constrained by institutional factors, including the technologies and applications supported by the institutions, quality assurance policies and standards, availability of staff training and support in e-learning, the existing level of staff proficiency in technology and e-learning, the perspectives of staff responsible for coordinating e-learning development, and the amount of time and funding made available for e-learning practice”. Pirani (2004) found that, “Institutions surveyed cited various institutional, user, and market drivers as spurring the adoption of e-learning including faculty interest, student convenience, alleviation of overcrowded classrooms, or CMS ease of use”.

H1a. An organization’s felt needs/problems influence the decision to adopt eLearning

All organizations strive to fulfill felt needs and overcome operational problems. For some this is a business need. In India, it is expected that organizations in the country will “continue to adopt the concept of e-learning in order to meet its communication needs and seize business opportunities” (Banduni, 2005). Other needs may be more important for some. “E-learning will ideally be employed by institutions for reasons of enhancing the individualization of instruction, improving educational quality, increasing access,



reducing costs and sustaining innovation (Twigg, 2001 as cited in Nichols and Anderson, 2005).

H1b. An organization with previous experience in using related technologies will have higher likelihood of using eLearning as an alternative delivery mechanism

Evidence suggests that adopting eLearning requires a certain level of expertise in a number of areas both technological and pedagogical. The more relevant experience an organization has the greater the likelihood that it will be able to adopt.

As Kollinger and Schade (2003) observed, “The idea is that most new technologies require learning efforts, reorganization of processes, and cumulating experience on the side of the user. If a firm has already done so for one particular technology, it will have greater benefits or lower costs from the adoption of a related technology. E-business technologies constitute such a cluster of technological innovations with a unique paradigm (i.e. the Internet), owing to significant complementarities which extend to IT-infrastructure, organization, processes, know-how of employees and firm strategy. The use of e-learning in a firm is strongly related to the existence and use of other e-business technologies which all stem from one common technological paradigm (Internet) with significant complementarities which extend to IT infrastructure, organization, processes, strategy, and know-how of employees and managers.”

This observation is supported by the high use of eLearning “in sectors with a high degree of computer penetration – IT and financial services” (Lain and Aston, 2004).

H1c. Organizations with a 'champion' will adopt eLearning faster than the ones without

“There is substantial evidence from the literature on organizational change and learning that the appointment of champions or new key figures plays a key role in bringing about change in organizations (Martin and Beaumont, 2001) and we would expect that such events would play a key role in ACAP for eLearning” (Martin, Massy and Clarke, 2003).

It can be claimed that companies with more skilled human resources personnel have a better chance to succeed at eLearning. Literature in change management bears this out, confirming that the existence of a champion, in other words someone who has the knowledge, skills, responsibility and authority to lead the organization toward adaptations of an innovation is positively related to adoption of an innovation (e.g. Carnell & Shank, 2003; Koska, 1992 as cited in Aydin and Tasci, 2005).

The importance of an eLearning champion has been confirmed by a number of studies “One of the most critical factors in sustaining elearning is to obtain support from senior management. Without champions at the top level, an overall culture shift will not happen” (Arora, 2004, Barron, 2003 as cited in Gibson and Berge, 2006). Psycharis (2005) found that, “Without appropriate leadership which will offer obvious and constant support for e-learning, the acceptance of this innovation will be slow if not impossible. Arabasz, Pirani and Fawcett (2003) suggested that , “For some institutions, e-learning program’s nature and extent stem from a particular administrator’s vision-for example, a president, CIO, provost, or chancellor. “

H2. The characteristics of a Technology/Innovation are key determinants of adoption

The attributes of an innovation influence organizational adoption decisions (Fichman & Kemerer, 1993) and the innovation's subsequent use in organizations (Eveland & Tornatzky, 1990 as cited in Hovav, Patnayakuni and Schuff, 2004).

Adoption theory "includes five significant innovation characteristics: relative advantage, compatibility, complexity, trial ability and observables. These characteristics are used to explain the user adoption and decision making process. They are also used to predict the implementation of new technological innovations and clarify how these variables interact with one another." (Wu and Wang, 2005)

According to Rogers' diffusion of innovation model, three sets of variables, technology ownership, adopters' characteristics, and innovation attributes, have enduring impacts on the adoption of new technologies (Li, 2003).

H3. Presence of basic technological infrastructure is necessary to successfully adopt eLearning

Without a basic minimum level of technological resources, eLearning is impossible. Existence of the appropriate technology infrastructure seems to be one of the critical components in every e-Learning effort adoption (Borotis and Poulymenakou, 2004).

Web-based learning, considered as subset of eLearning, presupposes availability of appropriate technology base. Technology base could comprise of hardware, software, networking and interconnectivity among other things. It is pertinent to note that "Availability" factor plays important role in usage of technology and migration to new learning paradigms (Nanjangud and Gopal, n.d.).

“For e-learning to succeed in the developing world, it needs to build on another important pillar: the existence of infrastructure, along with some degree of connectivity (Sehrt, 2003). As FAO (2005) notes, “the rural digital divide must be bridged. Otherwise e-agriculture applications will remain beyond reach of rural communities, and will merely exacerbate the existing rural digital divide - leading to an ever-widening knowledge gap between information “haves” and “have-nots”.

Studies have shown that many educational providers are well aware of this constraint, “Nearly one third of providers (32%) think that the employer’s ICT infrastructure is a barrier to future e-learning take-up, while 26% have concerns about their own ICT infrastructure” (BECTA, 2005).

H4. The characteristics of targeted learners (needs, skill level and access) influence the decision to adopt eLearning

Targeted learners are a powerful driver of change. “Many providers are implementing elearning to provide a better quality learning experience for learners and to respond to learner expectations” (BECTA, 2005). Elgort (2005) notes that, “My own work with staff in the area of e-learning clearly shows that the e-learning adoption decision is frequently motivated by student pressure. “Students want flexibility and convenience [regarding] when and where they take courses and that comes with an e-learning environment” (Arabasz, Pirani and Fawcett, 2003).

But need and desire is not enough, “In order to complete Web-based learning experiences and to participate fully, learners must have an existing facility and comfort with Web technologies. Providers must make sure that learners have at least a minimum skill set, the end user needs intermediate Windows and Internet navigation skills and basic typing

abilities” (Resource Bridge, n.d.). Sehr (2003) notes that, “Computer-literacy is an imperative precondition for learners to benefit from technology-based learning. E-learning can only build on a set of basic computer literacy skills”.

### 1.3 Significance of the Study

While adoption studies for technologies in other fields are common, this is not the case for eLearning in general and for agricultural eLearning in particular. Such studies are almost unknown in the Asian context. If the barriers to eLearning adoption can be clearly identified and their relative importance determined, this information can be used by Asian educational organizations, donors and government to increase the use of this approach and the quality and quantity of agricultural learning. This, in turn, will have a positive impact on sustainable agricultural development in Asia and development in general. The results will also serve as a valuable baseline of adoption so that growth or decline of this approach in Asia can be tracked.

### 1.4 Research Context

#### Assumptions

One of the underlying assumptions in this study is that the model upon which the survey and survey questions was based is an accurate representation of the factors affecting adoption of eLearning in agriculture. The development of this model was guided by the author’s extensive experience and exhaustive review of literature in eLearning and agriculture eLearning in particular.

It also assumed that the survey respondents are representative of similar learning organizations not included in the survey or that did not respond. Lastly, the respondents

are knowledgeable of the subject matter and provided answers that are accurate estimate of the truth.

### Limitations

While the research design has some inherent limitations, it was chosen because it offers an efficient and powerful way to gain insight into the agricultural eLearning situation in Asia.

Asia is very diverse in terms of culture and several languages exist. Extensive review of available information about eLearning activity on the region mainly from Internet and in English language might not project what is really happening on the ground. For example, “virtual universities are growing fast and, with 17 virtual universities in Korea alone! Many conventional, campus-based universities have started to offer e-Learning programs as well. For example, 67 e-Colleges have been established within conventional research universities in China” (Jung, 2007).

One of the research methodologies employed in this study is the use of online survey sent using email. One professor contacted in South Korea explained that it is difficult to get response from universities in this country because the questionnaire is written in English. Translation of the questionnaire into the local languages of the target recipients will be prohibitively expensive.

Another limitation is the bias generated from conducting the survey using the Internet and email as it excludes those organizations without access to these resources. But such organizations are less likely to have eLearning. As well, the sample was not randomly generated, but a result of an extensive Internet search to identify suitable respondent organizations as well as the author’s personal knowledge of agricultural learning

organizations in the region. Everyone in the list was contacted to ensure good response rate.

## **Chapter 2. Literature Review**

### **2.1 Introduction**

A considerable amount of information exists on many of the key areas of this research study. Numerous studies have established that agricultural education is essential for rural and national development and successes and failures are well documented. While limited, a number of recent studies are available that look at how ICTs can be used as a new tool in this effort, in providing agricultural knowledge and the associated technological limitations and constraints.

As this study is focused primarily on adoption, an extensive review of existing adoption models was a major part of the effort. Given the subject matter, this study drew on and adapted 3 existing conceptual frameworks. The sections below will summarize the existing information in these areas.

### **2.2 Role of Agricultural Education and Extension in Support of Sustainable Development**

As the CGIAR (n.d.) notes, “In a world where 75 percent of poor people depend on agriculture to survive, poverty cannot be reduced without investment in agriculture. Many of the countries with the strongest agricultural sectors have a record of sustained investment in agricultural science and technology. The evidence is clear, research for development generates agricultural growth and reduces poverty.”

New agricultural practices and products are an essential part of the development process in most developing countries and a sound investment. Norton (n.d.) has calculated that for agricultural research in the United States, “Most of the rates of return are in the 30-60 percent range, several times the return typically obtained from conventional investments



in manufacturing.” He attributes this to 8 main factors, 1) Adoption of new technologies generated by research leads to reduced costs per unit of production and expanded supplies of food and fiber. 2) Improvements in agricultural productivity have enabled farmers to remain competitive in world markets and to expand exports. 3) Agricultural advances have a multiplier effect on the rest of the economy by generating jobs and incomes in the non-farm sector. 4) Agricultural research has led to improvements in food quality, food safety, and nutrition. 5) Agricultural research has contributed technical and institutional solutions to improve environmental quality. 6) The complementary relationship among research, teaching, and extension programs in U.S. universities means that students, farmers, government officials, and agribusiness leaders have received more sophisticated up-to-date training than if our university teachers and extension workers just regurgitated the knowledge they were taught. 7) Agricultural research has eased the drudgery and extended the productive work life of the farmer. 8) Agricultural research has generated information that can be used to improve government policies or other institutional arrangements that affect the well-being of producers and consumers.

But research results and products that fail to make it from the laboratories and research stations to farmers are useless. To realize the potential economic and social benefits, the necessary information and knowledge must be disseminated. Traditionally, a major part of this has been the role of agricultural extension services, an educational activity that seeks to promote the application of scientific research and new knowledge to agricultural practices. Rivera, et al (2006) noted that, “Agricultural development depends on constantly improving existing practices and on the development and adoption of innovations. Promoting agricultural development in developing countries by investing in research and extension is a well-established approach. Richardson (2006) added, “Extension brings information and new technologies to farming communities, allowing

them to improve their production, income and standard of living. In fact, “In development studies, no country has been known to achieve any meaningful progress in agricultural development without substantial investments in agricultural research and extension” (Arokoyo, 2003).

Unfortunately, while agricultural research is relatively healthy, numerous authors from both developed and developing countries have documented the ongoing “crisis” in agricultural extension (Vanclay, 1994; Alex et al, 2002; ILEIA, 2002; Ghosh, 2007).

Even though “Past investments in extension have yielded high economic rates of return and are seen as one reason for good global performance in food production”, “Public extension services are under pressure for poor performance and often criticized for: being inefficient; lacking clear objectives and incentives; having limited coverage, especially of the poor and women; and lacking relevance. Public funding for extension is often insufficient, but it is unlikely that more money will become available for public extension and the pressure is on public extension to deliver *more* results with *less* money!” (Alex et al, 2002). LEISA Magazine (ILEIA, 2002) cites the following factors behind decreasing public support for agricultural extension:

- severe and repeated financial crises in most developing countries;
- a shift in preference for private enterprises over government intervention that is reflected in structural adjustment programmes imposed by international donors but also by national governments – it is believed that private companies are more efficient than the public sector in providing services;
- dissatisfaction with the perceived lack of impact by agricultural extension.

As a result of this situation, “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.” (ILEIA, 2002)

Paradoxically, at the same time that agricultural extension is in decline and disarray, farmers’ needs for knowledge and information are growing and becoming more complex.

As a World Bank report pointed out (Alex et al, 2002):

- Agriculture itself is changing and becoming more commercialized, thus changing the quantity and nature of farmer information needs.
- 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.
- Extension is being forced to embrace a broadened mandate, with two agendas particularly important-poverty reduction and environmental conservation.

Globalization is another key factor. “Where it does offer potentially new markets, the implication for extension is clear – all aspects of production, processing and marketing need to be driven by the requirements of the market, and extension guidance has to be tailored accordingly (ILEIA, 2002).

### 2.3 Use of Information and Communication Technologies (ICTs) in Information Dissemination and Knowledge Generation

Given this context, it is no wonder that much attention is currently being given to developing and evaluating alternative mechanisms and tools for information and

knowledge dissemination. Perhaps the most exciting area being looked at is the use of Information and Communication Technologies (ICTs). “Agricultural extension, which depends to a large extent on information exchange between and among farmers on the one hand, and a broad range of other actors on the other, has been identified as one area in which ICTs can have a particularly significant impact” (Ballantyne and Bokre, 2003). As a result, “extensionists are grappling with the question of how best to harness information and communication technologies (ICTs) to improve rural livelihoods” (Richardson, n.d.).

These technologies are increasingly being seen as cost-effective and practical tools, “to facilitate information delivery and knowledge sharing among farmers, extension agents and other stakeholders” (Annor-Frempong et al, 2006).

They are also being seen as a way to go beyond just farmer education and a way to improve education in general which may be even more important in the development process. “The relationship between education and sustainable development is complex. Generally, research shows that basic education is key to a nation's ability to develop and achieve sustainability targets. Research has shown that education can improve agricultural productivity, enhance the status of women, reduce population growth rates, enhance environmental protection, and generally raise the standard of living. But the relationship is not linear. For example, four to six years of education is the minimum threshold for increasing agricultural productivity. Literacy and numeracy allow farmers to adapt to new agricultural methods, cope with risk, and respond to market signals. Literacy also helps farmers mix and apply chemicals (e.g., fertilizers and pesticides) according to manufacturers' directions, thereby reducing the risks to the environment and human health. A basic education also helps farmers gain title to their land and apply for credit at banks and other lending institutions. Effects of education on agriculture are greatest when

the proportion of females educated to threshold level equals that of males. (ESD Toolkit, n.d.)

“Information and communication technologies are relevant to any strategy for agricultural and rural development, including greater public accountability and decentralization of services and responding to the needs of the most marginalized of rural people, women and youth” (Hafkin and Odame, 2002).

Experience gained from a number of projects, “show that ICTs can indeed help extension workers to broaden the range and increase the quality of their services that meet the information needs of farmers. However, they also show that ICTs are no ‘magic bullet’, and can only work if they are firmly embedded in new extension strategies that go far beyond the narrow current focus of ‘technology transfer’. (ICT Update, 2003)

And this may not be an easy task, “Despite the huge potential to harness ICT for agricultural development, only a few isolated projects have been initiated in India and a few in other parts of the world. Interestingly, many of these projects were started by NGOs, private organizations, cooperative bodies and governmental organizations other than agricultural departments. This shows the apathy of agricultural development departments towards incorporating ICT into their day-to-day activities.”(Meera, Jhamtani and Rao, 2004). This observation is strengthened by the results of an EFITA questionnaire data set that, “clearly suggest that ICT adoption for agriculture continues to remain a major problem justifying investment of public funds to alleviate this situation. This conclusion is augmented by recognition of the fact that successful ICT adoption is an issue of public interest involving environmental issues and rural economic viability.”(Gelb and Parker, n.d.)

### 2.3.1 Computer and Internet use and penetration

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 et al, 2003; Winrock, 2003; Marker, et. al , 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, 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 12.4% of Asia’s population has access to the Internet. Table 2-1 provides some indication of the scale of the digital divide between richer and poorer regions of the world.

**Table 2-1. Internet world usage statistics (Internet usage and population for each region)**

World Regions	Population ( 2007 Est.)	Internet Usage Latest Data	% Population ( Penetration )	Usage % of World	Usage Growth 2000-2007
Africa	933,448,292	43,995,700	4.7 %	3.5 %	874.6 %
Asia	3,712,527,624	459,476,825	12.4 %	36.9 %	302.0 %
Europe	809,624,686	337,878,613	41.7 %	27.2%	221.5 %
Middle East	193,452,727	33,510,500	17.3 %	2.7 %	920.2 %
North America	334,538,018	234,788,864	70.2 %	18.9%	117.2 %
Latin America/Caribbean	556,606,627	115,759,709	20.8 %	9.3 %	540.7 %
Oceania / Australia	34,468,443	19,039,390	55.2 %	1.5 %	149.9 %
WORLD TOTAL	6,574,666,417	1,244,449,601	18.9 %	100.0 %	244.7 %

(Internet World Stats, September 30, 2007)

Looking specifically at Asia, the statistics are even more discouraging. The region has countries at every stage of development and, as Table 2-2 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 9%. And it is these lesser developed countries that are characterized by being largely rural and agrarian.

**Table 2-2. Internet usage for Asia (Internet users and population statistics for 35 Countries and Regions in Asia)**

Asia	Population (2003 Est.)	Internet Usage Latest Data	% Population (Penetration)	% of Users
More developed countries (Hong Kong, S. Korea, Singapore, Taiwan, Japan, Malaysia, Macao)	242,547,884	158,565,513	65.37%	34.51%
Less developed countries (28 countries)	3,469,979,740	300,911,312	8.67%	65.49%

(Internet World Stats, September 30, 2007)

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, 2003). 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).

### 2.3.2 Current and emerging ICT tools used in support of sustainable development

Even looking just at the area of knowledge and information dissemination, the list of potential applications and approaches is long. It not only consists of, “online learning,



but also of the use of audio and videotapes, interactive video, VCDs, CDs, DVDs, cellular telephony, SMS, etc. Where teledensity is low and devices and delivery are high relative to local incomes, the digital divide can also be bridged by using telecentres (multi-purpose community-based ICT facilities). Community access systems such as Warana Wired Village, Cyber Grameen and Rural Access to Services through the Internet (RASI) in rural India, and the IDRC/Acacia telecentres in Africa have shown that there are viable markets for tele-learning, tele-medicine and tele-health, e-government and e-commerce in poor rural areas” (Latchem, Maru, Alluri, 2004).

What these technologies offer is an increased ability to share knowledge and information, not just from government research and extension, but from farmer to farmer. “Convergence of traditional communication practices and media with new communication technologies such as the Internet and mobile phones can greatly enhance people’s ability to share experiences and knowledge in support of agriculture and rural development.” (FAO, 2005)

This is seen as a major advantage of ICTs. In traditional approaches, “farmers are often passive recipients of didactic instruction. Messages are typically based on perceptions of farmers’ needs, or one the requirements or desires of public sector agencies” (World Bank, 1999 as cited in Richardson, 2006). ICTs will allow much freer farmer to farmer exchange and is embodied in such efforts as the Virtual Extension-Research Communication Network (VERCON). VERCON is a conceptual model that employs Internet-based ICTs to strengthen linkages among agricultural policy, research, and extension institutions and individuals (FAO, 2005).

### 2.3.3 Utilization of eLearning

“E-learning has become the general term encompassing the application of computer technologies to education, whether it occurs in face-to-face classrooms, in blended and hybrid courses, in mediated distance education contexts or in online learning environments” (Abrami et al, 2006). Many maintain that eLearning, “has the capacity to enhance learning and expand access to education and training in agriculture and natural resource management at the global, regional and local levels” (Atkinson, Beniest and Rao, n.d.). eLearning is seen as a practical way to, “extend the reach of education to broader audiences and provide ways to enhance traditional education, generating significant social and economic benefits to populations who have access to them (Intel, 2006).

Training delivered via eLearning is rising quickly in nearly every field of work. Throughout North America, Australia and Europe, eLearning in non-agricultural sectors is becoming widely used. Though no sector has reached 100% adoption, a vast majority has adopted eLearning in their training programs (Leary and Berge, 2006).

But the adoption rate of eLearning for agriculture lags far behind that of other sectors. For example, “eLearning in Canadian, European, American, and Australian agriculture falls significantly behind the current adoption rates seen in nonagricultural sectors” (Leary and Berge, 2006). And in other parts of the world, adoption of this approach is even less advanced. “E-learning for sustainability is still in its infancy and there remain many problems with online and distance education programmes. Nevertheless, these technologies are here to stay and if effectively utilized could work as a multiplier to increase the effectiveness and reduce costs of education programmes designed to support the promotion of sustainable development across the globe” (Barrett, 2002).

## 2.4 Theoretical Models Used in IT Research

To assist in sketching a picture of the agriculture eLearning adoption in Asia, several models that are commonly used for IT research have been reviewed. The existence of several related IT studies based on Rogers' diffusion of innovation theory, technology acceptance model and absorptive capacity for eLearning indicate the suitability of these models in explaining the adoption of agriculture eLearning.

### 2.4.1 Diffusion of innovation theory (DOI)

According to Rogers' diffusion of innovation model, three sets of variables, technology ownership, adopters' characteristics, and innovation attributes, have enduring impacts on the adoption of new technologies (Li, 2003). DOI theory sees innovations as being communicated through certain channels over time and within a particular social system.

This model has been applied and adapted in numerous ways in information technology research and has been used to describe the potential diffusion of expert systems in forecasting (Armstrong and Yokum, 2001); factors influencing corporate web site adoption (Beatty, Shim, and Jones, 2001); factors influencing the adoption of electronic newspapers in Taiwan (Li, 2003); factors influencing the adoption of the Internet as a teaching tool at foreign language schools (Martins, Steil and Todesco, 2004); why organizations adopt information system process innovations (Mustonen-Ollila and Lyytinen, 2003); assimilation of knowledge platforms in organizations (Purvis, Sambamurthy and Zmud, 2001); and, diffusion of innovations as a theoretical framework for telecenters (Roman, 2003).

#### 2.4.2 Technology acceptance model (TAM)

TAM which is based upon the theory of reasoned action (TRA) from the social psychology literature, postulated that technology adoption behavior is an outcome of an individual's affective response to, or attitude toward, the innovation. TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. TRA and TAM, both of which have strong behavioral elements, assume that when someone forms an intention to act, that they will be free to act without limitation. In practice constraints such as limited ability, time, environmental or organizational limits, and unconscious habits will limit the freedom to act.

Like DOI, this model has been used for several information technology studies and includes: to investigate what determines user mobile commerce (MC) acceptance (Wu and Wang, 2005); to evaluate the impact of one belief construct (shared beliefs in the benefits of a technology) and two widely recognized technology implementation success factors (training and communication) on the perceived usefulness and perceived ease of use during technology implementation. (Amoako-Gyampah and Salam, 2004); to understand Internet banking adoption and use behavior in Hong Kong (Chan and Lu, 2004); to evaluate the impact of persona-system characteristics, technical backing, and computing skill on information systems (IS) usage by Malaysian small and medium firms (SMF) (Ndubisi and Jantan, 2003); and, to understand IT adoption decisions in small business (Riemenschneider, Harrison and Mykytn, 2003).

### 2.4.3 Absorptive capacity for eLearning (ACAP)

Absorptive capacity is a limit to the rate or quantity of scientific or technological information that a firm can absorb. Conceptually, it is similar to information processing theory, but at the firm level rather than the individual level. Absorptive capacity was introduced by Cohen and Levinthal in 1990 and was extended Zahra and George in 2002 by specifying four distinct dimensions to absorptive capacity: acquisition, assimilation, transformation and exploitation.

When absorption limits exist, they provide one explanation for firms to develop internal R&D capacities. R&D departments can not only conduct development along lines they are already familiar with, but they have formal training and external professional connections that make it possible for them to evaluate and incorporate externally generated technical knowledge into the firm. In other words, a partial explanation for R&D investments by firms is to work around the absorptive capacity constraint.

Information technology studies using this model include: to examine the antecedents of knowledge transfer in the context of such an interfirm complex information systems implementation environment (Ko, Kirsch, and King, 2005); to understand knowledge brokering from the perspective of IT professionals as they reflect upon their work practice (Pawlowski and Robey, 2004); and, to illustrate the dynamics of knowledge development and transfer in more and less virtual teams (Griffith, Sawyer, and Neale, 2003).

### 2.5 Summary

New agricultural practices and products are an essential part of the development process in most developing countries. The evidence is clear that research for development generates agricultural growth and reduces poverty. And it is known that promoting

agricultural development in developing countries through research and extension is a well-established approach.

Traditionally, a major part of this has been the role of agricultural extension services but there is ample and growing concern that agricultural extension is in a serious crisis. The agricultural extension systems in the Asia have experienced a continuous decline in their effectiveness due to a variety of reasons.

Given this context, it is no wonder that much attention is currently being given to developing and evaluating alternative mechanisms and tools for information and knowledge dissemination.

ICTs are increasingly being seen and suggested as an alternative to the traditional mechanism in improving rural livelihoods. They are seen to be cost effective and practical tools to facilitate information delivery and knowledge sharing among farmers, extension agents and other stakeholders. One of the most popular ICT applications is eLearning. With this, we go beyond information sharing and use the available technologies to enhance learning and expand access to education and training in agriculture.

But the use of the eLearning for Agriculture in Asia is still low. Several models that are commonly used for IT research such as Rogers' diffusion of innovation theory, technology acceptance model and absorptive capacity for eLearning seem to offer suitable framework in exploring this.

## Chapter 3. Agriculture eLearning in Asia and Beyond

### 3.1 Introduction

This chapter presents some of the more pertinent research efforts of the author in the area of eLearning for agriculture. The first highlights the important role of the Internet in this process. The second is a case study illustrating how eLearning was used as an alternative for delivering tertiary education to underserved provincial students in Cambodia. The third reviews the limited efforts by major international agriculture organizations to develop and deliver eLearning products and describes how two small non-profit groups dealt with the challenges of implementation.

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

*“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.

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 (2002), “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 (Ramírez 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 “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, 2003).

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 researchers 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-profit – 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, 2003).

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

Berdegú 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, 2003, 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 2-1 provides some indication of the scale of the digital divide between richer and poorer regions of the world.

Looking specifically at Asia, the statistics are even more discouraging. The region has countries at every stage of development and, as Table 2-2 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).

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, 2003). 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, 2003).

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 (2003) 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://www.digitaldividend.org/clearinghouse/index.htm> ). 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-enabled 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 the 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 (as cited 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:

1. Rethink current faith in the ability of the private sector to adequately serve the rural sector.
2. Target public sector and donor funding towards the most efficient and effective agencies and organizations.
3. Develop and follow a clear strategy for promoting and supporting ICT-based information sharing and knowledge development in rural communities.
4. Provide sustained and substantial support for Internet-based initiatives.
5. 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.

### 3.3 eLearning in Higher Education Makes Its Debut in Cambodia: Implications of the Provincial Business Education Project

*The modern world is undergoing a fundamental transformation as the industrial society of the twentieth century rapidly gives way to the information society of the twenty-first century. This dynamic process promises a fundamental change in all aspects of our lives, including knowledge dissemination, social interaction, business practices, political engagement, media, education, health, leisure and entertainment (Sehrt, 2003).*

Developing countries face numerous challenges as they strive to enter and successfully compete in the new global economy briefly described above. Although often blessed with the traditional production factors of land and labor they are generally severely constrained by inadequate levels of physical and financial capital and, perhaps most important in today's knowledge-based economies, human capital.

Human capital, the quality of labor resources which can be improved through investments, education, and training, is fast becoming the key to success for both individuals and nations. But the means to develop this critical resource are expensive and

difficult to provide in developing countries where educational systems are often weak and under funded, and access to education and training, limited and inequitable.

Addressing this situation through traditional means particularly for developing countries will be costly and potentially ineffective. As the recent United Nations Educational, Scientific and Cultural Organization (UNESCO) Meta-survey on the Use of Technologies in Education (2004) concluded,

*More of the same is just not going to work. Building more classrooms, and training more teachers to reach those currently unreached by education systems is unrealistic and will not be enough to meet the Education for All (EFA) challenge. Some countries are already spending considerable percentages of their Gross Domestic Product on education and have little room for maneuvering. In addition, traditional education models will no doubt be unable to achieve educational empowerment effectively in the emerging Knowledge Societies.*

Just as important is that traditional means of educational development will only bring education in developing countries up to a point already being left behind by education in the more advanced knowledge economies (Wedel, 2000).

eLearning is increasingly being suggested as an alternative to, or a way to enhance, traditional educational approaches. eLearning is the most recent evolution of distance learning - a learning situation where instructors and learners are separated by distance, time or both. eLearning (sometimes also defined as 'Internet-enabled learning'), uses network technologies to create, foster, deliver, and facilitate learning, any time and anywhere. Potential advantages of this approach for developing countries are clear.

eLearning can match the needs of non-traditional students, increase the educational facilities available to traditional students, provide cost-efficient yet effective training options and give learners in developing nations an invaluable means of gaining a first world education tempered by third world experience.

Although eLearning is increasingly being adopted in developed countries to reach both traditional and non-traditional students, it is still relatively unknown and unused as an educational approach in developing countries. Reasons for this are numerous. There is a general skepticism about the effectiveness of eLearning as compared to more traditional approaches. It takes specialized skills and knowledge to develop and implement online courses that are not generally found in most developing country educational institutions. Internet connections and phone lines are unreliable. Bandwidth is narrow resulting in slow access to web sites. Computers in general are not widely available and Internet connected computers even more so, particularly in areas outside of major urban centers. Traditional approaches to teaching and learning may also be a factor. In many developing countries, students are most familiar with a didactic approach and do not necessarily understand the instructor as a "facilitator" rather than as a "teacher" in the traditional sense. Added to these factors is the relative and absolute higher cost of Internet access in developing countries, most often as a result of misguided telecommunications regulations that discourage the development of Internet-access service through competition.

All of these impeding factors can certainly be found in Cambodia, one of the least developed countries in the world and now engaged in a critical effort to develop its human resources after decades of intellectual decay. In an effort to assess the potential of eLearning as a mechanism for developing human capital in this country, a number of

partners came together to implement the “Provincial Business Education through the Community Information Centers project” in Cambodia. This paper is a report on the activities and results of the project and an analysis of what was learned during and after project implementation.

### ***Project background***

Cambodia is a country currently engaged in a concerted effort to overcome years of stagnation and decay as a result of political instability and war that “destroyed not only the physical infrastructure but the intellectual one as well” (Jones, n.d.). Probably more than any other single factor, success in this effort will depend on being able to redevelop the country’s educational system. It is widely recognized that, “as this conflict-scarred, largely agricultural country in Southeast Asia tries to rebuild itself, poor education remains a critical stumbling block, slowing down labour productivity and weakening Cambodia's ability to create a sound economic base” (Chatterjee, 2006).

The magnitude of this problem is severe. As Ashwill (2000) reports, the country’s educational system, a cornerstone of any viable society, is in shambles. According to the United Nations, of 1,000 Cambodians born today, 290 will never go to school, 390 will repeat the first grade, and 500 will not progress beyond the primary level. Only 27 out of 1,000 who enter primary school will graduate from high school.

And the situation is, if anything, more grave in terms of higher education “with just 1.2 per cent of the population enrolled, compared with an average of 20.7 per cent in all the ASEAN countries” (Cambodia Cultural Profile, 2005).

The goal of the ‘Provincial Business Education through the Community Information Centers project’ was to assess the utility of eLearning as an approach to expanding the



reach of educational opportunities in higher education in support of economic and social development. The importance of higher education in the development process is now recognized. As Bloom, Canning and Chan (2006) observe, while higher education is often considered to be “an expensive and inefficient public service that largely benefited the wealthy and privileged. Now it is understood to make a necessary contribution, in concert with other factors, to the success of national efforts to boost productivity, competitiveness and economic growth”.

A key objective of the project was to determine if eLearning could address the challenges associated with reaching students outside of Phnom Penh. These provincial students represent the vast majority of Cambodia’s potential learners as less than 10% of Cambodians live in Phnom Penh Province (Census of Cambodia, 1998). Unfortunately, almost all opportunities for higher education are available only to those willing or able to move to the capital city and few provincial students are prepared, or can afford, to leave homes, families and jobs to move to the capital for extended periods.

The project was also interested in seeing if eLearning could work given the low level of familiarity with computers and computer technology. The vast majority of Cambodian students have had very limited experience with computers. Of the 698 secondary schools, only 13% are connected to electricity, 8% have generators and 4% have solar panels. 75% have no power supply at all. Very few state schools have computers. Only 6% of lower-secondary schools and 35% of upper-secondary schools have between 1 and 2 computers for administrative purpose. Only 8 upper-secondary schools have more than 10 computers (Cambodian Ministry of Education, Youth & Sport, n.d.). Computer availability is severely limited with 2.2 computers per 1,000 citizens, lower even than Papua New Guinea (13.7) and considerably behind the regional leader Malaysia (319.7) (Statistical

Annexes, n.d.). Additionally, Internet penetration in Cambodia is extremely limited and currently estimated at only 0.3 % of the population with most of this access is in Phnom Penh. By comparison, similar estimates of Internet penetration for the region are 9.9% and for the world 23.1% (Internet Usage in Asia, 2007).

### ***Project partners***

This effort was part of a larger project funded by United States Agency for International Development Asia and the Near East (USAID/ANE) through the dot-Gov Program and implemented by Internews Network, Inc. ([www.internews.org](http://www.internews.org)) and The Asia Foundation ([www.asiafoundation.org](http://www.asiafoundation.org)). A select number of Community Information Centers (CICs- [http://www.cambodiatic.org/about\\_project\\_en.asp](http://www.cambodiatic.org/about_project_en.asp)) were responsible for providing internet access, creating an enabling learning venue for students and helping students learn the Khmer eLearning platform. The academic partner was the International Institute of Cambodia (IIC - [www.iic.edu.kh](http://www.iic.edu.kh)), an innovative leader in providing educational opportunities in the fields of business and Information and Communication Technologies in Cambodia. The non-profit Sustainable Development eLearning Network (SDLEARN - [www.sdlearn.net](http://www.sdlearn.net)) provided on-line and face to face “Train-the-Trainer” courses for IIC faculty and developed and provided an eLearning platform which was then configured to use Khmer Unicode. This learning management system was then installed on servers maintained and provided by the Japanese Ministry of Agriculture, Forestry and Fisheries Information Network (<http://www.maffin.ad.jp/>). Additional support was provided by Khmer OS, ([www.khmerOS.info](http://www.khmerOS.info)), a local NGO responsible for training IIC instructors, CIC staff and students in the use of the Khmer Unicode keyboard.

### ***Project development and implementation***

The project was carried out in a phased approach with the first phase focused on establishing an implementation plan that guided the activities of all the partners. In a consultative process, the project goals, objectives and partner responsibilities were refined. Particular attention was given to the needs of the instructors chosen to design and implement the eLearning courses to be made available. SDLEARN staff provided face to face consultation and guidance on online educational pedagogical theory, online course design and best practices in eLearning technology. They also ensured that the necessary infrastructure and personnel were available for the conversion of the existing paper-based materials into digital formats and assessed the suitability of the Community Information Centers as learning venues. Details of student identification, recruitment and orientation were discussed with IIC staff and administrators. It was also during this phase that all the partners agreed to use Khmer Unicode for course content and collaboration tools such as email, online discussion boards and chat rooms.

Experience has shown that there is no better way to learn how to design and implement an online course than to actually participate in one. Therefore, as part of phase 2, SDLEARN conducted a six-week online train-the-trainer course “eLearning Course Design and Facilitation” for 25 IIC faculty members. Participation in this course reinforced what had been covered in the face to face sessions with IIC and the hands on practice sessions gave participants exposure to SDLEARN’s learning management system (LMS). The course focused on how to use the tools most commonly employed in an online learning environment, basic internet concepts, what it takes to succeed in an online course, what is expected of an online course facilitator, proven facilitation

strategies, how to deal with common facilitation problems and how to design and develop an effective online course.

In addition to providing participants with the needed online teaching skills, an important outcome of this phase was the creation of a community consisting of those involved in the administration of the eLearning program and the course facilitators. This community provides an ongoing mechanism for sharing of information and a way to ask questions and receive answers and guidance from experts and peers.

Upon completion of the online course for the IIC faculty, the third phase dealt with logistical, administrative and technical details for designing and uploading the courses, promotion of the program, and recruitment of students. One hundred forty eight scholarships were awarded evenly to male and female students in 5 provinces (Banteay Meanchey, Kampong Cham, Kampong Som, Pailin and Pursat). Scholarships covered tuition fees and 5 hours of free internet access per week from the CICs. The 3 courses implemented and scholarships awarded are detailed in Table 3-1.

**Table 3-1. First round scholarship distribution by course and gender**

Course Title	Number of Male	Number of Female	Total
Microeconomics	31	19	50
Principles of Marketing	23	27	50
Fundamental Accounting Principles	20	28	48
Total	74	74	148

Since this project was the first attempt at distance education and online learning in Cambodia, a one-day face to face orientation immediately followed selection of the scholarship recipients. This orientation was intended to introduce students to the online program, IIC, the roles and responsibilities of students, lecturers and CIC staff, and provide some technical guidance on how to sign up in the learning management system.

Upon the successful implementation of the 3 courses, a decision was made to offer 4 additional online courses including 2 newly developed ones for students from Kampong Som, Kampong Cham, Pailin and Banteay Meanchey provinces. This was done to consolidate the notion of distance education in Cambodia and to capitalize on the momentum gathered from the first courses offered. To support this second round of course offerings and to build the capacity of IIC to continue to offer online courses in the future, SDLEARN conducted an additional “eLearning Course Design and Facilitation” online course for 24 IIC faculty members. The 4 courses subsequently implemented by IIC faculty and scholarships awarded are detailed in Table 3-2.

**Table 3-2. Second round scholarship distribution by course and gender**

Course Title	Number of Male	Number of Female	Total
Principles of Marketing	11	8	19
Introduction to Business	4	3	7
Fundamentals of Management	31	16	47
Fundamental Accounting Principles	23	24	47
Total	69	51	120

Based on experience gained during the implementation of the first round of courses, a number of adjustments were made in the way the second round was conducted. Promotional and recruitment activities were expanded and targeted at potential candidates who better fit the profile of successful students. These were identified as women, recent high school graduates and people not fully employed. The orientation program was also extended to one week to better prepare students for the online learning. Students were given a longer time to practice typing in Khmer Unicode with the Khmer keyboard and get accustomed to the LMS. Another activity added was the training of CIC staff to provide them the necessary skills and knowledge to better support the students. This was done in recognition of the important role that they played in keeping the students motivated and on-track in the online courses.

A major effort was made throughout the project to monitor, document and evaluate progress and outcomes. During the implementation of the courses, SDLEARN staff and a Khmer education consultant carefully monitored project activities and student reactions and the difficulties they encountered. IIC staff conducted regular assessments of student

performance and awarded numerical grades based on assignments and examinations. Two formal evaluations of the project were also conducted by SilkRoad Cambodia ([www.silkroadcambodia.com/](http://www.silkroadcambodia.com/)) – one at the end of Round 1 and the other at the end of the project. These evaluations involved extensive face to face and phone interviews with students and other stakeholders (Hutchinson, 2005).

### ***Results and discussion***

Under this project, two “semesters” of online business courses were delivered to students in five provinces. Two hundred eleven out of a starting group of 272 Cambodian students successfully completed one or more of the 5 online courses developed under the project. A description of these students and their performance in both Round 1 and Round 2 is provided in Table 3-3.

**Table 3-3. Characteristics and performance of Cambodian students who registered for project eLearning courses**

Categories	Round 1			Round 2		
	F	M	Total	F	M	Total
Age Group						
< 20	19	8	27	15	9	24
21-25	49	43	92	27	23	50
26-30	4	19	23	2	19	21
> 31		4	4		10	10
Missing value	5	1	6	7	8	15
Mean age	22	24	23	22	26	24
Total	77	75	152	51	69	120
Occupation	F	M	Total	F	M	Total
Student	44	28	72	32	25	57
Working	28	46	74	19	44	63
Missing value	5	1	6	0	0	0
Total	77	75		51	69	120
Grade	F	M	Total	F	M	Total
A	13	3	16	13	15	28
B	19	18	37	19	21	40
C	18	9	27	8	16	24
D	13	16	29	6	4	10
Fail	4	9	13	5	13	18
Incomplete	10	20	30	0	0	0
Total	77	75	152	51	69	120

Despite the disadvantages faced by these students, their performance and achievements were considered to be excellent. Dropout rates were low at 20% in Round 1 and 0% in Round 2 which compares favorably with online students in more technologically advanced higher education settings in developed countries. (Carr, 2000; Dublin, 2003; Flood, 2002; Nash, 2005). More than three quarter of these students received passing



grades which was similar to other Cambodian students at IIC enrolled in traditional classroom sessions.

The views of D'Antoni's about the critical importance of the 4 "A's" of eLearning (as cited in Daniel, West, D'Antoni, & Uvalic-Trumbic, 2005) seem to provide a basis for explaining why these students did so well. D'Antoni contends that if courses are easily accessible, the content is appropriate, participation is rewarded with formal accreditation and learning is affordable, the chances of success are significantly increased. In the case of this project, a concerted effort was made to ensure all 4 criteria were met.

The CICs were the main mechanism to ensure accessibility in terms of hardware, software and internet connectivity as well as in the equally important area of helping inexperienced users become familiar with the technology. They provided a comfortable learning environment that is not generally available in most provincial towns and expert technical and even pedagogical support. The importance of the contributions of the CICs and CIC staff was recognized by students who indicated that they considered CIC staff instrumental in creating a supportive learning environment. Ninety eight percent of the surveyed students rated the CICs as helpful or extremely helpful in the level of support provided and the connectivity they offered (Hutchinson, 2005).

All of the courses implemented under this project were delivered, monitored and accredited by a well respected university in Cambodia. Students who successfully completed all the course requirements and who scored sufficiently high on assignments and tests were awarded with a formal certificate from the International Institute of Cambodia and eligible for university credit toward a degree.

The course content was certainly appropriate given the needs of the country and the interests of the students in improving their career prospects. The change to a market economy since 1993 has facilitated the growth of private higher education establishments where some of the most popular courses offered are in ICT related subjects, foreign languages and business (Cambodian Ministry of Education, Youth & Sport, n.d.). The importance of the subject matter was confirmed by alumni feedback with more than 85% of students indicating that they felt that their participation in an online business course had helped their job prospects (Hutchinson, 2005). That the content and interaction was all in the local language Khmer must also be recognized as a factor. The development of a Learning Management System that allowed the use of Khmer Unicode for content delivery and communication was instrumental in making this possible.

Every attempt was made to make these students' first introduction to eLearning affordable which in Cambodia is primarily related to the prohibitively high cost of internet access. Internet access costs in Cambodia are the 3<sup>rd</sup> highest in the Asia-pacific region at an average of US\$85.40 per month (compare with Singapore at \$10.56). And given the disparities in wealth between countries this absolute greater price is even more of a constraint. For example, in Singapore, internet access is equivalent to 0.5% of monthly GDP per capita. In Cambodia, internet access costs almost 4 times the average monthly income (Nicol, 2003). In the first round, all students competed for full scholarships covered by project funds covering tuition fees and 5 hours per week of free Internet access through the CICs. In round 2, two types of scholarships were awarded – full as well as partial scholarships which covered 50% of the total costs.

In addition to the general factors mentioned by D'Antoni, there were also several factors perhaps unique to Cambodia that were considered to have contributed to the success of

the project. It must be recognized that, for students living outside of Phnom Penh, online courses represent the only real option for accessing accredited, higher education learning opportunities. Cambodian students in the provinces have extremely limited choice and if they cannot move to Phnom Penh for extended periods they are essentially denied access. This is even more of a problem for provincial women whose mobility is even more constrained than their male counterparts. Even from their early years, “For reasons on personal security, girls are not allowed to travel long distances and live away from family to attend upper secondary schools in provincial towns” (Ledgerwood, n.d.). This situation remains even after women graduate from upper secondary school and represents a major impediment for women interested in pursuing higher education. Partly as a result of this inequity, women represent less than one third of the total population of higher education students in Cambodia (Mak, 2005). That women represented half of the participants in this project suggests that women are as interested as men in enhancing their economic futures by furthering their education. Additional evidence for the attractiveness of online learning for provincial Cambodian women can be found in their performance which was higher than that of their male classmates. A t-test on the final grades earned by all the students from the 2 rounds of courses showed that women’s mean final grades were significantly higher than men’s as measured by performance on assignments and a mid-term and final examination. (see Table 3-4)

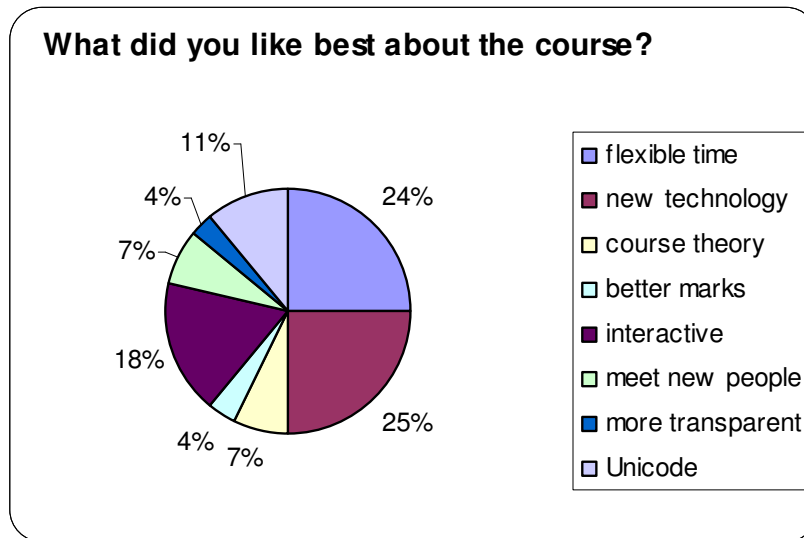
**Table 3-4. Result of t-test on the final grades of all students who participated in the provincial business education project in Cambodia**

Round	Female			Male			t-value
	N	Mean	SD	N	Mean	SD	
Round 1	67	70.897	16.8426	55	61.3000	22.9257	-2.58436**
Round 2	51	68.918	22.0937	69	58.3925	28.4163	-2.28195*

\* p < .05

\*\* p < .01

Survey results provided some additional reasons for the high student achievement and completion rates. These included students' appreciation of the ability to learn about and use technology and the flexibility online learning allows. In the survey of graduates, 25% cited the technological nature of the delivery system as one of the things they liked best about the course. Almost equally valued was that the online format allowed them to study in their own time suited to their individual schedules. Flexibility was cited as a desirable factor by 24% of the survey respondents. Interestingly, only 7% of graduates indicated that they liked learning the actual course content and theory (see Figure 3-1).



**Figure 3-1. Characteristics of online courses most appreciated by the Cambodian students.**

Finally, some credit has to be given to the local and international partners behind the design and implementation of the project. They demonstrated a clear understanding of individual comparative advantages, roles and responsibilities and an understanding of student needs and circumstances. They recognized the importance of close monitoring and documentation of project activities and results and were able to modify activities during implementation based on student and partner feedback. That dropout rates declined to 0% in Round 2 can be credited to a large degree to partners adjusting the emphasis given to student orientation before the courses started and to more comprehensive on-site support during the semester.

### *Summary and conclusions*

The “Provincial Business Education through the Community Information Centers (CICs) project” was an ambitious effort to use eLearning to reach underserved provincial students in Cambodia with quality accredited educational opportunities in business theory and skills. Over a period of 18 months, project partners successfully delivered two “semesters” of online business courses in Khmer language to students residing in five provinces outside Phnom Penh. Key outputs included the establishment of a distance learning program at the International Institute of Cambodia, the creation of a core group of experienced online course developers and facilitators, experienced student support personnel at the Community Information Centers, an open source Khmer language Learning Management System based on Khmer Unicode standards and the establishment of a strong network of mutually supportive partners. Two hundred seventy two provincial Cambodian students took advantage of one or more of the five online courses developed under the project to improve their knowledge of key business topics and over three quarters of these individuals scored sufficiently high on exams and assignments to receive accredited certification. These results strongly suggest that eLearning can be a successful approach to providing quality higher education to underserved provincial students in Cambodia and that this approach can open new opportunities for educational institutions to reach out to underserved women and men in Cambodia via online courses.

Key factors associated with these results were that that the courses met the most critical standards for success. Every attempt was made to ensure that they were easily accessible, the content was appropriate, participation was rewarded with formal accreditation and the learning was affordable.

Other contributing factors identified by students were that online learning gave added value in that eLearning allowed students to develop IT skills while also learning subject matter related business. Participation in these courses provided an opportunity to learn how to use computers and digital communication tools. This finding tends to confirm the ideas of Wedel (2000) who noted that, a key advantage to using technology for education is that the use of technology is in itself a crucial education. Computers and the Internet are particularly suited for self-learning and for many other uses. So, for example, by learning to use the Internet to take a course in history, the student also learns language and Internet skills that will be valuable for finding international markets for local handicrafts or getting the latest crop prices on world markets.

Given that nearly half of the students were working adults, it is not surprising that a much appreciated aspect of the courses was its flexibility in allowing learners to study at the times most convenient to their schedules. Without this flexibility, many of these students would not otherwise have been able to participate in a formal learning program.

But these factors are not so different from what makes eLearning work anywhere else in the world. In the context of Cambodia, and for students living outside of Phnom Penh in particular, a major factor has to be that these courses represented the only opportunity for provincial students to further their education. That they could continue their education without leaving home seemed to be an especially attractive aspect of eLearning for provincial women learners. While women currently represent less than one third of the total population of higher education students in Cambodia nearly 50% of the students who registered for and participated in the online courses were women. Women definitely demonstrated their ability to learn online and scored significantly higher on tests and assignments than their male classmates.

While there are still major difficulties to overcome and much work to be done, it is maintained that the results of this project provide strong evidence that eLearning can be a powerful approach for reaching underserved men and women learners living in the country's provinces. Perhaps the most serious impediment to more widespread adoption of eLearning will be the prohibitive cost of internet access. Survey responses showed that students would be willing to pay between \$20 to \$30 for an accredited course and that they would be unwilling to pay extra for internet access. Whether or not this level of effective demand will be economically attractive for educational institutions or if there are feasible options for providing affordable internet access is not yet known. There is definitely a real danger that, "Unless access can be subsidized, either by donors or the government through a universal access policy the full potential of online learning in Cambodia will remain underutilized" (Tweedie, 2006).

It is certainly hoped that the country will overcome this and other constraints as there is strong evidence that eLearning can and does work in Cambodia and perhaps in other countries facing similar challenges. As stated in an article published in the United Nations Chronicle:

*If education and capacity-building are critical steps for entering into the new global economy, e-learning should be considered a critical facet of basic development, an alternative medium of capacity-building and a means to people's empowerment (Sehrt, 2003).*

#### 3.4 eLearning for International Agriculture Development: Dealing with Challenges

*"Today, farmers feed 6 billion people. However, some 800 million people go to bed hungry every night and 166 million children are malnourished. At the same time, current agricultural practices are responsible for dead zones at the mouths*



*of the world's rivers and rapid species extinctions. By 2050, the human population will grow by two to three billion. The challenge for agriculture is not only producing more food but producing it in a sustainable manner while raising living standards for the poor, many of whom live and work in rural areas. All this must be done while dealing with the uncertain consequences of global warming and geopolitics. The solutions will include new policies, new technologies, and new production practices.” (Nelson, 2006)*

This assessment succinctly illustrates the current major challenges facing global agriculture and sustainable food production. Even with sufficient production of food, many go hungry. Efforts to raise production adversely affect the environment and the ability of the agricultural resource base to remain productive for future needs. The environment is changing, energy costs are rising, water resources are decreasing and competing with industrial and domestic needs. With prosperity, has come heightened customer expectations for better taste, health and nutrition and environmental stewardship from farm to table.

Underlying these situation, of course, the ever increasing human population, expected to, “increase by 2.5 billion over the next 43 years, passing from the current 6.7 billion to 9.2 billion in 2050. This increase is equivalent to the size that the world population had in 1950 and it will be absorbed mostly by the less developed regions, whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050.” (Asian Forum of Parliamentarians on Population and Development, 2007)

Responding to these complex challenges will require efforts in a number of areas. Capital is critical and credit is notoriously limited for smallholder and subsistence farmers. In many countries, national policies tend to ignore the needs of rural communities in favor

of urban centers and industrial enterprises. In developing countries, 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. (Abdon and Raab, 2005)

While addressing these and a host of other limiting factors could have a major impact on agricultural development, access to information and knowledge has long been recognized as a key element. As early as 1961, in a seminal work in human capital theory, Schultz observed that education explains the greater part of total factor productivity. Since then, Schultz's ideas have been substantiated by numerous studies (Lockheed, Jamison & Lau, 1980; Phillips, 1994; Moock, 1973; 1981; and Gurgand, 1993 as cited in Atchoarena and Sedel, 2003)

The challenge, however, has long been in getting knowledge and information to farmers and rural communities. Leary and Berge (2006) note that a host of agricultural "problems do have workable solutions, yet the global difficulty is getting the appropriate information to farmers." The World Bank observes that. "The appropriate mechanism to organize and manage research and technology dissemination for knowledge-intensive agriculture is still being debated". (as cited in Abdon and Raab, 2005)

While getting the essential knowledge to those who need it most remains difficult and expensive much optimism has been generated as a result of the increased growth and sophistication of new electronic information services—even in remote rural areas. Information and communication technologies (ICTs), and such specialized ICT applications as eLearning, are offering new options to deliver knowledge and information to farmers directly and indirectly through knowledge intermediaries. eLearning is

increasingly being mentioned as a viable approach to overcome the challenges of information and knowledge delivery.

“eLearning can benefit every agricultural community around the world, from research scientists in American universities to the poor subsistence farmers of developing countries. It can benefit persons of all ages, all locations, and bridge the gaps created by mountains, deserts, oceans, wars, and political boundaries. eLearning in agriculture can assemble resources and knowledge from distant places that may otherwise be unobtainable. It can connect farmers with far away researchers and experts. It can also dramatically increase the numbers of farmers who can be reached by single training programs”. (Leary and Berge, 2006)

But even though the potential benefits of this approach are exciting, the adoption of eLearning for agricultural development, particularly in or for developing countries where agriculture is so critical, has been slow to take off. The challenges facing eLearning are real and well documented and pioneers in this field are experimenting and learning about approaches that can make this work. In this paper, the authors would like to share challenges they have faced in using eLearning for agriculture, what they have learned about ways this approach can be made to work and what can be done to further promote its adoption.

### ***Current status of eLearning for agricultural development***

eLearning is defined in a variety of ways but perhaps the most appropriate is the one advanced by Stockley (2003). According to him, eLearning is:

*The delivery of a learning, training or education program by electronic means.*

*E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material.*

A quick Internet search will yield remarkably few results with eLearning opportunities related to agriculture. The majority of the links found are primarily position and research papers on pilot efforts and a few online degree programs from agricultural universities – primarily in Western and predominantly in the United States. Almost nothing can be found on eLearning developed or delivered by developing country organizations or targeting developing country learners.

Even looking closely at the major international agricultural development entities like the United Nations Food and Agriculture Organization (FAO) and the Consultative Group on International Agricultural Research (CGIAR), it is clear that the development and delivery of eLearning targeting agricultural producers or knowledge intermediaries is limited. Although a considerable and increasing amount of agricultural information is being made available through the Internet, online education is not.

A glance through the list of FAO's eLearning products, either developed by FAO itself or in collaboration with other agencies, indicates that the focus of their eLearning efforts is primarily agricultural policy makers, information managers and select research scientists. Some of the major FAO eLearning products and programs (<http://www.un.org/ecosoc/innovfair/FAO.pdf>) include:

- Information Management Resource Kit: A series of eLearning modules to build understanding and skills of individuals responsible for information management

capacity at national and local levels to manage and share information  
([http://www.imarkgroup.org/modulelist\\_en.asp](http://www.imarkgroup.org/modulelist_en.asp))

- Food Security Information for Action: A series of eLearning courses on the collection, management, analysis, and reporting of food security information. The target audience includes technical professionals as well as policy formulators and programme managers monitoring progress in poverty reduction, and meeting food security goals and targets ([http://www.foodsec.org/dl/dlintro\\_en.asp](http://www.foodsec.org/dl/dlintro_en.asp) )
- The Right to Adequate Food: A series of eLearning materials are to support the progressive realization of the right to adequate food. For use by FAO and UN staff, duty bearers at national level (legislators, parliamentarians, institutions, judiciary, policy makers), as well as NGOs, civil society organizations and social movements dealing with human rights ([http://www.fao.org/righttofood/kc/dl\\_en.htm](http://www.fao.org/righttofood/kc/dl_en.htm) )
- Enhancing Participation in Codex Activities: An eLearning course which explains the organization, management and procedures of the Codex Alimentarius Commission, and provides guidance on developing national Codex structures and activities. For government officials, as well as representatives of food industry, consumer groups, and observer organizations. (<http://www.fao.org/docrep/008/y5884e/y5884e00.htm> )

- The Joint FAO/IAEA Programme on Nuclear Techniques in Food and Agriculture assists Member Countries of FAO and IAEA to use nuclear techniques and related biotechnologies for developing improved strategies for sustainable food security. (<http://www-naweb.iaea.org/nafa/fep/news-learning.html>, <http://www-naweb.iaea.org/nafa/fep/elearning/courses.html> )

Like FAO, the CGIAR Centers have focused primarily on the publication of online information resources and offer relatively few eLearning opportunities. An initial system-wide effort in this direction is the CGIAR Learning Resources Centre - <http://learning.cgiar.org/> which enables centers to produce and maintain online courses where users can access a repository of CGIAR Centers' learning objects (558) and other training resources, as well as a few Web-based training courses.

Another CGIAR initiative is The Global Open Food and Agriculture University. <http://www.openaguniversity.cgiar.org/index.htm>. This is a program for open distance learning and capacity strengthening that serves traditional and open universities in developing and developed countries. It aims to provide resources that these universities can take advantage of to strengthen their master's degree programs in agriculture.

### ***Two eLearning for agriculture organizations***

While the major international agriculture organizations have made only limited efforts to develop and deliver agricultural eLearning products, a number of small, non-profit groups have attempted much more. The authors have considerable experience with two organizations focused entirely on the use of eLearning for agricultural development.

*The Asia-Pacific Regional Technology Centre (APRTC)*

APRTC was an independent, non-profit organization established with the support of the International Crop Science Industry. It was dedicated to improving the welfare and knowledge of developing country farmers and the promotion of sustainable agricultural practices. A priority activity of APRTC was agLe@rn - an eLearning program taking advantage of modern information and communication technologies to address the continuing educational needs of agricultural educators and other professionals who serve and support farmers and farming communities.

APRTC began operation in early 2001 and graduated its first students in May of that year. By the time it was dissolved at the end of 2003, it had made 33 offerings of 7 courses on sustainable agriculture and natural resource management which represented almost 900 learning opportunities for a widely dispersed student body. Although primarily attracting participants from developing countries in the Asia-Pacific region (86%-20 countries), agricultural professionals from other regions also signed up for and participated in agLe@rn courses (8% Africa-17 countries, 4% Latin America-9 countries, 2% Other). Alumni represented all major agricultural stakeholder groups with academics representing 40% of the total, government 20%, private sector 24% and NGOs 13%.

APRTC's portfolio consisted of 7 online courses which are archived at - <http://www.sdlearn.net/APRTC/index.asp> :

1. Digital Literacy for Agricultural Professionals
2. Introduction to Integrated Pest Management (IPM)
3. Integrated Pest Management in Cotton
4. Integrated Pest Management in Irrigated Rice

5. Basics of Vegetable IPM
6. Responsible Pesticide Use
7. Integrated Soil Fertility Management

In an effort to find more about participant's views on and use of APRTC's eLearning opportunities, a survey was conducted in 2003. Survey results showed that over 90 percent of APRTC alumni felt that they gained very much or much knowledge and that what they gained was worth the effort. Most (83%) were also using agLe@rn course materials and references and incorporating them in their own teaching and training activities. With only one exception, all respondents indicated that they had passed on something of what they learned in the courses to colleagues, students and/or farmers. A typical alumnus shared agLe@rn knowledge with an average of 74 other people and those who took earlier courses with many more.

*Sustainable Development eLearning Network (SDLEARN)*

With the discontinuation of funding from the International Crop Science Industry, the individuals most involved with APRTC were able to secure other funding sources and continue to offer sustainable agriculture related online courses for agricultural professionals. APRTC was subsequently reincorporated as the Sustainable Development eLearning Network (SDLEARN). One major activity was "Promoting human resource development for sustainable agriculture in the GMS: Taking advantage of eLearning", this project developed and deployed a web-based resource to promote learning and sustainable agriculture in the Greater Mekong Sub-region (GMS). Funding was provided under Rockefeller Foundation's Learning Across Boundaries in the Greater Mekong Sub-region (LAB) initiative.



This project had multiple direct and indirect goals. The main focus was to provide online educational opportunities in the area of sustainable agriculture and to upgrade the knowledge and skills of agricultural educators and agricultural development practitioners living and working in the GMS. This project was also designed to give professionals in the agricultural sector a better understanding of how to use the Internet and online resources to access and evaluate relevant information, communicate quickly with distant peers and acquire a basic skill set for life long learning.

Three online courses were implemented primarily targeting agricultural professionals and educators in the GMS. These were

- “Digital Literacy for Development Professionals”,
- “Fundamentals of Integrated Pest Management” and
- “Fundamentals of Integrated Soil Fertility Management”.

By the end of the project, 120 learning opportunities had been taken advantage of by a total of 95 individuals from 12 different countries. Seven students participated in 3 courses, 11 in 2 courses and 77 in just one course. Overall, 45% of the participants were women. These individuals were employed in 45 different organizations and represented a wide variety of agricultural sectors.

Students overwhelmingly indicated that they thought it was effective way to learn and the information was useful. Most indicated that they had changed some aspect of how they went about their jobs and that they were more effective and efficient as a result of what they learned in the online courses. All thought additional opportunities for learning should be made available for their own professional continuing education as well as for upgrading the knowledge and skills of other professionals in their countries.

### *Challenges faced*

While the above descriptions may give the impression that delivering these courses was a relatively simple and straightforward effort, it must be made clear that a number of challenges had to be dealt with. Leary and Berge (2006) looked at the major challenges of eLearning in national and international agricultural development and their study provides a good framework for discussing challenges we faced.

In their paper they identified the following key challenges:

- Gaps between trainers and designers
- Challenges faced by trainers/instructors
- Challenges faced by students/farmers

#### *Gaps between trainers and designers.*

Leary and Berge (2006) clearly documented deficiencies in educators' inability to bridge the technical divide. Even if they can identify the knowledge and skills most needed by the students and farmers, these educators then have considerable difficulties in presenting material in an appropriate, user friendly design so that eLearners can translate that information into applicable solutions on the farm.

In our experience, however, this was not a particularly serious challenge except in the very early stages. In both APRTC and SDLEARN, courses were designed by instructional designers who also had experience with agriculture and online learning. With the bulk of the design work taken care of by these professionals, instructors were able to concentrate on course facilitation and instruction.

### *Challenges faced by trainers/instructors*

Instructors in agriculture are faced with similar challenges as those experienced by persons working in other fields. These issues include (Leary and Berge, 2006):

- lack of time and skills needed in adopting new technologies
- lack of both formalized reward system and technical support
- a concern about the loss of the teacher student relationship
- marketing for programs
- financial rewards
- maximizing returns on their investment in time and money
- major increases in administrative work

We also found that trainers and instructors had difficulties switching to online teaching and major efforts were made to address these. As most of our instructors were employed in agricultural universities, we first requested permission from their employers and for time to be granted for them to carry out their eLearning activities. Getting such permission was relatively easy as university administrators seemed to recognize the benefits to their institutions. While instructors did impart knowledge, they also reported that they learned much through their interactions with far distant students. To ensure that they had the requisite skills, newly recruited instructors were given substantial instructions before facilitating courses and consistent coaching by more experienced trainers during course delivery. Instructor efforts were rewarded both in financial terms and in the personal satisfaction they gained as a result of being able to share knowledge

with an international student body. The organizations were entirely responsible for marketing and much of the administrative work and instructors were allowed to concentrate exclusively on teaching and facilitation.

In our experience, the loss of the teacher-student relationship was a major concern. Several mechanisms are built in the course implementation to ensure that eLearners and facilitators can easily communicate with each other. As a result, all of our online instructors indicated that they were able to interact as well as or better than in face-to-face classrooms.

#### *Challenges faced by students/farmers*

Of the 3 challenges identified by Leary and Berge (2006), we found this to be most significant. They correctly note that it is extremely difficult to design and market eLearning directly for farmers. Internet penetration is limited in most rural areas, computers are not available and/or affordable, material in local language is scarce and most developing country farmers lack the prerequisite computer literacy, this challenge is one that will only be addressed in the future. Instead, our approach was to focus our efforts on reaching “knowledge intermediaries” the many individuals employed by government extension systems, non-government organizations, academia, and the private sector, who have the responsibility to provide information and educational opportunities for farmers.

The other major aspect of this challenge is the difficulty of allowing for hands-on learning. One approach we employed that showed considerable promise in addressing this issue was the use of computer simulations. Computer simulations and their recreational counterpart, computer games, allow users to 'try out' aspects of the real world

while controlling or easing many of the complexities that the real world represents. Main advantages of simulation are that they are engaging, cheap, fast, and safe to use, and they can be used again and again.

For example, in an Introductory IPM course offered by both APRTC and SDLEARN, the learner is guided through a series of experiments that use the simulation as a tool to answer specific questions. For example, some simulations ask the learner to vary the strength of the pesticide, to use more than one kind of pesticide, to spray only when the pests reach a certain density, etc. The learner is also encouraged to invent new experiments and to test problems from their real-world experience using the simulation. The learner can apply dangerous amounts of pesticide season after season, run hundreds of seasons worth of experiments in a single afternoon, experience and see the results of a complex mathematical model without concerning themselves with its derivation, and avoid spending money on real pesticides (or losing real crops).

Simulations developed and used by APRTC and SDLEARN are available online at the following URLs.

- Crop Production Simulation -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/popup2\\_11.asp](http://www.sdlearn.net/APRTC/intro_ipm/popup2_11.asp)
- Economic Injury Level Simulator -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/module2\\_14.asp?ID=0&OFR=0&CID=3&FNC=0](http://www.sdlearn.net/APRTC/intro_ipm/module2_14.asp?ID=0&OFR=0&CID=3&FNC=0)
- Pesticide Resistance Simulator -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/module2\\_20.asp?ID=0&OFR=0&CID=3&FNC=0](http://www.sdlearn.net/APRTC/intro_ipm/module2_20.asp?ID=0&OFR=0&CID=3&FNC=0)

- Removal of Natural Enemies Simulations -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/module2\\_24.asp?ID=0&OFR=0&CID=3&FNC=0](http://www.sdlearn.net/APRTC/intro_ipm/module2_24.asp?ID=0&OFR=0&CID=3&FNC=0)
- Pesticide Resurgence Simulator (Hormoligosis) -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/module2\\_26.asp?ID=0&OFR=0&CID=3&FNC=0](http://www.sdlearn.net/APRTC/intro_ipm/module2_26.asp?ID=0&OFR=0&CID=3&FNC=0)
- Removal of Competitors Simulations -  
[http://www.sdlearn.net/APRTC/intro\\_ipm/module2\\_28.asp?ID=0&OFR=0&CID=3&FNC=0](http://www.sdlearn.net/APRTC/intro_ipm/module2_28.asp?ID=0&OFR=0&CID=3&FNC=0)
- A Simulated Scouting Game -  
[http://www.sdlearn.net/APRTC/ipm\\_veg/module3\\_06.asp?ID=0&OFR=0&CID=6&FNC=0](http://www.sdlearn.net/APRTC/ipm_veg/module3_06.asp?ID=0&OFR=0&CID=6&FNC=0)
- How to calibrate a knapsack sprayer -  
[http://www.sdlearn.net/APRTC/responsible\\_use/popup4\\_06a.asp](http://www.sdlearn.net/APRTC/responsible_use/popup4_06a.asp)

### *Sustainability*

Although not specifically listed as a challenge in the Leary and Berge (2006) paper, one of their key observations dealt with the issue of sustainability. As they note, “Most elearning programs in agriculture currently being undertaken in the world are in the pioneering phase. Services tend to be free and are studies, pilot projects, and other initiatives supported by grants. Many of these projects are not sustainable; after a limited number of training sessions they end when the funding ends, perhaps with a research report published on the Internet and an expectation that individuals can find it, fully accept it, and integrate the findings into training curricula” (Leary and Berge, 2006).

This accurately describes the main challenge faced by both APRTC and SDLEARN and one for which we did not have a good response. Neither of these organizations is currently providing online learning for agriculture. The target audience for the learning courses was not in a position to pay for the courses and it was not possible to interest donor agencies in continuing to fund learning activities.

### ***Conclusions and recommendations***

A considerable amount of evidence suggests that eLearning can make an important contribution to international agriculture development. But it is also clear that the widespread adoption of this approach faces a number of challenges. Based on personal experience in this field, the authors would like to propose the following actions that could allow eLearning in agriculture to reach its full potential.

#### *1. Address digital divide issues*

Without Internet connectivity eLearning is impossible. “For e-learning to succeed in the developing world, it needs to build on another important pillar: the existence of infrastructure, along with some degree of connectivity (Sehrt, 2003). As FAO (2005) notes, “the rural digital divide must be bridged. Otherwise e-agriculture applications will remain beyond reach of rural communities, and will merely exacerbate the existing rural digital divide - leading to an ever-widening knowledge gap between information “haves” and “have-nots”.

Addressing connectivity problems is firmly within the mandates of national governments, government institutions and the agencies that support them. This may involve investing in such basic infrastructure as rural electrification. Next is to ensure that rural areas have access to basic and affordable telecommunication service. It is no secret that rural areas

are generally much less likely to receive equitable attention in terms of governance and administration. Unless and until governments improve their service to rural communities, they will constantly be at a disadvantage to their more favored urban counterparts.

One relatively low-cost option is the establishment of rural telecenters. Another emerging solution to providing connectivity in rural communities that is both low-cost and designed specifically for agricultural application is the Fieldserver (<http://model.job.affrc.go.jp/FieldServer/FieldServerEn/default.htm>). In addition to providing remote scientists with information on temperature, humidity and light intensity it can also provide wireless LAN environment to an area with diameter of 100m around it.

But investments in these and other technologies will not happen in countries where the telecommunication sector is highly controlled and monopolistic. Monopolistic services tend to stifle the technological innovation, infrastructure investment and price improvements that often come with competition (Richardson, 1997). Where telecommunication reforms have occurred, telecommunication services have "expanded and improved at a faster pace, productivity has increased, new services have become available, and in some cases, international capital markets have been tapped effectively" (Saunders, Warford and Wellenius, 1994 as cited in Richardson, 1997).

A second and equally important dimension of the digital divide is providing people the knowledge and skills required to take advantage of the new tools and opportunities. Literacy is, of course a key concern. First is the more traditional literacy in terms of being able to read and understand written material. Second, and more specifically related to eLearning, is "Digital Literacy" - "The ability to access and take advantage of networked computer resources and to use and understand information as presented by computers". Marker, McNamara and Wallace(2002) aptly pointed out that,



”Impediments to poor people benefiting from ICTs due to lack of skills can be reduced both by education and training to increase individuals’ skills and by developing applications which are adapted to the needs of low skilled or illiterate users”.

*2. Provide support and training opportunities in online course design and facilitation for agricultural educators*

High quality, engaging and relevant online agricultural training courses will not be developed if agricultural educators are not given the necessary skills and practice. They need to be “literate in the new technologies and retrain themselves in pedagogy for them to understand how to make technology support conceptual formation and change in students” (Rapatan, 2002 as cited in Bandalaria, 2007). Agricultural educators must, “know how to target the audience, consisting of working adults who have limited free time and experience learning online (Sehrt, 2003).

Our experience showed that providing agricultural educators with simple, focused training in online course facilitation worked well, particularly when this training involved coaching and mentoring during the delivery of a real course. This approach has been validated by The National Center To Improve Practice (NCIP), another organization with substantial experience in supporting inexperienced online educators. NCIP takes, “responsibility for responding to technical questions and providing user support and for (1) co-constructing workings with the facilitator (2) modeling and mentoring (3) coaching to prevent and ameliorate problems (4) working in tandem with the facilitator to promote interactivity” (Zorfass et al, 1998).

### *3. Increase long-term, public-sector, and/or donor support for agricultural eLearning*

Expanding electricity and Internet connectivity in rural areas, providing users with basic conventional and computer literacy, and training agricultural educators in how to make the most of eLearning all have substantial cost implications and the required funds must be made available. Given the targets for agricultural eLearning, it is unrealistic to expect the users to bear the costs. After all, the main objective of such efforts is to reduce poverty and raise living standards.

Information for agricultural and rural development was until recently considered a global public good to be made freely available to all, but donors and governments are increasingly relying on private sector delivery. Unfortunately, this sector “is reluctant to cover the cost of developing infrastructure in remote and poor areas, unless forced to do so through regulatory mechanisms or to cover the actual and hidden costs of providing information that empowers poor people, or of gathering, processing and circulating valuable indigenous knowledge“(FAO COAIM II, 2002).

This leaves governments and/or donors as the only currently viable source of funding. And, this may well be in society’s best interest. If learning is available only to the elite few who can afford it, there is considerable danger that the divide between the rich and poor will not only remain but grow. Winrock (2003) cautions that while, in general, reliance on the private sector is good, “information and access to it closely resemble a public good threatened with undersupply by market failures.” In cash-strapped developing countries, donor support will be critical.

### 3.5 Summary

eLearning is still relatively unknown and unused as an educational approach in Asia but 2 small non-profit groups (APRTC and SDLEARN) with which the author had been intimately involved in was able use this approach to provide online educational opportunities in the area of sustainable agriculture and to upgrade the knowledge and skills of agricultural educators and professionals in the region. Feedback from the learners had been overwhelmingly positive. The use of simulations to allow hands-on learning was always appreciated and agricultural educators who participated in the course and experienced the benefits of using simulations even use them in their own teaching.

A key factor in the successful implementation of the eLearning programs was the collaborative efforts involving academia, the private sector, donors and government and non-government agencies. Also, every attempt was made to ensure that the courses were easily accessible, the content was appropriate, learning was affordable and participation was rewarded.

With the dedicated efforts of project partners, availability of funds and strong support from the International Institute of Cambodia's administration and faculty, even in country with underdeveloped technology infrastructure like Cambodia, eLearning was successfully implemented. Substantial technical and pedagogical support in the forms of training provided to university faculty, IT and CIC staff on online course design and facilitation and administration enabled the content development and delivery of courses in the local language – Khmer.

A considerable amount of evidence from the projects implemented by APRTC and SDLEARN suggests that eLearning can be an effective alternative mechanism in delivering agricultural education. But it is also clear that a number of challenges faced by

teachers/trainers and students as well as several organizational issues had to be dealt with. Limited connectivity of target learners, the loss of teacher-student relationship and difficulty of allowing for hands-on learning are just some of the issues that need to be resolved to effectively implement an eLearning program.

## **Chapter 4. Evaluation of Agriculture eLearning Adoption in Asia**

### 4.1 Introduction

Several studies have looked at the barriers to eLearning adoption in developed countries but very few have looked at the application of this approach for agriculture and almost none in the Asian context. Jagoda (September 7, 2007, personal communication) set out to examine the eLearning adoption trends within the agricultural producer community in Central Java, Indonesia but was not able to execute the plan due to budget constraints. Meera, Jhamthani and Rao (2004) compared three projects in India that used ICTs for agricultural development but none has so far attempted to investigate the adoption of eLearning for agriculture in Asia. Thus, this study is contributing to filling a major gap regarding the understanding of what drives and what constrains adoption of agricultural eLearning in Asian agricultural educational organizations.

The previous chapter provided some information on the eLearning programs that the author has been intimately involved in. Combined with this information, a look at the current status of agriculture eLearning will give a more comprehensive assessment. The challenges faced during the implementation of these programs will also be discussed in this chapter as these may help to explain the slow adoption of agriculture eLearning in Asia and can provide significant insight and guidance in understanding this situation.

In order to answer the research questions set out in Chapter 1, an exhaustive review of literature on eLearning adoption in general and agriculture eLearning adoption in particular was carried out guided by the author's several years of experience in eLearning implementation. This served as the foundation and an important first step in the

evaluation process. Several models that explain adoption of technologies were also evaluated in the development of the conceptual model that was used as the basis for creating the survey instrument.

The results of the online survey integrated with the author's experiences are elaborated and discussed in the later sections of this chapter. A general precautionary statement on how the results should be interpreted is also provided.

#### 4.2 Current Status of Agriculture eLearning

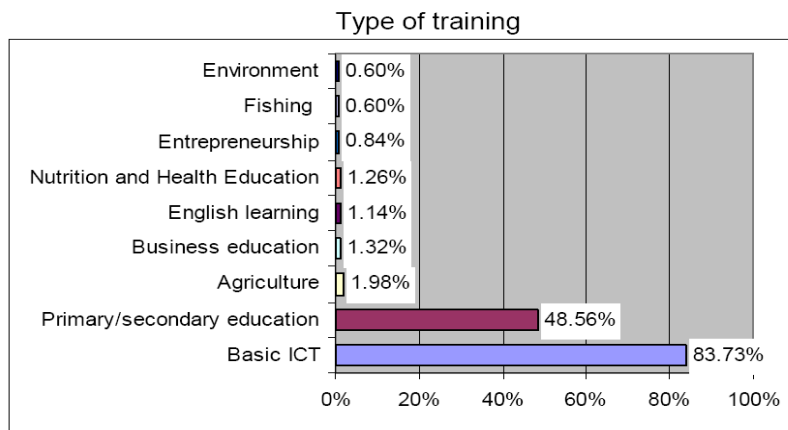
Experience gained from the involvement with organizations such as the previously described International Rice Research Institute (IRRI) and Asia Pacific Regional Technology Centre (APRTC) and Sustainable Development eLearning Network (SDLEARN) provided empirical evidence that an approach using ICT-based technologies, eLearning in particular, is an effective alternative in addressing the continuing educational needs of agricultural knowledge intermediaries particularly in the areas of sustainable agriculture and natural resource management.

But even though the potential benefits of this approach are exciting, the adoption of eLearning for agricultural development, particularly in or for developing countries where agriculture is so critical, has been slow to take off. Major international agricultural development entities are focused on using Internet technologies to disseminate information and have only minimal eLearning initiatives.

Some smaller organizations, however, have attempted much more and the activities and accomplishments of 2 such entities with which the author was involved implemented several agricultural online courses mainly targeting learners from developing countries in the Asia Pacific. These courses also attracted agricultural professionals from other

regions including Africa, Latin America and Europe. In collaboration with a local university in Cambodia, they were also able to deliver business courses to hundred of students in the provinces who had no other opportunities to continue their education.

But other than these activities, there is very limited agricultural eLearning in Asia. A recent ESCAP study of 11,160 telecenters in 11 countries in Asia provided an evidence of the limited eLearning activity in agriculture and other key economic and social fields. As shown in Figure 4-1, eLearning is primarily being used in Asia to teach basic ICT skills and, to a lesser extent, provide supplementary resources for primary and secondary education.



Source: Assessment of the Status of the Community-based e-learning facilities in rural areas, ESCAP, 2007

**Figure 4-1. UN ESCAP’s analysis of the provision of eLearning in Asian telecenters (Freire, 2007).**

Belawati and Zuhairi (2007) confirmed that, “The use of ICT in ODL in the developing country such as Indonesia is still at experimental stages, and even though many institutions are ready to experiment with modern ICT-based courses, access and participation by students is still relatively low”.

### 4.3 Evaluation Process

In the attempt to understand the reasons behind the slow adoption of this technology, the author drew on her personal experience and the available literature in this area to develop a conceptual model of the adoption process and the potential constraints to the adoption of eLearning. The development of this model and the supporting theories are explained below. This resulting model was used to design the online survey to better understand the adoption process and constraints to adoption.

#### 4.3.1 Development of conceptual model

The author's personal experience provided the opportunity to experience first hand what eLearning can do in support of agricultural development in Asia. It also showed the challenges that need to be overcome to realize its full potential. These challenges and lessons can be summarized as follows:

- » Support and interest from teachers/content experts are very important
- » Agricultural educators/professionals require retraining
- » Support from top management/presence of opinion leaders critical
- » Learner skills and connectivity a major concern
- » Donor community has no coherent strategy in supporting ICT projects
- » General skepticism about the viability of this new approach exists

An extensive review of literature on eLearning and agriculture eLearning in particular revealed that the author's experiences were shared by others in the field and that the commonly identified barriers can be categorized as organizational, innovation characteristics/features, pedagogical, environmental and attitudinal factors, and learner



variable and context. More specifically the following barriers were identified and were explored further in this study:

- » Relative advantage over other approaches
- » Ease of use
- » Compatibility with existing approaches
- » Visibility (Experience of others who have tried eLearning)
- » Trialability (ease of setting up a pilot program for testing before roll out)
- » Cost effectiveness
- » Ability to reach more learners
- » Level of computer and Internet skills of target audience
- » Level of computer and Internet access of target audience
- » Technology infrastructure in the region
- » Level of available technology and resources in the organization
- » Level of staff proficiency in the use of technology for learning
- » Organizational support
- » Presence of opinion leader and champion for the use of eLearning
- » Ability to meet organizational learning needs
- » Uncertain or unproven benefits
- » Interest of teachers/trainers in using eLearning
- » Availability of funding to support eLearning activities
- » Difficulty in measuring results
- » Concerns about security and cheating
- » Availability of quality eLearning content
- » Availability of eLearning content in local language
- » Availability of eLearning content in subject matter of interest

» Knowledge of good models for the use of technology in instruction

Table 4-1 presents the selected publications reviewed and deemed relevant to this study with the corresponding barriers mentioned in each.

In addition to identifying the barriers to eLearning implementation from published articles, several models used in explaining adoption of technological innovations have been reviewed. Of these models, Rogers' diffusion of innovation model and innovation-decision process, absorptive capacity for eLearning, and Borton's Process model are deemed to be the most suitable in explaining the eLearning adoption process. A description of these models follows.

Rogers' innovation-decision process (see Figure 4-2) is the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. The process consists of a series of actions and choices over time through which an individual or an organization evaluates a new idea and decided whether or not to incorporate the new idea into ongoing practice.

Based on Rogers' innovation-decision process theory, the needs and goals of an organization coupled with its previous practices related to the new technology in achieving those goals affect its search and evaluation of new knowledge and technology. The acquisition of new knowledge is also affected by the characteristics of the decision making unit in the organization and its access to communication channels.

**Table 4-1. List of selected publications and identified barriers to eLearning**

Title/URL	Author	Year Published	Barriers/Factors Identified to eLearning adoption
The Illusion of e-Learning: Why We Are Missing Out on the Promise of Technology <a href="http://www.league.org/publication/whitepapers/0802.html">http://www.league.org/publication/whitepapers/0802.html</a>	Frank L. Greenagel, Ph.D.	n.d.	<ul style="list-style-type: none"> <li>○ flawed model of cost-effectiveness (too much emphasis on ROI)</li> <li>○ misplaced concern over standards (too much emphasis on standards but missing on the learning outcome)</li> <li>○ little emphasis placed on measurable outcomes</li> <li>○ lack of standards and specifications</li> </ul>
An Overview of e-Learning in Canadian Agriculture and Agri-business <a href="http://www.agr.gc.ca/ren/pdf/elearn_e.pdf">http://www.agr.gc.ca/ren/pdf/elearn_e.pdf</a>	ZeddComm Inc.	2003	<ul style="list-style-type: none"> <li>○ uncertain or unproven benefits</li> <li>○ Internet and computer access</li> <li>○ cultural resistance</li> <li>○ lack of opinion leaders</li> <li>○ computer skills</li> <li>○ cost</li> <li>○ organization issues such as lack of training time for employees, increase in salary after training and reduce budget for human resources</li> <li>○ attitudinal barriers (people are used to f2f learning environment, unknown credibility of online courses)</li> </ul>
Drivers Behind e-Learning Initiatives <a href="http://www.educause.edu/ir/library/pdf/ers0303/rs/ers03035.pdf">http://www.educause.edu/ir/library/pdf/ers0303/rs/ers03035.pdf</a>	Educause Center for Applied Research	2003	<ul style="list-style-type: none"> <li>○ Institutional goals</li> <li>○ Experience from other types of distance-learning programs</li> </ul>
Analyzing E-learning Adoption via Recursive Partitioning <a href="http://www.diw.de/deutsch/produkte/publikationen/diskussionspapiere/docs/papers/dp346.pdf">http://www.diw.de/deutsch/produkte/publikationen/diskussionspapiere/docs/papers/dp346.pdf</a>	Philipp Koellinger & Christian Schade	2003	<ul style="list-style-type: none"> <li>○ Existence of other related technologies which stem from Internet</li> </ul>
E-learning: Adoption Rates and Barriers	The Forum Report	2003	<ul style="list-style-type: none"> <li>○ Time employees have available for training/learning</li> </ul>

Title/URL	Author	Year Published	Barriers/Factors Identified to eLearning adoption
<a href="http://www.forum.com/publications/report.PDF">http://www.forum.com/publications/report.PDF</a>			<ul style="list-style-type: none"> <li>○ Cost versus value</li> <li>○ Difficulty in measuring results</li> <li>○ Quality of learning content</li> <li>○ Perceived difficulty of using such a system</li> <li>○ Technology infrastructure</li> <li>○ Internal resistance to using technology instead of face to face learning</li> </ul>
Literature review of evidence on e-learning in the workplace <a href="http://www.employment-studies.co.uk/pdf/library/01580.pdf">http://www.employment-studies.co.uk/pdf/library/01580.pdf</a>	David Lain, Jane Aston	2004	<ul style="list-style-type: none"> <li>○ Lack of hardware</li> <li>○ Lack of e-learning expertise</li> <li>○ Lack of time</li> <li>○ Lack of resources</li> <li>○ Lack of trust</li> <li>○ Difficulty in determining the full cost of e-learning</li> <li>○ Culture of suspicion about e-learning from local and senior managers</li> </ul>
Factors influencing e-learning adoption intention: Examining the determinant structure of the decomposed theory of planned behavior constructs <a href="http://www.herdsa.org.au/conference2004/Contributions/RPapers/P057-jt.pdf">http://www.herdsa.org.au/conference2004/Contributions/RPapers/P057-jt.pdf</a>	Nelson Oly Ndubisi	2004	<ul style="list-style-type: none"> <li>○ Perceived usefulness</li> <li>○ Perceived ease of use</li> <li>○ Security</li> <li>○ Course leader's influence</li> <li>○ Self-efficacy</li> <li>○ Computing experience</li> <li>○ Training</li> <li>○ Technological facilities</li> </ul>
Strategic e-learning implementation <a href="http://fets.ieee.org/discussions/discuss_july2005.html">http://fets.ieee.org/discussions/discuss_july2005.html</a>	Mark Nichols and Bill Anderson	2005	<ul style="list-style-type: none"> <li>○ Technologies and applications supported by the institutions</li> <li>○ Quality assurance policies and standards</li> <li>○ Availability of staff training and support in e-learning</li> <li>○ Existing level of staff proficiency in technology and e-learning</li> <li>○ Perspectives of staff responsible for coordinating e-learning development</li> </ul>

Title/URL	Author	Year Published	Barriers/Factors Identified to eLearning adoption
			<ul style="list-style-type: none"> <li>○ Amount of time and funding for e-learning</li> </ul>
<p>Approaches and implications of eLearning adoption in relation to academic staff efficacy and working practice</p> <p><a href="http://cms.steo.govt.nz/NR/rdonlyres/8C221A73-CF28-4CC9-83E8-B8FD7D9C1164/0/ALETfinalReport251006.pdf">http://cms.steo.govt.nz/NR/rdonlyres/8C221A73-CF28-4CC9-83E8-B8FD7D9C1164/0/ALETfinalReport251006.pdf</a></p>	Bronwyn Hegarty and Merrolee Penman	2005	<ul style="list-style-type: none"> <li>○ Time</li> <li>○ Workload</li> <li>○ Institutional support</li> </ul>
<p>The future of e-learning in India</p> <p><a href="http://www.expresscomputeronline.com/20051114/market03.shtml">http://www.expresscomputeronline.com/20051114/market03.shtml</a></p>	Megha Banduni	2005	<ul style="list-style-type: none"> <li>○ Lack of course content outside of IT education area</li> <li>○ eLearning courses mostly available in English-language only</li> </ul>
<p>Trends in E-learning for Library Staff: A Summary of Research Findings</p> <p><a href="http://data.webjunction.org/wj/documents/14077.pdf">http://data.webjunction.org/wj/documents/14077.pdf</a></p>	Online Computer Library Center, Inc.	2006	<ul style="list-style-type: none"> <li>○ Lack of funding</li> <li>○ Staff time</li> <li>○ Expertise</li> </ul>
<p>E-learning: Progress and Prospects</p> <p><a href="http://www.cipd.co.uk/subjects/lrnanddev/elearning/elearnpr og.htm?lsSrchRes=1">http://www.cipd.co.uk/subjects/lrnanddev/elearning/elearnpr og.htm?lsSrchRes=1</a></p>	CIPD	2006	<ul style="list-style-type: none"> <li>○ Limits of current technology infrastructure</li> <li>○ Ensuring learners have time and space to participate</li> <li>○ Providing appropriate support for learners</li> <li>○ Finding attractive, relevant and high-quality content</li> <li>○ Gaining line manager support and commitment</li> <li>○ Employee hostility towards e-learning</li> <li>○ Motivating learners to complete courses</li> <li>○ Lack of basic IT skills in the workforce</li> </ul>

However, some critics find that this model fails to consider the complex organizational processes and the iterative nature of the process. As well, the stages might not occur in linear fashion.

Borton's Process model (see Figure 4-3) extends Rogers' innovation-decision process to address these shortcomings. Borton's model integrated and discussed the impact of organization factors on the adoption and implementation process. Organizational action influences individual adoption, organizational outcomes impact continued use, and the organizational context is assumed to influence all stages of the process.

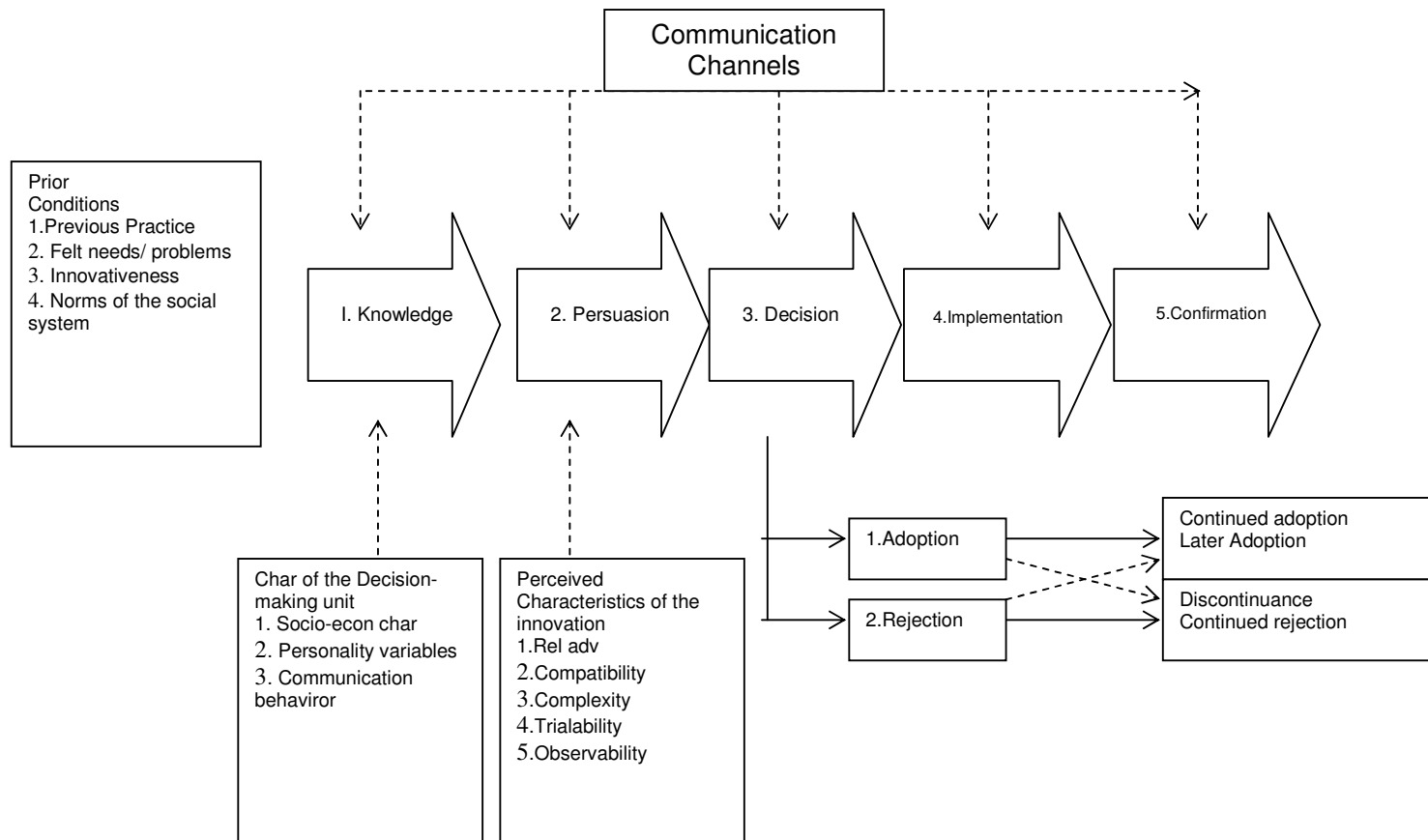
The persuasion stage of the process is described in more detail. Individual characteristics include perceived consequences of use, computing self-efficacy, and computing experience. Workgroup and technology characteristics included in the model are similar to those described by Rogers. Organization action is defined to include organization adoption, the development of a supportive computing infrastructure, management support and the existence of a technology champion.

The role of observational and enactive learning in the adoption and implementation process is described. As individuals use the technology and observe others using it, both individual and organizational learning take place. Observational learning is seen as important vehicle for feeding information back to potential adopters at the awareness and persuasion stages of the process. Enactive learning feeds back into the persuasion stage as current users consider the use of additional technologies or additional components of IT clusters. Organizational learning is impacted by enactive and observational learning which in turn impact the persuasion stage of the adoption process.

The implementation and confirmation stages are divided into four processes. Utilization and satisfaction are antecedents to individual performance/productivity outcomes, which are antecedents to organizational performance/productivity outcomes.

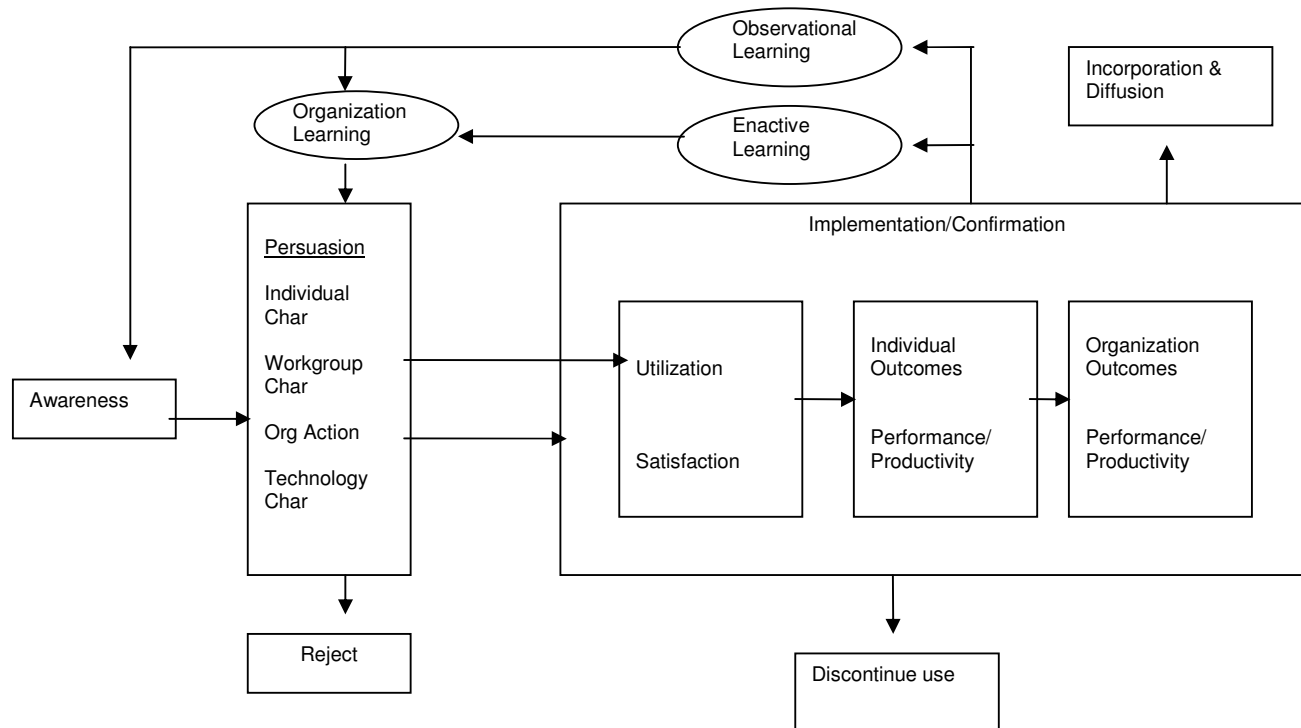
Absorptive capacity for eLearning (see Figure 4-4), a term derived from the general literature on absorptive capacity, which forms part of an explanation of adoption and diffusion of ideas, knowledge and technologies within organizations and countries. According to this model, each organization has a certain capacity for knowledge acquisition based on its ability to recognize, assimilate and utilize new knowledge. Researchers described this organizational capability as “absorptive capacity”. They described it as “an ability to recognize the value of new, external knowledge, assimilate it, and apply it to commercial end. This model proposes that organizations have different capacities for acquiring, assimilating, transforming and exploiting knowledge on eLearning to achieve strategic innovation and flexibility.

The resulting conceptual model (see Figure 4-5) incorporates the ideas behind Rogers’ innovation-decision process, Borton’s process model and absorptive capacity for eLearning. Based on this model, the needs and goals of an organization coupled with its previous practices and experience related to the technology under consideration affect its search and evaluation of new knowledge and technology. The knowledge about the innovation, attributes of the innovation, environmental conditions, target users context and variables plus organizational factors all play an important role during the persuasion stage. Depending on these factors, the organization will then decide whether to accept or reject the innovation.

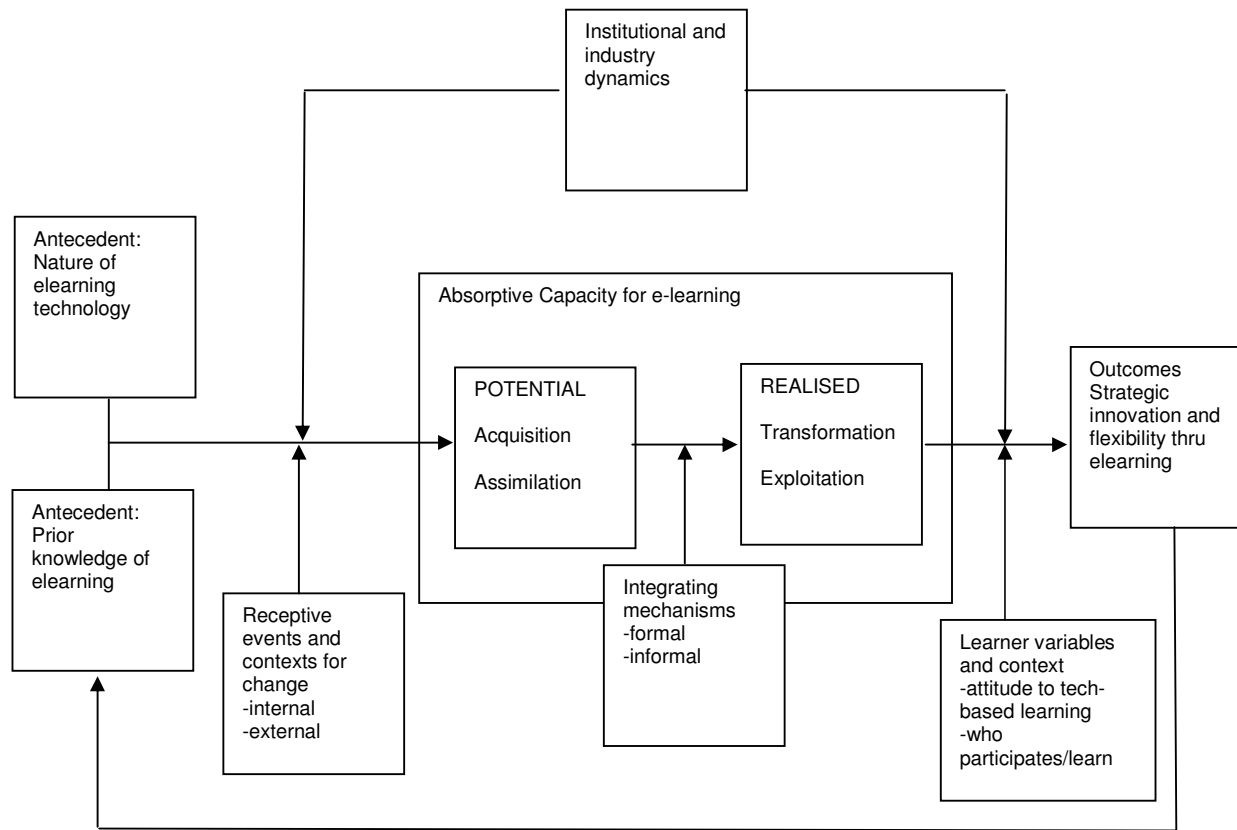


**Figure 4-2. Innovation-decision process (Rogers, 1983).**

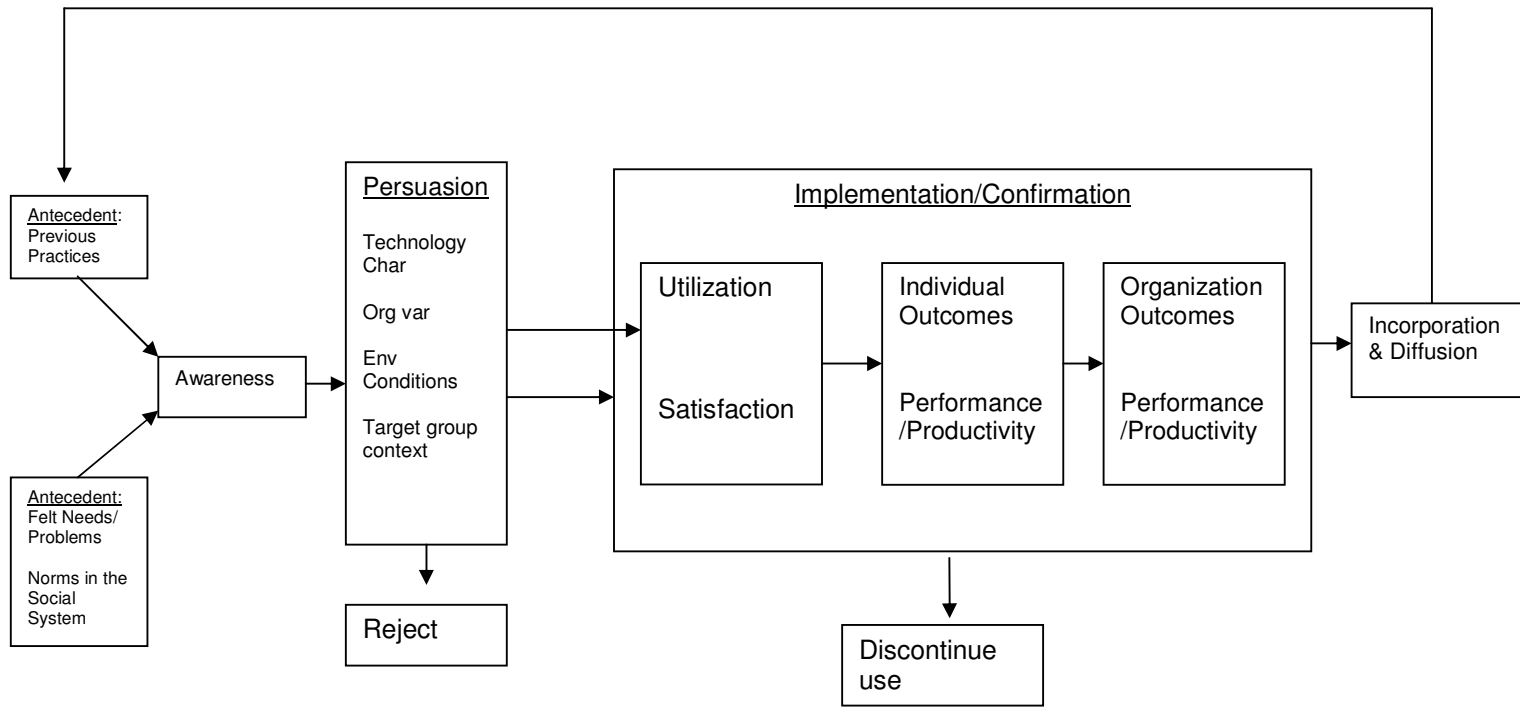




**Figure 4-3. Innovation-decision process combined with organizational learning theory (Borton, 1993).**



**Figure 4-4. Absorptive capacity for eLearning (Martin, Massy and Clarke, 2003).**



**Figure 4-5. The research conceptual model.**

#### 4.3.2 Conduct of the online survey

A list of agricultural and open universities, international NGOs and agricultural research organizations in India, Bangladesh, Philippines, Thailand, Vietnam, Malaysia, Indonesia, Nepal, Pakistan, Sri Lanka, South Korea, Japan, Cambodia, Lao PDR, China, Taiwan, Mongolia, Bhutan was developed through an extensive Internet search and from personal knowledge of Asian agricultural learning organizations.

At the same time, the survey instrument was devised and pre-tested. Comments generated from those who participated in the pre-testing were incorporated in preparing the final version of the survey instrument.

An email containing an explanation of the study and survey instrument was sent to the senior management of the targeted institutions. In cases where the name and email address of the dean of the Faculty of Agriculture for universities was available, the email was addressed to them. Otherwise, the email was sent to the general email address found in the university website addressed to the President or Chancellor or Vice-Chancellor. For research organization, the email was addressed to the head of training sections or extension departments. For NGOs and other non-profit organizations, program managers are the recipient of the emails.

The questionnaire (see Appendix) is divided in 4 parts. Section A asked for information about the organization, Section B asked to describe the learning situation in the organization, Section C asked to describe the use of eLearning in the organization and finally, Section D asked to describe the technology infrastructure available.

The online survey was conducted from April 17 to July 21, 2007. Two follow-up emails were sent to respondents over the 3 months that the survey was conducted.

## ***Statistical tools and data analysis used***

### ***Descriptive Statistics***

Descriptive statistics are used to describe the basic features of the data in the study. They provide simple summaries about the sample and the measures. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data. There are three major characteristics of a single variable that we tend to look at; the distribution, the dispersion and the central tendency

The distribution is a summary of the frequency of individual values or ranges of values for a variable. Distributions may also be displayed using percentages. Dispersion refers to the spread of the values around the central tendency. There are two common measures of dispersion, the range and the standard deviation. Measures of central tendency are measures which are representative of a sample or population. They enable one to be more objective when drawing conclusions or making inferences. These measures identify the *center* or *middle* of a set of values and best characterize the distribution. The typical measures of central tendency are mode, median and mean.

The mode is the value or category which occurs most frequently. Median, on the other hand is the value which divides the set into two equal halves, with half of the values being lower than the median and half higher than the median. The most common measure of central tendency, the mean is the arithmetic average of a set of numbers. The type of measure of central tendency that we use, of course, will depend on our data and the information we wish to convey. As an example, for ordinal data (such as response categories), only the mode and median can be used.

### *Logistic Regression*

Binomial (or binary) logistic regression is a form of regression which is used when the dependent is a dichotomy and the independents are of any type. Multinomial logistic regression exists to handle the case of dependents with more than two classes. When multiple classes of the dependent variable can be ranked, then ordinal logistic regression is preferred to multinomial logistic regression. Continuous variables are not used as dependents in logistic regression. Unlike logit regression, there can be only one dependent variable.

Logistic regression can be used to predict a dependent variable on the basis of continuous and/or categorical independents and to determine the percent of variance in the dependent variable explained by the independents; to rank the relative importance of independents; to assess interaction effects; and to understand the impact of covariate control variables.

The multinomial logistic regression model with dependent variable having  $G$  (0, 1, 2, ...,  $G-1$ ) categories and  $p$  independent variables can be expressed as follows (Kleinbaum and Klein, 2002) :

$$\ln [ P(D=g | X) / P(D=0 | X) ] = \alpha_g + \sum \beta_{gi} X_i$$

$$\text{where: } g = 1, 2, \dots, G-1 \\ i = 1, 2, \dots, p$$

The nominal logistic model fits a parameter for the intercept and slope for each of  $g-1$  logistic comparisons, where  $g$  is the number of categories in the dependent variable.

Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). In this way, logistic regression estimates the probability of a certain event occurring. Note that logistic regression calculates changes in the log odds of the dependent, not changes in the dependent itself as OLS regression does.

Logistic regression has many analogies to OLS regression: logit coefficients correspond to b coefficients in the logistic regression equation, the standardized logit coefficients correspond to beta weights, and a pseudo  $R^2$  statistic is available to summarize the strength of the relationship. Unlike OLS regression, however, logistic regression does not assume linearity of relationship between the independent variables and the dependent, does not require normally distributed variables, does not assume homoscedasticity, and in general has less stringent requirements. It does, however, require that observations are independent and that the independent variables be linearly related to the logit of the dependent. Also, goodness-of-fit tests such as model chi-square are available as indicators of model appropriateness as is the Wald statistic to test the significance of individual independent variables. However, Wald statistic is sensitive to violations of the large-sample assumption of logistic regression. Put another way, the likelihood ratio test is considered more reliable for small samples. For these reasons, the likelihood ratio test of individual model parameters is generally preferred. The likelihood ratio test is a chi-square test which makes use of maximized likelihood values while Wald test is a Z test.

#### *Software Used*

Microsoft Excel's PivotTable feature was used to generate the descriptive statistics and frequency tables. PivotTables are an easy way to summarize and present data.

For the logistic regression, JMP version 7 from the SAS Institute was used. The Fit Model menu item in JMP lets you tailor an analysis using a model specific for your data. It provides several fitting techniques such as the standard least squares, stepwise, loglinear variance, just to name a few.

#### 4.4 Results

##### a. Survey response rate

An email containing the questionnaire was sent to over 600 organizations in India, Bangladesh, Philippines, Thailand, Vietnam, Malaysia, Indonesia, Nepal, Pakistan, Sri Lanka, South Korea, Japan, Cambodia, Myanmar, Lao PDR, China, Taiwan, Mongolia, Bhutan. The survey questionnaire was distributed starting April 17 and the last response included in the study was received on July 21, 2007. Two follow-up emails were sent to respondents over the 3 months that the survey was conducted.

Table 4-2 shows the number of organizations in each country contacted by email and as expected, some of emails bounced back (128 emails). A total of 111 (22%) responses were received of which 24 (4.8%) respondents said that the survey is not relevant to them or that they are too busy to respond. Only organizations from Malaysia, Myanmar and South Korea failed to respond to the request for information.



**Table 4-2. Details of the online survey distribution and the response rate by country**

Country	No. of Organizations Contacted by Email (A)	No. of Bounced Email (B)	Too busy to respond or felt that survey not relevant to them (C)	No. of valid responses included in the analysis (D)	Percentage of Responses Received * (E)
Bangladesh	19	4	2	1	20.00
Bhutan	7		1	3	57.14
Cambodia	24	11	2	2	30.77
China	47	13	3	7	29.41
India	107	23	5	12	20.24
Indonesia	33	5	2	4	21.43
Japan	46	2	-	5	11.36
Lao PDR	32	2	1	6	23.33
Malaysia	17	3	1	-	7.14
Mongolia	11	4	1	1	28.57
Myanmar	6	1	-	-	-
Nepal	22	4	1	4	27.78
Pakistan	57	16	1	6	17.07
Philippines	60	21	1	14	38.46
South Korea	27	6	-	-	-
Sri Lanka	27	3	-	3	12.50
Taiwan	8	1	-	2	28.57
Thailand	48	4	3	11	31.82
Vietnam	26	5	-	6	28.57
Grand Total	624	128	24	87	

\* Values in column E computed as follows:  $[(C + D) / (A - B)] * 100$

The low response rate could be attributed to the following reasons:

1. Use of the English language: A few emails were received citing difficulty in answering the questionnaire due to the language.
2. Information taken from the websites such as name and email addresses of the potential respondent might not be updated. Some wrote back saying that they no longer hold the position. Although request was made to forward the email to the

current holder of the position, it is probably not given any priority or forgotten altogether.

3. Credibility of the email contact. Although email is very much accepted way of contacting people, some organizations and universities in Asia place low or no value to email correspondence. Also, with several spam emails circulating these days, it is quite likely that the email contact is mistaken to be one especially that the author has no personal contact with most of the recipients. But the use of email to distribute the online questionnaire designed to accommodate the answer made the whole process convenient for the researcher as well as the recipient. The first response was received two days after the distribution.

It is important to note that not all questions were asked of all respondents. The survey split to collect more detailed information about those who have and planning to start an eLearning program. A different set of questions were offered to those who are not using eLearning program or discontinued use.

#### b. Survey respondent profile

As shown in Table 4-2, a total of 87 responses from 16 different countries were deemed valid and included in the analysis.

The majority of the respondents are from educational/research institution (39%) followed by local/regional NGO (23%), international agricultural research centers (11.5%), and government research and development agency (10.3%). The rest came from UN and donor agencies, international NGOs and farmer organizations.

More than half (58.6%) of the respondents are primarily engaged in education/capacity building activities and the rest are doing research and development (15%), advocacy

(14%) and development assistance (12.6%). Forty-one percent of the respondents have less than 100 staff, 32% has 101-500 staff and 27% has more than 500 staff. More than half (53.5%) of them have been conducting training for 20 years.

c. Quantitative data analysis

Table 4-3 shows that 54% of the respondents have an active eLearning program while 13% are planning to start their program soon. A few (2.3%) tried to use eLearning but decided to discontinue while 31% have not used eLearning at all.

All of the respondents from Lao PDR reported no eLearning activity and most of the respondents from Nepal reported the same. From Table 4-3, it is quite difficult to differentiate or make any valid conclusions about the uptake of eLearning by country. One explanation is the extremely diverse level of Internet penetration in the region. As confirmed by Jung (2007), “In Asia, Internet technologies show very high concentrations of ‘inequality’, ranging from nearly 0 percent Internet penetration, to over 80 percent connectivity to the Internet.”

**Table 4-3. Distribution of responding organizations by country and uptake of eLearning**

Country	Yes	No	Planning to	Tried	Total
Bangladesh	1				1
Bhutan	1	1	1		3
Cambodia	1	1			2
China	5	1	1		7
India	8	3	1		12
Indonesia	3	1			4
Japan	5				5
Lao PDR		5	1		6
Mongolia		1			1
Nepal	1	3			4
Pakistan	2	2	1	1	6
Philippines	7	3	4		14
Sri Lanka	2		1		3
Taiwan		1		1	2
Thailand	8	3			11
Vietnam	3	2	1		6
Total	47	27	11	2	87
%	54	31	13	2	

Table 4-4 shows the extreme level of eLearning activity in the organizations that reported using this approach. Some are offering courses totally online (100% of training efforts delivered through eLearning) while others are using eLearning for as little as 5% of their total learning effort. The same trend is observed for the use of this approach in teaching agricultural topics. On the average, respondents with active eLearning program reported

that they are using this approach for an estimated 27% of their total education program. Individual values reported by respondents who have an active eLearning program on the percentage of training effort delivered through eLearning is multiplied with the percentage of eLearning activities focused on agricultural topics; the resulting value is divided by 100 to get an estimate of the percentage agriculture eLearning. The last column in Table 4-4 shows that the respondent's agriculture eLearning activity ranges from 0 to 75% and on the average these organizations are currently implementing an estimated 11.47% agriculture eLearning.

**Table 4-4. Estimated eLearning activity in organizations currently implementing a program**

Descriptive Statistics	Share of Training Effort Delivered Through eLearning	Percentage of eLearning Activities Focused on Agricultural Topics	Percentage of Agriculture eLearning
Min	5	0	0
Max	100	100	75
Average	26.63	49.5	11.47

The low percentage of agriculture eLearning is not surprising given that those who have an active eLearning program also mentioned that they are using this approach for other subject areas as follows:

- Agriculture, fisheries and forestry
- Management, business administration, agricultural economics
- Languages, English writing skills
- Training and awareness creation; Advocacy

- Sustainable agriculture and rural development
- Biology
- Natural resource management
- Community based disaster management
- Science communication, science and technology
- Environmental education
- Research dissemination; Extension
- IT, basic computer education
- Micro-finance
- Health
- In-service teachers program

It is also important to note that those who are using eLearning are still employing the most basic tools and techniques. This observation is elaborated in Table 4-5 which presents the delivery mechanism, type of instruction, communication method, content development, content packaging and presentation that the respondents are currently using.

Majority of the respondents (81%) used blended approach with the presence of expert help and instructor. Communication between the students and instructor mostly happen using email (70%).

More than 65% uses low to middle packaging techniques like the use of audio/video tapes, CD/DVD and website. Only about 32% of the respondents make use of learning management systems (LMS/LCMS).

Content is mostly developed in-house or outsourced but none reported using any off-the-shelf products. Several (48%) respondents used Powerpoint in conjunction with website and interactive quizzes to present content.

**Table 4-5. Description of the tools and techniques used by the respondents in implementing their eLearning program**

<b><u>Delivery Mechanism</u></b>	Count	%
Purely Online	7	13.21
Blended	43	81.13
Both	3	5.66
<b><u>Type of Instruction</u></b>	Count	%
Instructor-led group	15	28.85
Self-study(self-paced)	8	15.38
Self-study with expert help	17	32.69
Combination	12	23.08
<b><u>Communication Method</u></b>	Count	%
Live synchronous	4	8.16
Asynchronous email	34	69.39
Both	11	22.45
<b><u>Content Development</u></b>	Count	%
In-house	29	54.72
Outsourced	2	3.77
Ready-made vendor "off-the-shelf" products	0	0
In-house/Outsourced	14	26.42
Combination of 3	8	15.09
<b><u>Content Packaging</u></b>	Count	%
Low- tapes, CD/DVD	5	8.93
Mid – tapes, CD/DVD, website	33	58.93
Adv – tapes, CD/DVD, website,LMS	18	32.14
<b><u>Content Presentation</u></b>	Count	%
Low – PP, Website, Interactive quizzes	27	48.21
Mid – Website, Interactive quizzes	16	28.57
Adv – website, interactive quizzes, simulations	13	23.21

Respondents were asked to rate several factors that influence their decision about eLearning. Table 4-6 lists the reasons presented to the respondents who adopted or planning to use eLearning. They were asked to rate each reason according to its influence in their decision about eLearning use. Each reason is rated as follows: 1 – Not an influence; 2 – Weak influence; 3 – Moderate influence; 4- Strong influence; and, 5 – Very strong influence. Reasons/factors that were given consistently high rating (at least 4) by the respondents include relative advantage, compatibility, cost effectiveness, ability to reach more learners, and several organizational factors such as presence of opinion leaders and good organizational support, strong interest from teachers/trainers, and availability of technology and resources. Having proven benefits and being able to meet organizational learning needs are also cited to strongly influence the decision as well as the availability of eLearning content in the subject matter of interest.



**Table 4-6. Summary of the rating on each reason by those who adopted or planning to use eLearning**

Reasons	Mode	Median	% answering strong to very strong influence *
Considered to have a relative advantage over other approaches	4	4	52.73
Ease of use	3	3	
Compatible with the existing approaches	4	4	67.92
Positive experiences of other organization in your area who have tried eLearning	3	3	
Ease of setting up a pilot program for testing before roll out	2	3	
Cost effectiveness	4	4	75.00
Ability to reach more learners	4	4	80.36
High level of computer and Internet skills of target audience	3	3	
High level of computer and Internet access of target audience	3	3	
Good technology infrastructure in the region	3	3	
High level of available technology and resources in the organization	4	4	51.79
High level of staff proficiency in the use of technology for learning	3	3	
Good organizational support	4	4	63.16
Strong opinion leader and champion for the use of eLearning	4	4	66.07
Seen as being able to meet organizational learning needs	4	4	68.42
Proven benefits	4	4	54.39
Strong interest of teachers/trainers in using eLearning	4	4	50.91
Adequate funding to support eLearning activities	3	3	
Ease of assessing student performance	3	3	
Confidence in security of computer networks and cheating safeguards	2	3	
Availability of quality eLearning content	3	3	
Availability of eLearning content in local language	3	3	
Availability of eLearning content in subject matter of interest	4	3	47.27
Knowledge of good models for the use of technology in instruction	3	3	

\* Percentage of respondents who gave a rating of either 4 or 5 to the corresponding reason

The corresponding opposite of the reasons presented to adopters were offered to respondents who have not used eLearning or discontinued use (see Table 4-7). They were asked to rate these reasons using the same scale (1-Not an influence to 5 – Very strong influence). Reasons/factors that were given consistently high rating (at least 4) by the respondents include difficult to implement, not easy to setup a pilot program, and several factors that relate to the target audience such as high cost of Internet access, limited computer and Internet skills and insufficient connectivity. Limited budget for a program like this as well as limited availability of eLearning content in the local language and subject matter of interest also strongly influenced their decision.

**Table 4-7. Summary of the rating on each reason by those who discontinued use of eLearning or didn't use at all**

Reasons	Mode	Median	% answering strong to very strong influence *
Not seen as having an advantage over other approaches	1	1.5	
Difficult to implement	5	4	59.26
Incompatible with the existing approaches	1	2	
Poor experience of other organizations in your area who have tried eLearning	1	1	
Not easy to setup a pilot program for testing before roll out	5	3	45.83
Not seen as cost effective	1	2	
High cost of Internet access	5	3	48.15
Limited computer and Internet skills of target learners	5	5	69.23
Limited computer and Internet access of target audience	5	5	70.37
Limited technology infrastructure in the region	5	5	65.38
Limited technology and related resources in the organization	3	3	
Limited staff proficiency in the use of technology for learning	2	3	
Limited institutional support	2	2.5	
No one promoting the use of eLearning	3	3	
Not perceived as being able to meet organizational learning needs	3	3	
Uncertain or unproven benefits	1	2	
Limited interest of teachers/trainers	1	2	
Limited budget for eLearning activities	5	4	60.00
Difficulty in measuring results	1	2	
Concerns about security and cheating	1	1	
Limited availability of quality eLearning content	3	3	
Limited availability of eLearning content in local language	5	4	54.17
Limited availability of quality eLearning content in subject matter of interest	4	3.5	50.00
Lack of models for using technology in instruction	3	3	

\* Percentage of respondents who gave a rating of either 4 or 5 to the corresponding reason

The results above detail the reasons/factors that influence organization’s adoption of eLearning. It is also of importance to identify the characteristics of organization that may provide more insight about their decision. It is then appropriate to ask if the size, mandate, training experience and type of organization influence adoption. What is the relative importance of the various factors in influencing adoption decisions?

To answer these, the following variables were used and their weight on the decision to use eLearning verified:

<b>Variable Name</b>	<b>Description</b>
Size	Size of the organization in terms of number of staff
Orgtype	Organization’s type (education/research institution, UN Agency, donor agency, government research and development agency, local/regional NGO, International NGO, farmer organization, international agricultural research centers)
Function	Organization’s primary function (education/capacity building, development assistance, research and development, advocacy)
Scope	Organization’s geographical scope (whether students/learners are from local population, regional or global)
Trngyears	Total number of years the organization has been conducting training
Tottrained	Total number of students/learners trained each year
Totdelmech	Total number of delivery mechanism used (lectures, on-farm-demo, computer-based training, etc)

Given that the dependent variable “eLearning adoption decision” is nominal scale and has 4 categories (yes, no, planning to, tried but discontinued), a multinomial logistic regression was performed using the above independent variables. The following are the generalized logistics regression equation based on the dependent variable:

$$(1) \quad \ln [ P(\text{Decision} = \text{No} \mid X) / P(\text{Decision} = \text{Yes} \mid X) ] = \alpha + \beta_1 \text{Size} + \beta_2 \text{Orgtype} + \beta_3 \text{Function} + \beta_4 \text{Scope} + \beta_5 \text{Trngyears} + \beta_6 \text{Tottrained} + \beta_7 \text{Totdelmech}$$

$$(2) \quad \ln [ P(\text{Decision} = \text{Planning to} \mid X) / P(\text{Decision} = \text{Yes} \mid X) ] = \alpha + \beta_1 \text{Size} + \beta_2 \text{Orgtype} + \beta_3 \text{Function} + \beta_4 \text{Scope} + \beta_5 \text{Trngyears} + \beta_6 \text{Tottrained} + \beta_7 \text{Totdelmech}$$

$$(3) \quad \ln [ P(\text{Decision} = \text{Tried} \mid X) / P(\text{Decision} = \text{Yes} \mid X) ] = \alpha + \beta_1 \text{Size} + \beta_2 \text{Orgtype} + \beta_3 \text{Function} + \beta_4 \text{Scope} + \beta_5 \text{Trngyears} + \beta_6 \text{Tottrained} + \beta_7 \text{Totdelmech}$$

The logistic regression with dependent variable “eLearning adoption decision” is very significant (Prob <.0001,  $R^2 = 0.6583$ ) and the independent variables can account for almost 65% of the variation in the dependent variable. Also, the lack of fit Chi-square is not significant and supports the conclusion that there is little to be gained by introducing additional variables.

Table 4-8 shows the results of the likelihood ratio testing the effect of each independent variable. Organization size, geographical scope and total number of educational delivery mechanism are strongly related to decision about eLearning adoption. Organization type has some marginal effect on whether to adopt or not.

Organization’s primary function, length of training years and total number of people trained each year showed no effect on the eLearning adoption decision.

**Table 4-8. Results of the likelihood ratio test showing the effects of each independent variable on the eLearning adoption decision (n = 71)**

Independent Variable	Likelihood-Ratio Chi Square	Prob>Chi Square
Organization Size	13.5018819	0.0037**
Organization Type	30.5398817	0.0817
Organization's Primary Function	13.3311737	0.1482
Organization's Geographical Scope	22.140718	0.0011**
Total number of years the organization has been conducting training	0.15062297	0.9851
Total number of students/learners trained each year	0.26073467	0.9672
Total number of delivery mechanism used (lectures, on-farm-demo, computer-based training, etc)	36.3928946	<.0001**

Three sets of parameter estimates were provided by JMP, one for each generalized logistics regression equation presented above [ $P(\text{Decision} = \text{No} \mid X) / P(\text{Decision} = \text{Yes} \mid X)$ ,  $P(\text{Decision} = \text{Planning to} \mid X) / P(\text{Decision} = \text{Yes} \mid X)$  and  $P(\text{Decision} = \text{Tried} \mid X) / P(\text{Decision} = \text{Yes} \mid X)$ ]. Table 4-9 presents the parameter estimate for the first one (No/Yes) where a hit or success is equal to No(not using eLearning). The parameter estimate for size is significant and negative which means that as the size of organization gets smaller, the more likely they will not adopt eLearning. Similarly, from the parameter estimate for the number of educational delivery mechanism (Totdelmech), it can be concluded that as the number of educational delivery mechanism employed by the organization decrease, the more likely they will not adopt eLearning. The parameter estimate for Education/Capacity building (Function[1]) is also significant. Given that this variable is categorical, we need to compute for the odds ratio of this event resulting to hit or success (in this case, not using eLearning).

**Table 4-9. Estimated coefficients, standard error, chi-square and probabilities for the logistic regression model for the eLearning adoption decision (No/Yes)**

Term	Estimate	Standard Error	Chi-Square	Prob>ChiSq
Intercept	7.35722904	1621.8352	unstable	0.9964
Size	-0.0038766	0.0018383	4.45	0.0350 *
Orgtype[a]	5.15877227	1621.8327	Unstable	0.9975
Orgtype[b]	-18.430341	4654.2303	Unstable	0.9968
Orgtype[c]	3.54486158	1621.833	Unstable	0.9983
Orgtype[d]	2.86661073	1621.8337	Unstable	0.9986
Orgtype[e]	1.00635684	1621.8324	Unstable	0.9995
Orgtype[f]	5.78338951	1621.8507	Unstable	0.9972
Orgtype[g]	-0.4998507	10481.176	Unstable	1.0000
Function[1]	-3.2408099	1.4814256	4.79	0.0287*
Function[2]	3.02254815	1.8350578	2.71	0.0995
Function[3]	0.63065868	1.1869434	0.28	0.5952
Scope[global]	1.65049162	1.2324509	1.79	0.1805
Scope[local]	-0.1096053	0.8786626	0.02	0.9007
Trngyrs	-0.007035	0.0213238	0.11	0.7415
Tottrained	1.72145e-5	0.0000285	0.36	0.5460
Totdelmech	-2.4314442	0.8058526	9.10	0.0026 **

Computation of odds ratio for education/capacity building (Function[1]):

$$\text{OR (No/Yes)} = e^{(-3.2408099)} = 0.039132$$

Since the odds ratio is less than 1, the outcome (not using eLearning) is less likely to occur. We can therefore say that if the primary function of the organization is education/capacity building, the more likely that they will use eLearning.

#### 4.5 Discussion

The survey was developed and conducted in an effort to determine the challenges facing the application of eLearning to promote agricultural development and to substantiate other published studies and the author's experience.

A total of 87 responses from organizations in 16 different countries were used in the analysis. Only organizations from Malaysia, Myanmar and South Korea failed to respond to the request for information. The majority of the respondents is from educational/research institution followed by local/regional NGO, international agricultural research centers, and government research and development agency. The rest came from UN and donor agencies, international NGOs and farmer organizations. More than half of the respondents are primarily engaged in education/capacity building activities and the rest are doing research and development, advocacy and development assistance. Forty-one percent of the respondents have less than 100 staff and more than half of the respondents been conducting training for 20 years.

The study was based on a broad definition of eLearning which included the use of information and communication technology (ICT) to enhance and/or support learning in higher education and non-formal training programs. Results revealed significant diversity in the manner and extent to which eLearning has been adopted in the institutions surveyed, ranging from "none or trivial" to "fully online". It is also very clear that the use of eLearning for agriculture education is still very low.

Another important factor to consider is that those who are using eLearning are still employing the most basic tools and techniques. The majority of the respondents (81%) used a blended approach involving face-to-face instruction supplemented with online



resources and communication. Most organizations use email for communications between the students and instructor rather than online discussion boards, file sharing or interactive webpages. More than 65% of the respondents use simple packaging techniques like audio/video tapes, CD/DVDs and non interactive websites and only about 32% of the respondents make use of LMS/LCMS. About 48% of the respondents used Powerpoint in conjunction with webpages and interactive quizzes to present content.

The use of basic tools and techniques can be an indication of the relatively early stages of eLearning implementation. For example, the use of Powerpoint in presenting content is considered by some to be primitive. “When I respond by stating that all we use is PowerPoint, the most common reaction is a look of puzzlement or shame. Those with the puzzled looks are amazed at the response, often anticipating some name of an expensive content development application or company that we outsource this to. Those with the shamed reaction are often looking down and wondering why are we so primitive.” (McGinnis, n.d.)

eLearning content is mostly developed in-house or outsourced but none reported using any off-the-shelf products. One possible reason is “Dissatisfaction with off-the-shelf content was a common theme among respondents. Looking at the results of the SEA research it would be easy to associate the generally felt opinion of the unsuitability of off-the-shelf content with the lack of language options.” (Groeneweg, n.d.)

The survey results showed that a number of factors influenced the adoption of eLearning. Reasons identified by non-adopters seem to center on learner skills and context such as limited computer and Internet skills and access, high cost of Internet access and insufficient connectivity. Non-adopters feel that they don't have enough funding for a program that is complicated to implement. Limited availability of eLearning content in

the local language and in subject matter of interest also influenced their decision not to adopt this approach.

The literature substantiates many of these findings. Malik and Belawati (2005) articulated that, “Asia is also the most culturally and linguistically rich region. While more than 2000 languages are spoken in Asia, only a small percentage of Asians speak English, which is the de-facto language of the Internet. This, combined with the poor ICT infrastructure, probably explains some of the factors hindering higher Internet penetration in Asia.”

Yoon (n.d.) added, “Obstacles such as limited Internet access and low bandwidth discourage learning online. Many of the countries, already challenged by difficulties of effectively managing conventional educational programmes, are not able to invest efforts in extending their already stretched resources to online programmes. Nor should they, many would argue.”

On the other hand, adopters of eLearning see the positive attributes of the technology such as its relative advantage over other approaches, compatibility with existing delivery mechanism in the organization, cost effectiveness, ability to reach more learners and proven benefits. Their ability to take advantage of the benefits of eLearning is made possible by the strong organizational support and high level of available technology and resources in the organization. Adopters also cited the presence of opinion leaders and strong interest of teachers/trainers in using eLearning. They also feel that there is enough eLearning content in subject matter of interest and that eLearning is able to meet their organizational learning needs.

In terms of the organization's characteristics that influence the decision on eLearning adoption, it was found that organization size, location of its target audience and the total number of educational delivery mechanisms being used by the organization are strongly related to eLearning adoption. Also, if the organization is primarily engaged in education/capacity building activities, the more likely that they will use eLearning. With this, we can say that small organizations that are still significantly using traditional forms of training such as face to face, on-farm demonstrations, etc are most likely not to adopt eLearning at this stage.

While bigger organizations using several educational delivery mechanisms have more capacity to implement an eLearning program. A bigger organization may have higher access to available technology and resources giving enough room for experimentation with emerging trends. "The size of the establishment, measured by the natural log of the number of employee, should be positively related to innovation" (Zoghi, Mohr and Meyer, 2007)

Bersin (2005) added that, "Large organizations are much more likely to have been experimenting with e-learning for several years. There are several reasons for this. First, in the early days of Internet-based training, the solutions were very complex and expensive. It was expensive to get started."

Also, organizations that are using several educational delivery mechanisms are more likely to adopt eLearning. Leiponen (2005) explained, "Firms that engage in broad and diverse knowledge sourcing and learning activities are more likely to introduce substantial innovations than firms with local and cumulative learning strategies. Strategic emphasis on technology adoption is associated with an increased likelihood of service innovation."

Hypotheses:

The hypotheses developed to help guide this study and the key results for each are provided below. From these, it is quite evident that a number of intrinsic institutional characteristics as well as the characteristics of targeted learners (needs, skill level and access) strongly determine the degree to which an organization is able and willing to adopt eLearning.

Technology/Innovation's relative advantage over other approaches, compatibility and complexity are also key determinants of adoption. And lastly, it is quite obvious that without Internet connectivity, eLearning is impossible. The presence of basic technological infrastructure is necessary to successfully adopt eLearning.

More detailed explanation on these as follows:

H1. A number of intrinsic institutional characteristics determine the degree to which an organization is able and willing to adopt eLearning.

H1a. An organization's felt needs/problems influence the decision to adopt eLearning

The majority of those who adopted eLearning (68%) mentioned that they use this because it is seen as being able to meet organizational learning needs, was cost effective (75%) and has the ability to reach more learners (80%).

H1b. An organization with previous experience in using related technologies will have higher likelihood of using eLearning as an alternative delivery mechanism

The logistic regression revealed that organization using several delivery mechanisms have higher chances of adopting eLearning. This could be taken as a sign of organization's

innovativeness and having an open-mind to what's available. Also, experience with related technology makes the transition to the next smoother. As Jacobsen (1998) observed, "an adopter's experience with one innovation usually influences their perception of the next innovation in a technology cluster to diffuse through their social system."

The availability of technology and resources in the organization is cited by 52% of adopters. Psycharis (2005) confirmed that this provide a good incentive to adopt eLearning. "The resources possessed by an organization and consequently by an educational system are directly related to its potentials and its entrepreneurial procedures and are related to its ability to adopt and implement e-learning"

About 68% of the organizations responding to the survey mentioned that they used eLearning because it is compatible with existing approaches in their organization.

H1c. Organizations with a 'champion' will adopt eLearning faster than the ones without

Having a strong opinion leader and champion of the use of eLearning has been cited by 66% of adopter as a strong reason for using this approach. The important role of champions can not be over-emphasized. "Champions will lead the e-Learning efforts to success (Rosenberg, 2000a), guiding the process and operating as seawalls in possible contradictions." (as cited in Borotis and Poulymenakou, 2004)

Good organizational support (mentioned by 63% of adopters) is also necessary, "unless support is provided by the senior management, there is no chance of developing the impetus and crucial mass which are necessary for the transformation of the organization into one that accepts e-learning" (Psycharis, 2005).

Not to be forgotten are the ones who are actually going to do the hard work. About 51% of adopters mentioned that strong interest of teachers/trainers in using eLearning is critical. “for the successful adoption of e-learning by an organization. Its acceptance by the staff also constitutes a matter of high importance for its effectiveness” (Psycharis, 2005).

H2. The characteristics of a Technology/Innovation are key determinants of adoption

Respondents' perception about innovation characteristics influences the decision to adopt eLearning. Those who have active program mentioned that they see eLearning to have relative advantage over other approaches (53%), compatible with existing approaches (68%) and they benefited from using it (54%). On the other hand, those who decided not to use it reasoned that they find it difficult to implement (59%) and not easy to setup a pilot program for testing before roll out (46%).

Survey results showing that non-adopters point to complexity characteristic of the innovation while the adopters see the relative advantage and compatibility characteristics of an innovation reflect the findings of Frambach, Agarwal & Nijssen (2002), “The results show that the levels of perceived relative advantage and compatibility increase over the stages of the adoption process, whereas the perceived levels of complexity and risk largely decrease. The influence of the characteristics across the adoption stages shows that positive beliefs related to the innovation have highest salience in the initial stage of the process, whereas the salience of perceived complexity-generally considered an undesirable attribute-is highest in the final stage. In sum, our results imply that non-adopters are affected by innovation characteristics in a different way”.

Of the five characteristics of innovation tested in this study, relative advantage, compatibility and complexity are the most cited reasons influencing adoption by respondents. This seems to be in line with what Wu and Wang (2005) reported, “research has suggested that only the relative advantage, compatibility, and complexity are consistently related to innovation adoption. Relative advantage is similar to perceived usefulness, whereas complexity is similar to perceived ease of use. Compatibility is the degree to which the innovation is perceived to be consistent with the potential users’ existing values, previous experiences, and needs.”

Similar results was reported in E-commerce adoption study by Shen, Hawley and Dickerson (2004), “among these five characteristics, only compatibility and complexity were found to be significantly related to overall E-commerce adoption level”.

H3. Presence of basic technological infrastructure is necessary to successfully adopt eLearning

Without Internet connectivity, eLearning is impossible. “For e-learning to succeed in the developing world, it needs to build on another important pillar: the existence of infrastructure, along with some degree of connectivity” (Sehrt, 2003). The limited infrastructure in the region is cited by 65% of non-adopters to strongly influence their decision as well as the high cost of Internet access (48%). UNDP (2005) reported that “Poorer Asian countries such as Cambodia, Laos and Vietnam have significantly higher than average costs.”

These factors can clearly handicap many developing countries and even widen the digital divide.

H4. The characteristics of targeted learners (needs, skill level and access) influence the decision to adopt eLearning

In addition to availability of technology infrastructure, targeted groups for an eLearning program need to possess basic computer and Internet skills. The authors experienced showed that some donor agencies are very concerned about the limited skills of their learners and this has been confirmed in the survey. The two most commonly cited reasons by the respondents are the limited computer and Internet skills of target learners (69%) and limited computer and Internet access of target audience (70%).

Given Asia's existing infrastructure, most education providers will have second thoughts about using eLearning. Hawker (2004) explained, "Without access to PC's and PC training, then obviously Internet based learning cannot take place. But a UNCSTD report and other recent studies "call for caution and careful planning and implementation of ICT-based programmes if the technology is to be harnessed for genuine development objectives and goals." (UNDP, 2005)

Another impediment that most Asian learners face in using eLearning is language. Current estimates of websites in English range from 50-80%. "One widely quoted figure for the amount of web content in English is 80%. Other sources show figures five to fifteen points lower, though still well over 50%. (Wikipedia, n.d.)

About 54% of respondents who decided not to use eLearning mentioned the limited availability of eLearning content in the local language. This is probably because, "Internet users in the Asia-Pacific region continue to show a clear preference for viewing the Web in their native languages." (Raths, 2000)



To reach the majority of non-English speaking population in Asia, major efforts in developing eLearning content in local languages are essential.

#### 4.6 Key Assumptions and Limitations

Although this study has made progress in answering the research questions, the results should be interpreted with an awareness of the methodological limitations of this study. The methodological limitations relate to: (1) sample size and selection, (2) generalizability, (3) the variables selected for investigation. The following is a description and comment on each of these limitations.

##### *Sample Size and Selection*

One limitation of the present study is the small sample size. This potential sampling bias could be construed as a weakness of the study. However, it could also be argued that those who participated in the study had the best understanding of both the positive and negative aspects of integrating technology, have the most knowledge and experience to contribute to the research question, and have the most to contribute to understanding why the integration of technology is so appealing to some and not to others.

##### *Generalizability*

Because the results of this study are based upon a small and biased sample, it is not appropriate to generalize the overall survey results to a larger, potentially dissimilar population.

##### *Variables in the Study*

The survey instrument used in this investigation was designed and constructed by the author based upon a review of the literature and expert judgement. The variables are selected based on the several papers and articles reviewed. Although a major effort was done to ensure that the study covers most of the barriers to eLearning implementation

mentioned in the literature are included, the author cannot guarantee that this study includes an exhaustive list of barriers known to date.

#### 4.7 Summary

This chapter offered an insight as to what drives and what constrains adoption of agriculture eLearning in Asian agricultural educational organizations. To realize this, an extensive review of literature on eLearning and agriculture eLearning in particular was conducted and an online survey targeting agricultural research, development and educational institutions in Asia was carried out.

Results revealed significant diversity in the manner and extent to which eLearning has been adopted in the institutions surveyed, ranging from “none or trivial” to “fully online”. It is also very clear that the use of eLearning for agriculture education is still very low.

As well, the use of most basic tools and techniques in the program implementation suggests that most respondents are still in the early stages of eLearning adoption.

Those who embraced this technology and adopted cited several reasons. Adopters observed the positive attributes of the technology such as its relative advantage, compatibility, cost effectiveness, proven benefits and its ability to reach more learners. This is made possible by the strong organizational support and high level of available technology and resources in the organization. Adopters also cited the presence of opinion leaders and strong interest of teachers/trainers in using eLearning. They also feel that there is enough eLearning content in subject matter of interest and that eLearning is able to meet their organizational learning needs.

While adopters attribute their ability to implement an eLearning program to several organizational factors and positive attributes of the technology, non-adopters were constrained by learner skills and context such as limited computer and Internet skills and access, high cost of Internet access and insufficient connectivity. Non-adopters feel that they don't have enough funding for a program that is complicated to implement. Limited availability of eLearning content in the local language and in subject matter of interest also influenced their decision not to use this approach.

In terms of the organization's characteristics that influence the decision on eLearning adoption, it was found that organization size, location of its target audience and the total number of educational delivery mechanisms being used by the organization are strongly related to eLearning adoption. Also, when an organization is primarily engaged in education/capacity building activities, they are more likely to adopt eLearning.

We can therefore say that a number of intrinsic institutional characteristics as well as the characteristics of targeted learners (needs, skill level and access) strongly determine the degree to which an organization is able and willing to adopt eLearning.

Technology/Innovation's relative advantage over other approaches, compatibility and complexity are also key determinants of adoption. And lastly, it is quite obvious that without Internet connectivity, eLearning is impossible. The presence of basic technological infrastructure is necessary to successfully adopt eLearning.

## **Chapter 5. Conclusions and Recommendations**

This study highlighted the key role of agricultural education for rural and national development and the potential of ICTs to contribute to this effort. 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. It is obvious that the Internet can be an inexpensive and efficient way to cultivate knowledge about complex agricultural issues. New Information and Communication Technologies (ICTs) have tremendous potential to revolutionize the way information, knowledge and new technology is managed, developed and delivered to farmers.

The Internet is also facilitating the straightforward sharing and transfer of information that empower smaller organizations and individuals who had not previously had a way to contribute to the global knowledge base. Now, agricultural researchers from even the smallest and poorest countries are publishing and sharing information. Internet technologies are allowing geographically dispersed learners and experts to communicate quickly and to construct and validate knowledge. This sharing and knowledge construction is a central part of eLearning – for agriculture and for other fields.

Experience gained from organizations such as the International Rice Research Institute (IRRI), the Asia Pacific Regional Technology Centre (APRTC) and the Sustainable Development eLearning Network (SDLEARN) provided evidence that an approach using ICT-based technologies, eLearning in particular, is an effective alternative in addressing

the continuing educational needs of agricultural knowledge intermediaries in the areas of sustainable agriculture and natural resource management.

But even as the potential benefits of eLearning excite these organizations and others working in agricultural development, it is also observed that the widespread adoption of this approach, particularly in or for developing countries where agriculture is so critical, has been slow to take off. Some of the factors that may be responsible for this that the author experience firsthand were confirmed by what is known in the literature and the results of the online survey.

It is shown that adoption of agriculture eLearning in Asia is still low but interest is high and growing. The use of basic tools and techniques in the program implementation suggests that most initiatives are still in the pioneering phase.

Several reasons were identified explaining the limited adoption of eLearning for agriculture in Asia. The results suggest that small organizations face several challenges that overshadow the benefits of using eLearning. Their decision not to adopt eLearning at this stage was strongly influenced by learner's skills and context such as limited computer and Internet skills, high cost of Internet access and insufficient connectivity. They were also constrained by the limited budget to setup a program that they find complicated to implement. Limited availability of eLearning content in the local language and in subject matter of interest also influenced their decision not to adopt this approach.

While non-adopters seem to be hindered by learner's skills and context and lack of funding, those who embraced this technology seem to attribute their ability to implement an eLearning program to several organizational factors and positive characteristics of the technology such as relative advantage and compatibility. It is easier for bigger

organization primarily engaged in education/capacity building with opinion leader and enjoys good organizational support and has access to high level of available technology and resources to implement an eLearning program.

Based on the research findings and the author's extensive experience, the following recommendations are advanced for strengthening and accelerating the adoption of eLearning for agriculture in Asia and other developing countries. Specific recommendations are targeted to the Donor Community/Government Sector and Agriculture Universities/Research and Development Organizations. Also advanced are general recommendations related to the design and delivery of eLearning programs in Asia.

#### ***Donor Community/Government Sector***

Given that poor farmers are the most critical targets for agricultural eLearning, it is unrealistic to expect end users to bear the cost. Sustained public funding or donor support is essential. After all, the long-term goal of such efforts is to reduce poverty through agricultural development.

Public donor funding for ICT-based projects in general has not been directed by any sort of coherent strategy. For example, a project that uses ICTs for agricultural education targeting learners from several Asian countries will have difficulty attracting funding since most donors are not setup to handle projects that cut across several sectors (agriculture, education and ICTs) and links geographically dispersed learners. It is high time that "A regional approach to program development should be adopted since ICT and poverty alleviation transcend national borders (Flor, 2001). And in Asia, given the high

percentage of people working in the agriculture sector, poverty alleviation means development in the agriculture sector.

### Technology/Infrastructure

Addressing connectivity problems is firmly within the mandates of national governments, government institutions and the agencies that support them. This certainly involves investing in such basic infrastructure as rural electrification. Next is to ensure that rural areas have access to basic and affordable telecommunication service. It is no secret that rural areas are generally much less likely to receive equitable attention in terms of governance and administration. Unless and until governments improve their service to rural communities, they will constantly be at a disadvantage to their more favored urban counterparts and increases the risk of widening the gap further.

The problem is usually the last mile connectivity as there are several networks connecting countries in Asia such as the Asia Pacific Advanced Network (APAN) that provides linkages among research and education community in the region and beyond. Donor support or government funds can be used to extend this service to the rural communities through common access points such as telecenter or public kiosks.

Another emerging solution to providing connectivity in rural communities that is both low-cost and designed specifically for agricultural application is the Fieldserver (<http://model.job.affrc.go.jp/FieldServer/FieldServerEn/default.htm> ). In addition to providing remote scientists with information on temperature, humidity and light intensity it can also provide wireless LAN environment to an area with diameter of 100m around each server.

### *Agriculture Universities/Research and Development Organizations*

The transfer of results from research laboratories to farmers' fields is a long standing challenge for research organizations. Current technologies are ideally suited to disseminating research results, sharing information and communicating with those supporting farming communities.

Also, inconvenient trips to the farmers' fields that could disrupt research activities can now be eliminated. For example, with the use of inexpensive videoconferencing systems, researchers in distant laboratories can communicate and discuss problems in the field that need attention with the local technicians. Also, with a Field server installed in farmers' fields that measure moisture or monitor pest occurrences, remote experts can easily diagnose problems and provide advice to help solve local problems.

### Technology/Infrastructure

In order to get more organizations to use eLearning, it is very important to secure buy-in from the top management as well as the teachers or trainers. The presence of an opinion leader or champion that will push the idea in the organization is also critical. To get started in eLearning requires significant investments upfront and most agricultural institutions and universities have limited resources.

One approach to the resource problem is the one taken by APRTC and SDLEARN. These organizations were able to develop collaborative efforts involving academia, the private sector, donors and government and non-government agencies. In this model, traditional agricultural universities provide the intellectual capital, content and content support, evaluate student performance, and award appropriate degree credit or certification. Government institution like the Ministry of Agriculture, Forestry and



Fisheries Information Network (MAFFIN) in Japan contribute in such areas as hardware and software provision; APRTC and SDLEARN provide the instructional design for the Web, Website and communication fora maintenance, record-keeping, teacher training and technical support for courseware development and marketing. Private agricultural corporations or donor agencies provide financial resources, articulate educational needs and become major consumers of educational opportunities.

Starting a program using a blended approach is another way to overcome the challenge of limited technology and resources in organizations as this combine traditional delivery mechanism with new technologies. This approach allows organizations to build up the technologies and resources as they go along. This would ensure that staff can comfortably get familiar with the technologies to use in the new medium.

The use of simulations in teaching agriculture subjects that are complex or require hands-on experimentation should be encouraged. While actual experiments are important for advancing the agricultural knowledgebase; it requires land, labor, and money to run properly. Simulations at a fraction of the cost can adequately mimic the experiential learning aspects of experimentation. Also, well-designed and deployed simulations can transmit learning across language and cultural barriers where text-based content would be inappropriate.

### Skills

Developing the capacity of agriculture educators in online course design and facilitation should be given priority. Giving them the necessary skills and practice can result in the development of more agricultural eLearning content which is currently in short supply. Also, if they have the skills and confidence in facilitating online courses, they will be

more supportive and will have strong interest in using eLearning which is important in a successful program.

This was supported by the author's experience in an SDLEARN project implemented in Cambodia. University faculties were given training in online course design and facilitation while computer and IT personnel were given training on server administration and website development. This resulted in the successful offering of online business courses to hundreds of students in the provinces and allowed the development of materials, instructions and communications in the local language – Khmer. This is a significant achievement given that there is very limited online content in Khmer language available and this was the first eLearning program in Cambodia offered in the local language.

### Content

There are several national and regional agricultural research centers around Asia and beyond generating a wealth of new information and knowledge and yet, we frequently hear about not having enough content online. Even the respondents of the online survey cited that the limited availability of eLearning content in agriculture and in local language seem to be restricting the wider adoption of this approach.

Content per se is not the problem but the pedagogical and administrative aspects involved in making it readily accessible and relevant in a learning context. With the available digital technologies, some of the administrative difficulties could be slowly ameliorated as it is now much easier to publish documents and research results online. But merely publishing research results/reports, lecture notes and Powerpoint presentations are not enough for an eLearning program. Content has to be properly embedded in a learning

context and packaged in a way that students can easily understand and translate into applicable solutions.

As mentioned above, one way to resolve this is to provide agricultural educators with the skills and practice in online course design. Also, the organization has to put in place the required technology and substantial resources to support this activity.

International agricultural research centers and development agencies working in Asia like the IRRI and FAO have high level of technology, content and resources necessary for a successful implementation of an eLearning program. Also, these organizations have links to other agriculture stakeholders and in good position to lead a collaborative effort similar to what APRTC and SDLEARN built. It is therefore expected that organizations like these should step-up the use of eLearning in their efforts to disseminate scientific findings and technologies in support of agricultural development. Online publishing alone is not enough to do the job. A concerted effort to address the continuing educational needs of agricultural professionals in Asia and ultimately the farmers is critical and these organizations are critically positioned to lead the way.

### ***eLearning Programs in Asia***

For now, the most appropriate target learners of agricultural eLearning programs are knowledge intermediaries such as agricultural extension agents, educators, NGO groups and private sector employees working with farmers. For a number of reasons explained earlier, direct use of eLearning to teach farmers is still a distant dream for most developing countries in Asia. "For many regions, direct use of ICTs by farmers – with the exception of the cell phone – may take decades" (Winrock, 2003).

### Technology/Infrastructure

In the project SDLEARN implemented in Cambodia, the use of community information centers (CICs) in providing connectivity to remote learners not only offered accessibility in terms of hardware, software and Internet connectivity but also ensured the availability of expert technical help to guide inexperienced users unfamiliar with technology and trouble-shoot any computer related problems. The availability of computer access and Internet connectivity offered by CICs was critical. But equally important was the presence of on-site support system to assist learners when they encountered problems. This support system helped to maintain learners' motivation to continue with the program.

### Skills

Asian students are much more familiar and comfortable with a didactic type learning style, involving one way communication from teacher to student. This is due to the cultural belief that the teacher is the most learned and hence must be respected and revered. It is the teachers' role to impart knowledge. But with eLearning, much of the control passes from the teacher to the student which is very different from what Asian learners are used to. Online students must be largely responsible for their own learning: setting realistic goals, monitoring progress, reflecting on understanding, and seeking guidance from peers as well as instructors.

The author's experience over the past several years of offering eLearning courses to Asian students suggests that these cultural differences are important considerations in designing and delivering online courses and several factors must be kept in mind when designing courses for an Asian audience: Some of these include:

- Need for Structure

At least in the early stages of a course, Asian participants were not comfortable with the amount of freedom they have in exploring the course materials by themselves. They were emphatic in their requests that they be told explicitly what they were expected to do and why.

- Step by steps instructions

Many of the courses with which I was involved contained exercises that required participants to learn by doing. Introductory information and assignments were given and participants were expected to complete tasks by trial and error and develop skills and knowledge as they went through this process. However, our Asian students were uneasy with this approach. Especially for more complicated tasks, (e.g. downloading and installing a computer program) they wanted more explicit instructions.

- Constant encouragement

The majority of our Asian participants indicated that they were most comfortable as 'lurkers' in online discussions and that they felt they gained a lot from a passive presence. This may be feasible in large online communities with a mixture of contributors and lurkers but not in a situation of small predominantly Asian groups. Getting them to be more active was a major task and involved keeping a close watch on who was doing what and then using a variety of ways to get them motivated. Having explicit requirements for interacting as part of the exercises was a necessity.

- Make it Personal and Fun

The Asians in our courses seemed to prefer going through a process of getting to know the instructor as a first step in their acceptance of online learning. Creating this situation takes a major initial effort to 'connect' with online Asian students. A considerable amount of effort was required to send numerous personal email messages to each student and get two-way conversations going. Once a relationship had been established students were much more willing to participate in group discussions.

- Perceived roles of teachers and students

We put a lot of effort into breaking down the perceived stereotypes Asians seem to hold with regard to teachers and students. The facilitator should demonstrate a depth of knowledge in the subject matter but convey information in such a manner that it is not seen as superior. When that happens, Asian students tend to fall back into a more passive learning style.

- Face

In many cases our Asian students were reluctant to come forth with their own opinions or ways of doing things. But, they cannot afford to just "sit" in the corner and expect to be counted as participating since in online environment, everybody is expected to speak up and contribute to the discussions. A facilitator must be very careful not to put students in a position that might cause embarrassment (participating in a synchronous English chat session for example). It is also imperative to convey that, in many instances, there is no such thing as a wrong answer.

## **Abstract**

This study was an attempt to characterize agricultural eLearning in Asia and document the extent of and barriers to adoption. The goal was to use this information to develop strategies and actions that could be taken to overcome barriers and increase the application of this approach in support of agricultural development in Asia.

A review of literature established that agricultural education is essential for rural and national development and successes and failures are well documented. It also detailed how information and communication technologies (ICTs), particularly eLearning, can be an effective alternative in providing access to education and training in agriculture.

Several eLearning projects that the author helped implement provided strong evidence supporting this. It was shown that eLearning is an effective delivery mechanism in addressing the continuing educational needs of agricultural practitioners in the area of sustainable agriculture and in delivering tertiary education to rural youth and working adults in the provinces in Cambodia. But it is also clear that the widespread adoption of this approach faces a number of challenges and that major agriculture organizations have made only limited efforts to develop and deliver agricultural eLearning products.

The evaluation conducted on eLearning adoption for agriculture in Asia confirmed that utilization is still low but interest is high and growing. The use of basic tools and techniques in the program implementation suggests that most initiatives are still in the pioneering phase. Some of the reasons agricultural organizations cited for the slow adoption of eLearning center on learner's skills and context such as limited computer and Internet skills, high cost of Internet access and insufficient connectivity. They are also constrained by the limited budget to setup a program that they find complicated to

implement. Limited availability of eLearning content in the local language and in subject matter of interest also influenced their decision not to adopt this approach.

While there are many barriers to successful implementation of eLearning in Asia, there are also numerous ways of overcoming these barriers. Having good organizational support and strong interest from teachers/trainers, presence of a 'champion' and high level of available technology and resources in organization are fundamental factors to successful implementation.

An agriculture eLearning partnership model which the author followed, bringing together the diverse stakeholders such as the donor community, government, academia, private sector and non-government organizations that have the vision and skills to use these new tools can be very effective. This is one approach that small organizations confronted with limited resources could take. Another is to start a program using blended approach. This would allow organizations to build up the technologies and resources as they go along.

Another key factor for the success of eLearning for Asia is the importance of developing eLearning programs with Asians, and their cultural learning styles, in mind. Similarly, to stimulate more development of relevant, engaging and high quality online content in local language, agricultural educators must be given training and practice in online course design and facilitation.

The donor community and government sector should make available and sustain funding to ICTs projects that promote agricultural development and it is firmly within their mandates to address connectivity problems. Given the large percentage of Asia's population employed in agriculture, the effects of such agricultural development efforts will be to reduce poverty.



Research and education organizations have to actively promote their research findings. ICTs make disseminating research results and sharing information as well as establishing contact and communication with those supporting farming communities very convenient and quick. Moreover, these agricultural professionals working with farmers have the technical skills as well sufficient connectivity to receive and explain the most current information and knowledge to their clients.

eLearning for agriculture can work in Asia but it will require the dedicated efforts of a number of key actors. The recommendations advanced in this study, based on a comprehensive review of the literature, survey results and personal experience, are seen as practical and necessary guidelines to advance the use of agriculture eLearning in Asia.

## Acknowledgments

My ability to complete this endeavor was not without the generous assistance of many individuals.

I am deeply indebted to my adviser and committee chair, Professor Seishi Ninomiya, who not only provided guidance and support academically but also ensured my well-being during my stay in Japan.

Dr. Robert T. Raab who unconsciously served as my mentor, the several projects that we implemented together provided the experiences and insights fundamental to my research.

I would also like to thank the other members of my committee, Professor Masakazu Nagaki and Professor Masayuki Hirafuji, for going through the entire manuscript, asking questions all the way and never accepting less than my best efforts.

Oto-san and Oka-san (Akira and Hisayo Mizushima) and their family, for generously providing me a second home in Japan and treating me as one of them. To Onii-san (Katsuya Okubo), for his constant readiness in providing much needed assistance and support.

I am also grateful to Ms. Maria Ng Hoon and Dr. Ajit Maru who despite their busy schedules found time to contact people who can assist in my online survey. And to all those who responded to my online survey (too many to list), I am very thankful for their cooperation and assistance.

To my colleagues in NARC and the graduate students in my department as well as the Filipino community in Tsukuba (FAST), who made my stay in Japan as comfortable as possible.

And to my family, for always supporting my efforts and aspirations.

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# Appendix

## SURVEY QUESTIONNAIRE

### On Education Approaches Currently Being Used By Organizations Involved In Education for Sustainable Development

#### Introduction and instructions

Education and training are universally accepted as essential for national and organizational development. The challenge has been and remains the efficient and effective delivery of relevant knowledge to an ever increasing population – particularly in developing countries. The range of approaches for delivering education and training is broad and each has its particular strengths and weaknesses. This survey is an attempt to catalogue the educational approaches currently being used by organizations involved in education, to determine the anticipated changes in the educational landscape, to assess the effectiveness of various approaches and to identify constraints to change.

*The questionnaire:*

1. This file has been formatted so that you can only click and type in the grey-shaded areas.
2. The form is in 4 sections:
  - Section A asks you to give some information about the organization you represent
  - Section B asks you to describe the current learning situation in your organization
  - Section C asks you to describe the use of eLearning in your organization's learning activities
  - Section D asks you to describe the technology infrastructure available

*Instructions for completing the questionnaire:*

1. Start by saving this file to your computer. Add your family name to the end of the file name so that it looks like this:  
**eLearning\_survey\_YourFamilyName.doc**
2. Complete the questionnaire
3. Save the file again
4. Send the file as an email attachment to **pipot@affrc.go.jp**
5. If you have any questions about completing the questionnaire, please contact **pipot@affrc.go.jp**

**Tip:** Although the questionnaire has to be completed on the screen, you may find it easier to formulate your responses if you print it out and read it on paper first.

**A. Description of your organization.**

1. Name of Organization:

2. Size (# of staff):

3. Organizational type:

- University/College
- UN Agency
- Private Foundation
- Government Research and Development Agency
- Not for profit research and training organization
- Not for profit advocacy organization
- Donor/Development Agency
- Other: Please specify

4. Primary function:

- Education/Capacity building
- Development Assistance
- Research and Development
- Advocacy
- Other: Please specify

5. Geographic focus:

- Global
- South Asia
- SE Asia
- East Asia
- Local/Country level
- Other: Please specify

6. Year education program started:

**B. Current status of learning in your organization.**

1. Approximately what percent of your university/institute's budget is allocated to learning activities?      % of university/institute's budget

2. What are the main reasons your organization delivers training/learning activities?

- Formal education
- Research dissemination/extension
- Staff development
- Training for affiliated organizations or chapters
- Advocacy and issue education for the general public
- Other: Please specify

3. What are the main subject areas you cover in your learning/educational activities?

4. What percent of your leaning/educational activities focus on agricultural topics?  
%

5. To how many individuals does your organization provide training annually?

Students:	Farmers:
University Workers:	Elementary School Teachers:
Government Officials:	Secondary School Teachers:
Research Technicians:	Post-Secondary Teachers:
Extension Workers:	Others: Please Specify

4. What delivery mechanisms are currently used and in approximately what proportion? Please indicate what percent of your total educational program involves the following mechanisms and the changes, if any, you expect in the next 2 years? Please check all that apply

Delivery Mechanism	Current Usage (%)	Expected Usage in the next 2 years
<input type="checkbox"/> Classroom (Lectures/Seminars/Workshops/Conferences)		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Mail Correspondence		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> On-farm demonstrations		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Audio Programs broadcast via National Radio Network		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Video Programs broadcast via National Television Network		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Computer-based Training (using CD-ROM/DVD/ Internet/Intranet)		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Desktop Audio/Videoconferencing		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease
<input type="checkbox"/> Other: Please specify		<input type="checkbox"/> the same <input type="checkbox"/> increase <input type="checkbox"/> decrease

### C. eLearning

This part of the survey focuses specifically on learning about the status of eLearning in your organization. eLearning has been defined in many ways but a widely accepted definition is that it is:

The delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device (e.g. a mobile

phone) in some way to provide training, educational or learning material. (Derek Stockley, 2003)

Based on the above definition, does your organization currently use eLearning to deliver training and education?

- Yes (go to C-2)
- Planning to (go to C-2)
- No (go to C-1)
- Tried but discontinued (go to C-1)

C-1: If NO or discontinued

Please indicate the main reasons for not using eLearning and how much this reason influenced your decision.

Possible Reasons	Not an influence	Weak influence	Moderate influence	Strong influence	Very strong influence
Not seen as having an advantage over other approaches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Difficult to implement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incompatible with the existing approaches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poor experience of other organizations in your area who have tried eLearning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not easy to setup a pilot program for testing before roll out.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not seen as cost effective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High cost of internet access	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited computer and Internet Skills of target learners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited computer and Internet Access of target audience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited technology infrastructure in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited technology and related resources in the organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited staff proficiency in the use of technology for learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited institutional support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No one promoting the use of eLearning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not perceived as being able to meet organizational learning needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Uncertain or unproven benefits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited interest of	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



teachers/trainers					
Limited budget for eLearning activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Difficulty in measuring results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Concerns about security and cheating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited availability of quality eLearning content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited availability of eLearning content in local language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited availability of eLearning content in subject matter of interest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of models for using technology in instruction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C-2: If YES or planning to

2.1. How long has your organization been using eLearning?

- Plan to start soon
- One year or less
- One to two years
- Two or more years

2.2. How did you learn about eLearning? Please check all that apply

- Colleagues/Peers
- Newsletters
- Radio/TV
- Internet
- Discussion groups/Listserv
- Conferences
- Others, please specify

2.3. What share of your training effort is delivered through eLearning?

% of total training effort

2.4. For what subject areas are you using eLearning?

2.5. What percent of your eLearning activities focus on agricultural topics?

%

2.6. Do you expect the use of eLearning to change in the next 2 years?

- The same as this year
- More than this year
- Less than this year

2.7. What are some of the reasons why you expect change?

2.8. How satisfied are you with your current e-Learning program?

- Very satisfied  
 Somewhat satisfied  
 Somewhat dissatisfied  
 Very dissatisfied

2.9. Describe your eLearning program. Please check all that apply.

Delivery	Instruction	Communication	Content Packaging	Content Presentation	Content Development
<input type="checkbox"/> Purely online (no face to face meetings) <input type="checkbox"/> Blended learning (combination of online and face to face)	<input type="checkbox"/> Instructor-led group <input type="checkbox"/> Self-study (self-paced) <input type="checkbox"/> Self-study with expert help	<input type="checkbox"/> Live, synchronous via a conferencing system <input type="checkbox"/> Asynchronous via email, listserv, weblogs, forums	<input type="checkbox"/> Audio/Video tapes <input type="checkbox"/> CD/DVD <input type="checkbox"/> Website <input type="checkbox"/> Organized in LMS/LCMS	<input type="checkbox"/> Powerpoint/MS Word format <input type="checkbox"/> Webpage <input type="checkbox"/> Interactive quizzes/exams <input type="checkbox"/> Simulations	<input type="checkbox"/> In-house <input type="checkbox"/> Outsourced <input type="checkbox"/> Ready-made vendor 'off-the shelf' products

2.10. Do you have a separate unit/section managing/supporting your eLearning program?

- Yes  No

2.11. Please indicate the main reasons for using eLearning and how much this reason influenced your decision.

Possible Reasons	Not an influence	Weak influence	Moderate influence	Strong influence	Very strong influence
Considered to have a relative advantage over other approaches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Compatible with the existing approaches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Positive experiences of other organization in your area who have tried eLearning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of setting up a pilot program for testing before roll out.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost effectiveness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to reach more learners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High level of computer and Internet Skills of target audience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High level of computer and Internet Access of target	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

audience					
Good technology infrastructure in the region	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High level of available technology and resources in the organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High level of staff proficiency in the use of technology for learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Good organizational support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strong opinion leader and champion for the use of eLearning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Seen as being able to meet organizational learning needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proven benefits	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strong interest of teachers/trainers in using eLearning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adequate funding to support eLearning activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ease of assessing student performance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confidence in security of computer networks and cheating safeguards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of quality eLearning content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of eLearning content in local language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Availability of eLearning content in subject matter of interest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Knowledge of good models for the use of technology in instruction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.12. What do you consider to be the main strengths/key benefits of eLearning?

2.13. What do you consider to be the main weaknesses of eLearning?

#### **D. Technology infrastructure**

1. Please indicate the methods your university/institute uses to access the internet.

Dial-up

- ISDN/ B-ISDN
- DSL (ADSL/SDSL/VDSL)
- Cable (through the use of cable modem)
- Microwave
- Dedicated leased line
- Satellite
- VSAT

2. How do the following groups generally access the internet?

Teachers/Trainers	Students/Learners
<input type="checkbox"/> University computer labs	<input type="checkbox"/> University computer labs
<input type="checkbox"/> Computers in their office	<input type="checkbox"/> Computers in their office
<input type="checkbox"/> Community Information Centers	<input type="checkbox"/> Community Information Centers
<input type="checkbox"/> Internet cafes	<input type="checkbox"/> Internet cafes
<input type="checkbox"/> Home	<input type="checkbox"/> Home
<input type="checkbox"/> Other, please specify	<input type="checkbox"/> Other, please specify

3. How satisfied are you with your organization's current level of internet connectivity?

- Very satisfied
- Somewhat satisfied
- Somewhat dissatisfied
- Very dissatisfied

4. Recent and ongoing technological advances have greatly expanded the range and variety of online digital resources that educators can take advantage of. Which of the following would you like to incorporate in your educational activities? Please check all that apply.

- Satellite image monitoring
- Image analysis
- Disaster Observation
- Wireless LAN for users
- Link to field sensor devices to remotely measure field conditions like temperature, humidity and light intensity, soil moisture, leaf wetness, CO2 concentration, UV, pest accounting, etc.
- Data mining
- Modeling
- Others, please specify