Information and Communication Technology for Development:

Global Perspectives, Asian Initiatives

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This volume was originally compiled in 2008 as required reading in MMS 130 (ICT4D. Information and Communication Technology for Development) offered under the Bachelor of Arts in Multimedia Studies (BAMS) Program of the UP Open University. It was a product of field experience, a collection of grey literature and fugitive materials produced in our consulting sorties in Asian countries. Before the BAMS program, there were no formal courses on the subject nor were there any texts. With the highlighting of best practice and lessons learned, the restructuring of the text, and the inclusion of learning objectives and self-assessment questions, the compilations were transformed into what we feel, is a comprehensive textbook on information and communication technology for development.

In its current, updated incarnation, this volume takes the form of an e-book primarily meant for the consumption of development sector professionals and para-professionals manning ICT4D projects in any part of the world while enrolled in the Massive Open Online Course (MOOCS) on the same topic offered by the UP Open University. For this, we thank the UP Academic Program Improvement facility and the UPOU MOOCS Program.

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Sandy and Benjie Flor
Los Baños

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LIST OF ACRONYMS

A&E	Accreditation and Equivalency
A&F	Agriculture and Forestry
A3I	Accelerated Architecture Acquisition Initiative
AAET	Agency for Agricultural Extension and Training
AAHRD	Agency for Agricultural Human Resource Development
AARD	Agency for Agricultural Research and Development
ACPC	Agricultural Credit Policy Council
ADB	Asian Development Bank
ADS	Agricultural Development Strategy
ADSL	Asymmetric Digital Subscriber Line
AI3	Asian Internet Interconnection Initiatives
AIAT	Assessment Institutes for Agricultural Technology
AIIB	Asian Infrastructure Investment Bank
AIN	Agricultural Information Network
ALS	Alternative Learning Systems
AM radio	Amplitude Modulation
AMIA	Adaptation and Mitigation Initiative in Agriculture
AMS	Agricultural Marketing System
APAN	Asia Pacific Advanced Network
APEC	Asia Pacific Economic Council
ASEAN	Association of Southeast Asian Nations
ASIS	Agricultural Stress Index System
ATI	Agriculture Training Institute
AVC	Audio Visual Center
BAAC	Bank for Agriculture and Agricultural Cooperatives
BAFE	Bureau of Agricultural and Fisheries Engineering
BAFS	Bureau of Agriculture and Fisheries Standards
BAI	Bureau of Animal Industry
BALS	Bureau of Alternative Learning Systems
BAMS	Bachelor of Arts in Multimedia Studies
BAPPEDA	Badan Perencana Pembangunan Daerah
BAR	Bureau of Agricultural Research
BAS	Bureau of Agricultural Statistics
BCDR	Business Continuity and Disaster Recovery
BDC	Business Development Council
BEC	Basic Education Curriculum
BEIS	Basic Education Information System
BESRA	Basic Education Sector Reform Agenda
BFAR	Bureau of Fisheries and Aquatic Resources
BfF	Blaster for Farmers
BIMP	Brunei, Indonesia, Malaysia and Philippines
BIPPs	Balay Informasi Pertanian dan Penyuluhan/Rural Extension Centers
BIPS	Bhutan Information and Communication Technology Policy and Strategies

BLPPs	Balai Latihan Penyuluhan Pertanian/Agricultural Training Centers
BPI	Bureau of Plant Industry
BPTP	Balai Pengkajian Teknologi Pertanian
BRDD	Bridging the Rural Digital Divide
BSWM	Bureau of Soils and Water Management
CABTS	Central Agricultural Broadcasting and Television School
CADI	Center for Agricultural Database and Information
CARD	Council for Agriculture and Rural Development
CARP	Council of Agricultural Research Policy
CASIE	Central Asia Regional Symposium on ICT in Education
CASP	Core Agriculture Support Program
CCA	Climate Change Adaptation
CCExt	Contact Center for Agricultural Extension
CD	Compact Disc
CD-ROM	CD Read Only Memory
CeC	Community eCenters
CERN	European Organization for Nuclear Research
CGIAR	Consultative Group for International Agricultural Research
CHED	Commission on Higher Education
CICT	Commission on Information and Communications Technology
CIDA	Canadian International Development Agency
CLIN-BNP	Community Level Information System-Barangay Network Project
CLUP	Comprehensive Land Use Plan
CMMPC	Community Multimedia Production Centers
CNN	Cable News Network
CoC	Communities of Champions
COFISH	Coastal Community Development and Fisheries Resource Management Project
CoI	Communities of Interest
CONUS	Continental United States
CoP	Communities of Practice
CORRB	Council of Renewable Natural Resources Research of Bhutan
CRDC	Commune Rural Development Council
CRM4AQUA	Climate Resilience Management for Aquaculture
CRMP	Coastal Resource Management Project
CTRE	Communications Technology for Rural Education
CY	Calendar Year
DA	Department of Agriculture
DA AFMIS	DA Afghan Financial Management Information System
DA BAR	DA Bureau of Agricultural Research
DAEC	Department of Agricultural Extension and Cooperation
DAFEP	World Bank Project
DALAM	Department of Agricultural Land Management

DA-TERMS	Department of Agriculture's Trade Enabling Risk Management System
DepEd	Department of Education
DFAT	Department of Foreign Affairs and Trade
DFID	Department of International Development
DICT	Department of Information and Communications Technology
DISC	DOA Information Service Center
DIT	Division of Information Technology
DLS	Department of Livestock
DOA	Department of Agriculture
DOAE	Department of Agricultural Extension
DoF	Department of Forestry
DoFI	Department of Forest Inspection
DoI	Department of Irrigation
DoLF	Department of Livestock and Fisheries
DORD	District Office for Rural Development
DoS	Department of Agricultural Services
DRDC	District Rural Development Council
DRRM	Disaster Risk Reduction & Management
DSS	Decision Support System
DTI	Department of Trade and Industry
EAGA	East Asian Growth Area
EBA	Evidence-based Approach
EBP	Evidence-based Policy
E-IFM	Electronic Inward Foreign Manifest
EO	Executive Order
EU	European Union
F2F	Face to face
FAD	Functional Analysis and Design
FAO	Food and Agriculture Organization
FARMCs	Fisheries and Aquatic Resources Management Council
FEATI	Farmers' Empowerment through Appropriate Technology and Information
FFS	Farmers' Field Schools
FGD	Focus Group Discussion
FIS	Financial Information System
FIT-ED	Foundation for Information Technology for Education and Development
FITS	Framework for ICT Technical Support
FLAMES	Farm-level Agricultural Marketing Exchange Information System
FM radio	Frequency Modulation
FMS	Farmer Marketing Schools
FOS	Field Operations Service
FSIS	Food Security Information System
FY	Fiscal Year
GAD	Gender and Development
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GIS	Geographic Information System
GMO	Genetically Modified Organism
GMS	Greater Mekong Sub-region
GNH	Gross National Happiness
GNP	Gross National Product
GPRS	General Packet Radio Service

GSM	Global System for Mobile Communications
GST	General Systems Theory
HDI	Human Development Index
HDR	Human Development Report
HEI	Higher Educational Institution
HELP	Health, Education, Livelihood, Participation
HPI	Human Poverty Index
HRIS	Human Resources Information System
IAARD	Indonesian Agency for Agricultural Research and Development
IBM	International Business Machines
ICCM	Internet Center for Coastal Management
ICS	Information and Communication Service
ICT	Information and Communications Technology
ICT4AF	ICT for Agriculture and Forestry
ICT4BE	ICT for Basic Education
ICT4D	ICT for Development
ICT4E	ICT for Education
ICT4FAA	ICT for Food Availability and Affordability
ICT4HVC	ICT for High Value Crops
ICT4L	ICT for Rural Livelihood
ICT4SF	ICT for Staple Food Production
ICTPSD	ICT Planning and Standards Division
ICTS	ICT Service
ICX	Incoming Exchange
IEC	Information and Education Campaign
IFAD	International Fund for Agriculture Development
IITE	Institute for Information Technologies in Education
IM	Information Management
IMF	International Monetary Fund
IP	Internet Protocol
IRA	Internal Revenue Allotment
IREX	International Research Exchange
IRRI	International Rice Research Institute
ISP	Internet Service Provider
IT	Information Technology
ITPI	Intel Technology Philippines Incorporated
ITU	International Telecommunications Union
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
Kbps	Kilobits per second
KIST	Kigali Institute for Science and Technology
KM	Knowledge Management
KOICA	Korea International Cooperation Agency
KTNA	Kontak Tani Nelayan Andalan
LAN	Local Area Network
LDC	Least Developed Countries
LFA	Logical Framework Approach
LGU	Local Government Unit
LIFDCs	Low-Income Food-Deficit Countries
LMS	Learning Management System
LSMs	Logistics System Manager
M&E	Monitoring and Evaluation
MAF	Ministry of Agriculture and Forestry

MAFC	Municipal Agricultural and Fishery Council
Mbps	Megabits per second
MDC	Metropolitan District Council
MDG	Millennium Development Goals
MfDR	Management for Development Results
MHz	Megahertz
MIN	Mango Information Network
MIRS	Management Information Resources System
MIS	Management Information Systems
MOA	Ministry of Agriculture
MOAC	Ministry of Agriculture and Cooperatives
MOALI	Ministry of Agriculture Livestock and Irrigation
MoC	Ministry of Communications
MoE	Measure of Evaluation
MONET	Monitoring Network
MOOCs	Massive Open Online Courses
MORDI	Mainstreaming of Rural Development Innovations
MOS	Microsoft Office Specialist
MPTC	Ministry of Posts and Telecommunications of Cambodia
MRD	Ministry of Rural Development
MRIS	Management Resources Information Systems
MS	Microsoft
MSSQL	Microsoft SQL Server
NAFES	National Agriculture and Fishery Extension Service
NAFRI	National Agriculture and Forestry Research
NAFTA	North American Free Trade Agreement
NAIN	National Agricultural Information Network
NARES	National Agricultural Research and Extension System
NARI	National Agricultural Research Institute
NCCAG	National Color-Coded Agricultural Guide
NCR	National Capital Region
NDA	National Dairy Authority
NEAP	National E-Agriculture Program
NECTEC	National Electronics Technology and Computer Center
NGO	Non-Governmental Organizations
NIDA	National Information and Communication Technology Development Authority
NIN	National Information Network
NISP	National Initiative for Strategic Planning
NMIS	National Meat Inspection Service
NOMD	Network Operations and Management Division
NPFS	National Program for Food Security
NPSBE	National Program Support for Basic Education
NSPI	National Strategic Planning Initiative
NTA	National Tobacco Authority
ODA	Official Development Assistance
ODI	Overseas Development Institute

ODL	Open and Distance Learning
OIC	Officer in Command
OLPC	One Laptop Per Child
OPAPA	Open Academy for Philippine Agriculture
OU	Operating Units
PASIG	World Bank Project
PBSP	Philippine Business for Social Progress
PC	Personal Computer
PCAF	Philippine Council for Agriculture and Fisheries
PCC	Philippine Carabao Center
PCIC	Philippine Crop Insurance Corporation
PCMU	Program Management Coordination Unit
PFDA	Philippine Fisheries Development Authority
PFI3P	Poor Farmers' Income Improvement through Innovation Project
PhilFIDA	Philippine Fiber Industry Development Authority
PhilMech	Philippine Center for Postharvest Development and Mechanization
PhilRice	Philippine Rice Research Institute
PiL	Partners in Learning
PIP	Project Information Centers
PIU	Project Implementation Unit
PMUs	Project Management Units
PORD	Provincial Office for Rural Development
PPP	Public Private Partnerships
PRA	Production and Revenue Accounting
PRDC	Provincial Rural Development Council
PREGINET	Philippine Research and Education for Government Institutions Network
PRISM	Philippine Rice Information System
PS	Planning Service
PSA	Philippine Statistics Authority
PSP	PlayStation Portable
PWDs	Persons with Disabilities
QuedanCor	Quedan and Rural Credit Guarantee Corporation
R&D	Research and Development
RAPID	Research and Policy in Development
RASFF	Rapid Alert System for Food and Feeds
RBM	Results-based Management
RC	Regional Coordinator
RCM	Rice Crop Manager
RCO	Regional Coordination Office
RGoB	Royal Government of Bhutan
RIARCs	Regional Integrated Agricultural Research Centers
RKB	Rice Knowledge Bank
RNR	Renewable Natural Resources
RNRRC	Renewable Natural Resources Research Centre
S&T	Science and Technology
SAAD	Special Area for Agricultural Development
SAI	State Agricultural Institutes
SAIMS	SPFS Asia Information Management System
SARAI	Smarter Approaches to Reinvigorate Agriculture as an Industry

SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goals
SEAMEO	Southeast Asian Ministers of Education Organization
SLF	Sustainable Livelihoods Framework
SMS	Short Message Service
SOA	Service-Oriented Architecture
SOD	Science of Delivery
SPFS	Special Program for Food Security
SRA	Sugar Regulatory Administration
STEA	Science, Technology and Environment Agency
TC	Technical Committee
TCP	Transmission Control Protocol
TEEP	Third Elementary Education Project
TEI	Tertiary Educational Institution
TESDA	Technical Education and Skills Development Authority
TLE	Technology and Livelihood Education
TV	Television
TWG	Technical Working Group
UHF	Ultra High Frequency
UN	United Nations
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UP	University of the Philippines
UPOU	University of the Philippines Open University
USA	United States of America
USAID	United States Agency for International Development
USTDA	US Trade Development Agency
VASPs	Value-Added Service Providers
VCD	Video Compact Disc
VCIP	Village Computer and Internet Program
VDC	Village Development Councils
VERCON	Virtual Extension, Research and Communication Network
VHF	Very High Frequency
VHS	Video Home System
VSAT	Very Small Aperture Terminals
W3C	World Wide Web Consortium
WAICENT	World Agricultural Information Centre
WAN	Wide Area Network
WARNET	Warung Internet/Rural Internet Service
WARTEL	Warung Telepon/Rural Telephone Service
WHO	World Health Organization
WSIS	World Summit on the Information Society
WWW	World Wide Web
XML	Extensible Markup Language

PROLOGUE
THE INFORMATION AGE

In 1978, the American public broadcasting network aired a television documentary titled, *The Information Society*. The production was funded by the John and Catherine MacArthur Foundation, and was based on the voluminous doctoral dissertation of Marc Porat, who also served as the screenwriter and on-camera narrator. The feature was premised on the assertion that human civilization has gone through two major eras, the Agricultural Age and the Industrial Age. The former began with the invention of the plough, the latter with the introduction of the steam engine. Porat argued that as of 1978, humanity had already progressed deep into the Information Age, which commenced with the launching of the Sputnik satellite in the 50s and the advances in computer science in the 60s.

An economist by training and profession, Porat characterized the Information Age by rapid *informatization* (as differentiated from industrialization), widespread recognition of information as a critical resource and commodity, and the dominance of information-based economies in the global arena. Compared to agriculture-based and industrial-based economies, information-based economies have a labor force made up mostly of information workers. The documentary featured the leading information economist of the day, Fritz Machlup, who elaborated on the concept of an information society. Such a society exists in countries with information-based economies, as in the case of the United States in the West, Japan in the East, Germany in the North, and Singapore in the South. These exist side-by-side with agricultural and industrial societies, countries with agriculture-based and industrial-based economies, respectively.

Forty years later, there is hardly any question that the world is indeed in the Information Age. However, most developing countries remain agricultural societies. And an agricultural society is enormously challenged within the Information Age. Agricultural societies, developing countries, and emerging economies often find themselves

on the wrong end of the stick within this environment. In fact, valid theoretical arguments may be derived from a structural cum critical analysis of the Information Age phenomenon.[1]

The main engine of the Information Age is information and communication technology or ICT. And not even skill and talent in ICT are perceived to provide the saving grace for developing countries. Take the case of the Philippines. To quote a paragraph from the *2001 Asian Communication Handbook*:

> *Five months into the new millennium, the Philippines made it to the front page of every major international newspaper. It was not because of a hostage crisis caused by another Abu Sayaf kidnapping… It was due to a virulent email virus that sent computer network systems crashing worldwide, from the British Parliament to the Pentagon, causing an estimated damage of US$ 15 billion. No less than the U.S. Federal Bureau of Investigation assisted local authorities in apprehending a suspect. The so-called love bug was traced to an Internet service provider (ISP) in Manila, which subsequently led to a 23-year old computer science student named Onel de Guzman. Oddly enough, this deed earned him a considerable degree of respect from his peers, not widespread condemnation. Perhaps it was a reflection of the Filipino collective psyche for de Guzman to gain the moniker, Asia's first "world class hacker" (Flor and Flor in Goonasekara and Holiday, 2001).*

In spite of this incident, the general environment, and prevailing perceptions, one may argue that the developing world's prospects for distinction in ICT far exceed its potentials for notoriety. Asia supplies the world with ICT hardware, software, and services. India and the Philippines in particular lead in the number of software developers that are exported to the West and in the scale of business process outsourcing and contact center service provision. More importantly, it

[1] *For more on this, please refer to Developing Societies in the Information Age: A Critical Perspective by A.G. Flor, UP Open University (2009).*

is merely fitting for the developing world to lead in the global initiative for information and communication technology for development or ICT4D.

The developing world is being deeply impacted by new information and communication technologies. The business sector in emerging economies have profited immensely from the convergence of computers and telecommunications, allowing faster access to market information, sounder decision-making, quicker response to market developments, as well as more efficient streamlining of operations. Unfortunately, the rural development sector has lagged behind in exploring and tapping the potentials that ICT has to offer. These potentials range from: the sharing and re-using of data, research findings, lessons learned and best practices among R&D institutions to developing quick response mechanisms for agricultural crises situations; permitting informed decision making among our agricultural officials to sounder policy making among our legislators; improving the educational delivery systems in the rural areas to bringing *eCommerce* to our farmers. The possibilities are next to endless.

Furthermore, the existing development assistance environment is most favorable to ICT4D. The Okinawa Summit among G7/G8 nations has established the primacy of bridging the Digital Divide in the international development assistance agenda. The agriculture and rural development applications of ICT has become a fertile field of study for R&D institutions. The academe should actively train people not only to conduct research in this area but to implement ICT4D interventions that are now ever-increasing in number, increasingly complex in design, and progressively ambitious in targets. This book presents an introduction to the study of ICT4D, its sectoral applications, and its state of play. The volume takes as its goal the strengthened capacities of Third World ICT4D professionals by providing them with a comprehensive and adequate appreciation of the field.

UNIT I
SITUATING ICT4D

CHAPTER 1.
DEFINITION, SCOPE, RATIONALE, AND STRATEGIES

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Define information and communication technology (ICT);
2. Enumerate the characteristics and features of ICTs;
3. Delineate the scope of ICTs from the international development assistance perspective;
4. Provide examples of these technologies and their applications;
5. Differentiate among the four rationales of ICT4D; and
6. Describe ICT4D strategies and approaches.

KEY CONCEPTS

ICT
ICT4D
Conventional Media
New Media
Convergence
ICT4D Rationales
ICT4D Strategies

DEFINITION AND SCOPE

Generally, information and communication technology (ICT) is the collective term given to second and third generation information technology (IT) spawned by the merger of computers and telecommunications. This class of technologies makes available to specified users information or knowledge systems; and may generate information or knowledge products or services. One feature of ICT is the convergence of media (text, image, audio, and video – hence, multimedia) made possible by a common digital platform.

The phrase was introduced by Katzman in a 1974 ***Journal of Communication*** article. It was meant as an alternative to the normally used *information technology*, which was seen as limited to the object of technology (i.e., information) and unable to cover the process facilitated by the technology (i.e., communication). Initially, the more common usage of the phrase alluded to telecommunications and "communication machines"; thus, information and *communications* technology. However, academic circles and international development assistance agencies began relating ICT to social processes and impacts. Thereafter, the *s* in *communications* was dropped.

ICT4D is the acronym for information and communication technology for development, the purposive application of ICT in pursuit of the Millennium Development Goals or MDGs now SDGs (Sustainable Development Goals of The Goals). Within this context, ICT assumes a broader, more encompassing scope, since conventional media is more pervasive in developing countries. ICT4D thus includes all the elements of the existing information and communications environment.

Characteristics and Features

The existing information and communications environment have elements of both the old and the new; the conventional and the sophisticated; the analog and the digital.

Conventional Media. Conventional media are made up of media that preceded the Information Age. Much of these formed parts of what were traditionally known as tri-media. This grouping includes:

1. AM and FM radio;
2. VHF and UHF television;
3. Print media;
4. Photographs;
5. Industrial and small format video;
6. Cinema; and
7. Indigenous communication or folk media.

Although nowadays, most conventional media make use of digital technology in their production, dissemination/transmission, or utilization, they are not dependent on this type of technology and are essentially analog in nature.

Paradoxically, most conventional media have become more available, more accessible, and cheaper with the advent of new media. A comparison of statistics given by the Asian Communication Handbook shows that there are more radio and television stations, more radio and television sets, more movies, and more publications today. Fifty years ago, radio was acknowledged as the most pervasive medium in rural farming communities. Today, it remains to be the most ubiquitous, the only difference being that farmers today have equal access to both AM and FM broadcasts. With the spread of television coverage, rural communities have higher access to VHF and UHF transmissions. Small format video (Beta, VHS, Super VHS, Video 8 and Hi-8) has become obsolete giving way to VCDs which have also become obsolete with the advent of digital format videos. The increased availability of these offline and online digital video resulted in a seemingly contradictory situation wherein the number of cinemagoers has decreased but the popularity of cinema has increased. Similarly, higher literacy rates have also led to better potentials for print media.

There are higher prospects for us to tap conventional media for development purposes today than it was before, with one exception.

Indigenous communication or folk media is losing its potential as an extension medium in rural communities. The greater the influence of popular culture brought about by radio, television, and cinema, the lesser the popularity of folk media. There are, of course, exceptions to this observation, such as the sustained *dangdut* craze spreading all over Indonesia.[2]

Although the book will touch on conventional media, it recognizes the availability of comprehensive and voluminous texts and references on this area. Thus, conventional media will not be the book's focus.

New Media. New media, on the other hand, are products of the convergence of digital technologies. It includes digital media published or made available using the Internet Protocol, i.e., text, images, voice, music, and video. It may take the form of:

1. Websites;
2. Webcasts;
3. Podcasts;
4. Blogs;
5. Interactive forums;
6. Interactive games; and
7. Social networks.

Such media may be accessed through Web browsers and applications PCs, laptops, mobile devices and other gadgets. New media access range from web-enabled, networked technologies, to stand-alone offline technologies. This book emphasizes the use of new media for development.

RATIONALES

The following arguments have been forwarded by proponents of ICT4D:

[2] *Dangdut is a combination of indigenous beat, local song and ethnic dance employing contemporary themes. It is popular among all ethnic groups in the entire Indonesia.*

Technological Argument. From the point of view of sociologists and historians, we are now in the third major age of human civilization, the Information Age. This age was preceded by the Industrial Age that began with the development of the steam engine and the Agricultural Age that began with the development of the plough. The Information Age was heralded by the invention of the computer and the launching of the first telecommunications satellite, Sputnik. In the Information Age, information has become the primary resource and ICT, a primary asset. Each and every aspect of our lives is being increasingly influenced by ICT. We in the development assistance and public sectors should employ ICTs to achieve national and global development goals.

Economic Argument. From the point of view of many economists, information is wealth creating. That portion of the country's gross national product attributable to information-related activities is getting larger and larger. The number of our information workers is also increasing while the number of agricultural and industrial workers is decreasing. In other words, our economy is getting to be more and more information-based. Thus, information and communication technology is an integral part of economic development.

The Critical Argument. Critical theorists explain social phenomena from the point of view of power relations between and among stakeholders, institutions, and sectors. The power relations and social structures associated with social phenomena are established or undermined, perpetuated or ended through strategic uses of information and communication. Thus, information and communication technologies must be leveraged to end exploitative regimes and dismantle asymmetrical structures.

The World Systems or Meta Evolutionary Argument. Perhaps the least discussed and yet, most intriguing rationale for ICT4D is the argument that as a living system, the world is undergoing a process of evolution and ICTs are extra-biological products of such. Norbert Weiner based the science of cybernetics on the assumption that communication is a critical function of all living systems. Marshall MacLuhan, who introduced the concept of the global village, was convinced that communication media are extensions of man. We can

then argue that at a collective or macro level, new media such as the Internet and the World Wide Web, are extensions of mankind. They provide the infrastructure for an evolving world brain. Biologically, economically, and socially, development is synonymous to growth. Thus, the development of ecosystems, economies, or societies, requires information and communication.

STRATEGIES AND APPROACHES

ICT4D adopts several strategies and approaches:

1. It taps popular media.
2. It is biased towards community-based, participatory approaches.
3. It promotes the capacities of support agencies.
4. It is predisposed towards low-end, low-cost information and communication technology such as mobile phones and cable television;
5. It is scalable.
6. It employs a programmatic instead of a technological approach.

Riding the Tide of Popular Media. Popular media is spreading like wildfire in rural Asia. In the hinterlands of West Kalimantan, one can observe Dayak youths in communities seven hours away from urban centers sporting American Idol T-shirts or hip-hop jeans. In the evenings, you would see them dance to a *dangdut* tune in a wedding celebrated in the middle of a provincial highway. The popularity of music videos, songs, and artists, may be tapped in development undertakings. For instance, a product endorsement from a local popular music artist would go a long way. Instead of rural radio forums or schools on the air, the extension worker may experiment on inserting agricultural technology messages in entertainment programs and music videos.

Community Based/ Participatory Media. With the increased availability of conventional media, communities are now able to participate in the production of low-cost information and communication materials. A case in point is the use of video in the documentation of best practices. Using a low-cost camcorder

or even a mobile video device, local talents may be tapped in the documentation process. The video files may then be shared with other communities. If several communities are involved in this documentation, then a “sharing network” for the exchange of materials among these communities may be initiated.

Capacity Building for Support Agencies. The Okinawa Charter recommends “the development of human resources capable of responding to the demands of the Information Age through education and lifelong learning…” Along this line, the capacity building approach increases the institutional capability of central, as well as devolved support agencies such as the departments of agriculture, education, and health, in providing support services to farmers. Increasing the institutional capability involves: *system design and development*; *hardware and software procurement*; and *staff development*. However, this approach does not directly target the ultimate beneficiary - the rural farmer, fisher folk, and housewife - but rather the services that provide support to him/her.

Programmatic ICT Strategy. The ideal approach, however, is the use of ICT that would directly improve the farmer’s access to information, and reinforce his linkages with the research, extension, and market sub-systems. Some are of the opinion that such an approach is difficult if not impossible for the following reasons:

- Farmers are not computer literate. Many of them are not even functionally literate.
- ICT is very expensive. Farmer’s would rather spend their hard earned money on basic necessities rather on ICT.
- Internet service providers are unavailable in the rural areas.

These concerns may be adequately addressed by three strategies:

- Employing low-end, low-cost information and communication technology such as cellular phones, VCDs, cable television;
- Achieving economies of scale; and
- Using a programmatic instead of a technological approach.

The first strategy will be dealt with in the succeeding section. The second is self-explanatory. With regard to the last, ICT should not be introduced as a purely technological intervention alone but a programmatic intervention with a comprehensive set of attendant services, which may include: pre-financing; market linkages; and technical assistance.

An example of the programmatic ICT approach is the Empowerment of Rural Households Through Information Technology Project currently being processed by the Asian Development Bank as a technical assistance project for the Philippines. The objectives of the project is to increase the income of poor rural households by linking the production of high-value products, using available natural resources in the community, with domestic and international markets through ICT for sustainable development. The goal of the project is to reduce poverty of several ethnic minority groups and several ethnic majority groups.

The project area consists of twelve pilot provinces, all of which belong to the poorest provinces according to Government classification. The project will have two parts. Part A will consist of three components: (i) community empowerment, (ii) establishment of IT Livelihood Centers in the Rural Communities, and (iii) development of sustainable livelihoods. Part B will consist of three components: (i) establish a network of DTI Livelihood Centers at provincial capitals, cities, and the national capital, and (iii) provide public information service.

SELF ASSESSMENT QUESTIONS

1. What are ICTs? What is ICT4D?
2. What are the characteristics and features of ICTs?
3. What consists of ICTs from the international development assistance perspective?
4. What are the four rationales of ICT4D?
5. Can you enumerate ICT4D modalities?
6. How would you describe ICT4D strategies and approaches?

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CHAPTER 2.
ICT AND THE SUSTAINABLE DEVELOPMENT GOALS

LEARNING OBJECTIVES

After studying this chapter, you are expected to:

1. Describe the concept of sustainable development;
2. Differentiate the MDGs from SDGs; and
3. Conceptualize how ICTs may hasten (or hinder) the achievement of these goals in your own locality.

KEY CONCEPTS

Development
Sustainable Development
Millennium Development Goals
SDG indicators
Participation

DEFINITION

Development

The term development had been defined in many ways by many people based on differing contexts. Different eras of development had a context-based understanding and operationalization of the term. Rogers (1976) as cited by Servaes (2008), defines "development as a participatory process of social change in a society, intended to bring about both social and material advancement, including greater equality, freedom, and other valued qualities for the majority of people through their gaining greater control over their environment.

Similarly, Adedokun (2008) defines development as the power of people to solve their own problems with their own wisdom,

experience, and resources, to eliminate poverty, pestilence, and starvation. From a social perspective, Akinpelu (2002) defines development as the process of enhancing man's knowledge, skills, attitudes, boosting his self-confidence, self-reliance, and self-pride to face the world.

This implies that the center of development is man (Ongkiko and Flor, 1998). Suffice to say, that man's development should be a concern not only of one's self, but a collective action involving the people, government, and institutions, even nations. This notion of collective growth gave way to the formation of the United Nations that eventually led to the formulation of a universal agenda, which was the Millennium Development Goals (MDGs) which were supposed to be achieved in 2015. There were eight goals identified, namely; eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria, and other diseases; ensure environmental sustainability; and develop a global partnership for development.

However, by 2015, not all MDGs were achieved (UN, 2015). Hence, the launching of the Sustainable Development Goals (SDGs) came into fruition. According to the UN, the SDGs are integrated and indivisible, and balance the three dimensions of sustainable development: the economic, social, and environmental. So, what then is the concept of sustainable development?

The etymology of the word "development" reveals it to be the French antonym for envelopment or containment. In the 17th century, development pertained to the natural, unhindered growth of an organism or colonies of organisms. However, in the 20th century, economists began using it as a more technical, less politically laden synonym for progress.

Our engagement in the development discourse began in the 70s, during what development observers refer to as the Second Development Decade (Ongkiko and Flor, 2003). Then, we were questioning the constructs that were prevalent in the 60s, i.e., GNP as the development yardstick, and the so-called trickledown

effect. But it was years later, during the Third Development Decade, when sustainability became mainstreamed and development was defined by economic, social, and environmental goals. To drive home the importance of sustainability, the post 2015 agenda of the international development community had been re-christened as the Sustainable Development Goals or SDGs. If anything, the SDGs accentuate the transdisciplinary nature of sustainability.

Sustainable Development

According to the International Institute for Sustainable Development, sustainable development has many definitions, but they have adopted those made by Our Common Future or the Brundtland Report which is: sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Flor and Ongkiko (1998), on the other hand, defines sustainable development as the convergence of economic, social, and environmental goals. It means that for any development intervention, these three goals must be considered to make it sustainable, long lasting, and enduring, so that benefits could accrue to future generations to come.

THE GOALS

The SDGs, also known as the Goals, are targeted to be achieved by 2030. A brief description of each goal is hereby presented. Indicators have also been identified but these will not be discussed here. Here are the Goals:

Goal 1 End poverty in all its forms everywhere (No poverty)

Eradicating poverty is the greatest challenge of many countries. If a person earns less than $1.25 per day, by today's standard, that person is poor. Many countries are poor especially in Africa, Asia, and Latin America. In the Philippines, poverty is the number one problem that has been plaguing the country for decades.

Goal 2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture (Zero hunger)

More than 100 million people go hungry everyday brought about by many causes like man-made conflicts, climate change, food availability, and poor nutrition. If one is poor, it follows that they cannot eat enough daily and the quality of food suffers.

Goal 3 Ensure healthy lives and promote well-being for all at all ages (good health and well-being)

The need for good hospitals and health care services must be in place to ensure that people are well protected. In times of pandemic, many countries are a disadvantage because health care facilities are poor. Some are also not ready on how to address a pandemic. Good health depends on good nutrition but without food, people will not only get sick but may die as well.

Goal 4 Ensure inclusive and equitable quality education, and promote lifelong learning opportunities for all (Quality education)

Education has been recognized as key to have a better future. The aim is not only to provide literacy but skills that would allow people to learn in their lifetime. Basic education is a right, but functional literacy is a must. This means that for people to have better opportunities, they must not only be able to read and write, but can think critically and decide judiciously. Such life skills must be imparted through high quality education.

Goal 5 Achieve gender equality and empower all women and girls (Gender equality)

Women still seem to be at a disadvantage in some countries, may it be at work or positions in government. They are also victims of violence whether at home or in public places. Women are treated as companions rather than as co-equal in many societies. Abuse of women physically or sexually is still rampant being perceived as the weaker sex.

Goal 6 Ensure availability and sustainable management of water and sanitation for all (Clean water and sanitation)

Water is perhaps the most important commodity in life. In all that people do, water plays a role. People can go without food, but not water. Since it is essential, water services must be provided to ensure sanitation and stay away from getting sick. Dirty hands bring a lot of diseases to one's body.

Goal 7 Ensure access to affordable, reliable, and sustainable and modern energy for all (Affordable and clean energy)

Sources of energy that people use must be made available. These must be clean, renewable, and accessible. Research on the use of renewable energy like sunlight, wind, rain, tides, waves, and geothermal must be carried out to ensure sustainability.

Goal 8 Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all (Decent work and economic growth)

Work opportunities for all including people with disabilities, young people, men, and women must be made available. Small and Medium Enterprises have a great role to play in providing such opportunities. In many countries, young people and PWDs are hired for work and paid accordingly. This implies that the country must have a robust economy to ensure that everyone gets paid correctly for services rendered.

Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation (Industry, innovation, and infrastructure)

Support to technology development should be a priority to improve people's living conditions. Science and technology play a significant role in helping a country to come up with new inventions that can enhance people's lives, but must be sustainable and should not harm the environment.

Goal 10 Reduce inequality within and among countries (Reduced inequalities)

Inequalities in all its forms must be recognized and observed. This includes race, religion, ethnicity, physical disability, sex, age, and gender as they apply to work opportunities or migration. Official development assistance or ODA funds are geared to developing countries as they need this most. Financial investments must be strategic to countries which need the most assistance.

Goal 11 Make cities and human settlements inclusive, safe, resilient, and sustainable (Sustainable cities and communities)

Having green spaces to walk around, comfortable and efficient transport system especially for women, children, and PWDs must be in place. A clean and green environment where pollution and smog are absent and free from diseases.

Goal 12 Ensure sustainable consumption and production patterns (Responsible consumption and production)

People must learn how to recycle, reuse, and reduce wastes. Only eat what is needed and refrain from too many wastes in all its forms. Food wastage does not only deprive the hungry, but irresponsible consumption can lead to food shortage.

Goal 13 Take urgent action to combat climate change and its impacts (Climate action)

Climate change is here to stay. Being resilient means people can adapt and mitigate impacts of climate change if properly made aware. This implies that awareness of people must be increased. Organizations in-charge of climate change should have more information dissemination or strategies to include it in the curriculum for everyone to be knowledgeable about it.

Goal 14 Conserve and sustainably use the oceans, seas, and marine resources for sustainable development (Life below water)

Marine resources protection and management should be everybody's concern. Bodies of water are connected locally and internationally. Pollution of one body of water can affect nearby waters, and eventually, bigger bodies of water. Water, once polluted, may take a lifetime to clean and use it again.

Goal 15 Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss (Life on land)

Natural resources must be managed and protected. Unnecessary use of these natural resources is prohibited. Instead, stewardship especially among the locales, is encouraged to protect them.

Goal 16 Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels (Peace, justice, and strong institutions)

Justice for all, locally and internationally, shall be observed. Transparency in governance must be practiced. Abuse of authority must not be practiced. Corruption must be curtailed. A just and an upright society will do justice for all.

Goal 17 Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development (Partnerships for the Goals)

Big brother approach shall be used to help those needing assistance in terms of technology development, financial resources, expertise, and the like. Such partnership and collaboration can pave the way to strategic, and yet holistic, development of each member country. Support to each other and among nations can eventually result to universal achievement of the Goals.

PARTICIPATION AND HOLISTIC ACTION

For the Goals to be achieved, participation of nations is crucial. Nations should realize that everyone should be capacitated and that no one shall be left behind. Each country should be able to articulate in their national agenda the institutionalization of these plans. For instance, the Philippines has operationalized the SDGs through the Philippine Development Plan 2017-2022. Participation cannot be done on an individual capacity but must be addressed holistically. Local government units (LGUs) who are at the forefront of development must spearhead the implementation with people participation. Often, development interventions fail because recipients do not participate in planning or are not involved in the development process. Being holistic implies the participation of stakeholders from the national, regional, provincial, municipal, to the barangay levels, and eventually to the family. As a nation, it has to move as one to achieve the Goals.

SELF ASSESSMENT QUESTIONS

1. What is sustainable development?
2. What are the differences and similarities of these UN goals (MDG and SDG)?
3. How will the Goals be achieved?

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CHAPTER 3.
ICT AND POVERTY

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Establish the correlation between poverty and ICT access in Southeast Asia;
2. Discuss the four poverty paradigms;
3. Describe ICT interventions to alleviate poverty; and
4. Enumerate lessons learned on ICT and poverty.

KEY CONCEPTS

Human Development Index (HDI)
Human Poverty Index (HPI)
ICT Indicators
Technological Paradigm
Economic Paradigm
Structural Paradigm
Cultural Paradigm
Digital Divide
Poverty Mapping

INTRODUCTION

The 1997 Human Development Report proposed six essential actions to eradicate poverty, foremost of which is to “empower individuals, households, and communities to gain greater control over their life and resources.” Greater control requires greater access to knowledge that ensures food security and economic well-being, as well as to the tools that enable this access.

Ever since Machlup and Porat introduced the “information society” concept in the 70s, the correlation between access to information and poverty has been widely acknowledged. It may be implied that: information leads to resources; information leads to opportunities that generate resources; access to information leads to access

to resources; and access to information leads to access to opportunities that generate resources. We are now in the Information Age, where knowledge is a critical resource and information is a primary commodity. It follows that in an Information Society, the information-poor have also become the resource-poor. This chapter attempts to explore the relationship between information and communication technology or ICT and poverty, specifically in Asia.

The 2000 Okinawa Summit of G7/G8 nations describes ICT as "one of the most potent forces in shaping the Twenty-first Century…fast becoming a vital engine of growth for the world economy." Indeed, ICT may be applied to almost every problem in probably all sectors. Yet, the highest social application of ICT is *poverty alleviation*, since it is the most pressing problem confronting society, in general, and the international development assistance community, in particular. Furthermore, following the propositions given earlier, ICT (specifically, the lack of it) may be considered both as a cause and an effect of poverty.

CORRELATION OF POVERTY AND ICT: THE CASE OF SOUTHEAST ASIA

The widening gap between the information-rich and the information-poor has dire policy implications, particularly in the agricultural sector. The existence of this gap, not only in this sector but in all other sectors associated with development, is now widely recognized due primarily to the July 2000 Okinawa Summit of the G7/G8 nations. As mentioned in Chapter I, this gap is known as the *digital divide*.

Nowhere else in the world is the Digital Divide considered more of an enigma than in Southeast Asia. This region boasts of countries that are in the forefront of digital technology. Singapore, Taiwan, Malaysia, and Thailand are producers and exporters of such technology. Also in this region are countries, which may be considered as the most deprived in ICT – Laos, Cambodia, Myanmar, and Vietnam.

To begin with, the differences in the standards of living among countries within the region are quite glaring. Based on the 1999 UNDP Human Development Report, the human development index (HDI), human poverty index (HPI) as well as the HDI ranks of ten Southeast Asian countries are given in Table 1.

Out of 174 countries, Singapore is ranked 22nd in human development, while Lao PDR is ranked 140th. Brunei Darussalam is ranked 25th while Cambodia is ranked 137th. Malaysia is ranked 56th, while Myanmar is ranked 128th. Within the same region, we find countries classified under high, medium, and low human development.

Singapore and Brunei's poverty indices are negligible, while Myanmar and Lao PDR's (32.3 and 38.9, respectively) are quite high. The poverty index of Malaysia, Thailand, and the Philippines (14.2, 18.7, and 16.3) are within the same range, while those of Indonesia and Vietnam (27.7, 28.7) are moderate.

The HDR database also offers some interesting insights on the correlation between ICT and poverty. Data on four major ICT indicators, namely, internet hosts per 1000 persons, telephone lines per 1000 persons, personal computer ownership and television ownership were placed side by side with the aforementioned poverty indices. The correlation is unmistakable.

The higher the HDR rank, the higher the ICT indicator values. The higher the human poverty index, the lower the number of ISPs, telephone lines, PCs and TV sets per 1000 persons. The higher the value of ICT indicators (as in the case of Singapore, Brunei, and Malaysia), the lower the poverty index.

Table 3-1. Poverty and ICT Indicators

HDI Rank	COUNTRY	Human	Human poverty index	ISPs/ 1,000	Telephone Lines/ 1,000	PCs/ 1,000	TV/ 1,000
22	**Singapore**	0.887911	..	15.11	513	216.8	361
25	**Brunei Darussalam**	0.877795	..	2.41	263	..	417
56	**Malaysia**	0.768328	14.2	2.09	183	42.8	228
67	**Thailand**	0.753147	18.7	0.03	70	16.7	167
77	**Philippines**	0.739973	16.3	0.21	25	9.3	125
105	**Indonesia**	0.680862	27.7	0.11	21	4.8	232
110	**Viet Nam**	0.663824	28.7	no data	16	3.3	180
128	**Myanmar**	0.579768	32.3	..	4	..	7
137	**Cambodia**	0.514409	no data	0.01	1	..	9
140	**Lao PDR**	0.491107	38.9	no data	6	1.1	10

The gap between hardware and software capabilities also exists. For instance, the Philippines is considered to be the second largest exporter of ICT professionals and software developers next to India. Yet, it has hardly caught up with broadband and wireless technologies. The Digital Divide within sectors is likewise formidable. In Thailand and the Philippines, the business sector is fast catching up with its counterparts in Singapore ICT-wise. However, the educational sector is lagging far behind. At the tail end of the ICT utilization spectrum is the agricultural and rural development sector with the least number of ICT users, applications, and solutions. In these sectors, we find the preponderance of the information-poor.

POVERTY PARADIGMS

The Asian Development Bank defines poverty as the deprivation of essential assets and opportunities to which every human is entitled.

> *Everyone should have access to basic education and primary health services…Beyond income and basic services, individuals and societies are also poor- and tend to remain so-if they are not empowered to participate in making the decisions that shape their lives. Poverty is thus better measured in terms of basic education; health care; nutrition; water and sanitation; as well as income, employment, and wages.*

There seems to be a general agreement on the definition of poverty. As to its causes, however, there are differing points of view. These may be classified under four major paradigms used in analyzing poverty, namely: the technological paradigm, the economic paradigm; the structural paradigm; and the cultural or values paradigm.

***Technological Paradigm*.** Adopting a point-of-view based on technological determinism, many technologists and engineers believe that the primary cause of poverty is the lack of technological know-how in the developing world. Their premise is based on the observation that Western nations are rich because they employ modern technology in agriculture, industry, transportation, telecommunications, and health. They argue that the Third World will solve most of its problems by adopting new technology. They are firm believers of the concepts of "technical assistance" and "technology transfer" wherein the know-how of the West is transplanted, modified, and practiced in the developing world. This is primarily accomplished through the services of expatriate experts or consultants.

***Economic Paradigm*.** Economists argue that poverty is caused by the lack of sound fiscal and/or monetary policies within the government. Hence, the IMF occasionally recommends policy reforms for developing economies.

***Structural Paradigm*.** Most political scientists and ideologues believe that poverty is a function of the social structure. The primary exponents of this view believe that the only way to combat poverty is to change the so-called System or the government. The structural

paradigm distinguishes between elites and the masses, centers and peripheries, conflict of interests and harmony of interests. From this paradigm, we borrow phrases such as "top down" and "bottom up." Part I of this book adopted this paradigm in its analyses of informatization.

Cultural Paradigm. Some anthropologists and sociologists argue that poverty is a function of culture or social values. Twelve years ago, an anthropologist colleague from the University of the Philippines observed that the so-called Asian tiger economies, had predominantly Chinese populations or were, at one time or another, influenced by Confucian teachings (i.e., Singapore, Taiwan, Korea, etc.). The countries that lagged behind were predominantly Malay (i.e., Malaysia, Philippines, and Indonesia). He concluded that with the proper values and worldview, one can combat poverty effectively. In the Philippines, a Senate Committee found that the erosion of moral values had direct links to poverty (the Shahani Committee, 1990). Such erosion brings about corruption, exploitation, and greed which all lead to poverty. The 1999 ADB annual report, stating that the Asian economic crisis was in no small measure caused by corruption, is supportive of this view.

Which of these paradigms should be adopted in the use of ICT for poverty alleviation? The situation reminds us of the poem *The Blind Men and the Elephant* wherein six blind men attempted to describe an elephant through the part of the animal that they approached and touched. In a way, many of us are blind men when it comes to poverty. We approach the issue from one direction and arrive at a conclusion of what it is based on the part we address. One thing is certain, however. There are ICT interventions for any of the four paradigms enumerated above.

INTERVENTIONS

Bridging the Digital Divide

All over the world, nongovernmental organizations and governments are undertaking small independent initiatives to help bridge the Digital Divide. The most common of these initiatives is the actual

introduction of low-end information and communication technology to impoverished areas.

In June 2000, CNN aired a special that was co-sponsored by the World Bank and the Bill and Melinda Gates Foundation. The thirty-minute documentary, entitled *"Virtual Villages: Technology and the Developing World,"* featured four segments, each of which showed dramatic results in the introduction of information and communication technology to poor villages. The opening spiel of the documentary relates:

> *Technology has become the driving force of change in the modern world. It has altered our economic structures and the ways we communicate. It has even changed how we relate to one another. Examine how technology -- even in small amounts -- is helping developing nations and communities overcome convention and tradition to take leaps forward.*

Bangladesh. Among the more successful financing models ever to emerge from the Third World is the micro-credit system introduced by the Grameen Bank of Bangladesh. Grameen's founder and director, Professor Muhammad Yunus, has again embarked on an innovative undertaking based on an idea that is as simple as it is elegant. The bank has initiated a cellular phone project, dubbed the Grameen Phone Company, which would put a mobile phone in some 45,000 villages, giving residents access to ICT. Each mobile phone is acquired by an individual through a small loan from the bank. This phone becomes a village telephone service provider, earning income for the owner besides providing a much-needed utility to the community.

Professor Yunus is following this up with an experimental Village Computer and Internet Program or VCIP, which would provide an email and Internet service to villagers. Instead of paying for phone calls to contact relatives in the cities or friends abroad, the villagers will now be able to avail themselves of email for a fraction of the cost of a long distance call. A simple form of e-commerce will also

be initiated by this system. Farmers will now be able to check out market prices and study the list of wholesalers in Dhaka by surfing the Web.

Dominican Republic. El Limon is a tiny village in the Ocoa region of the Dominican Republic. With the help of a volunteer, Jon Katz of Cornell University, its residents built a local hydroelectric system to generate enough electricity to light their houses and their school house. CNN continues:

> *Once they had electricity, the villagers hooked up a donated computer to the Internet using a digital radio and an antenna relay system that connects to the nearest phone line, ten miles away. Now, their school, which has no library – in a village with neither telephones nor indoor plumbing – has a connection to the World Wide Web.*
>
> *The students in El Limon are learning digital video editing on a computer and are making their own documentary about the hydroelectric project. They plan to show the video to other communities in the area – in the hopes of repeating El Limon's success story.*

India. The documentary featured several ICT-related interventions in a number of cities in India. The most remarkable, however, was an experiment conducted by Dr. Sugata Mitra, a researcher for the NIIT software and education company. Dr. Mitra's "Hole in the Wall" Project put an Internet kiosk in a poor Indian neighborhood. After some time, children who could neither read nor write learned how to use the computer without the benefit of any instruction whatsoever.

These three cases reveal how the mere introduction of technology in impoverished areas result in immediate positive impacts. However, there is more to ICT than mere technology.

Poverty Mapping

Information and communication technology can improve economic policy and facilitate the policy-making process. An array of ICT tools is available to the policy-maker and decision-maker. Foremost in this list of tools are poverty maps, which are made possible by geographic information systems (GIS).

The Asian Development Bank defines poverty maps as spatial descriptions of the distribution of poverty in any given country. Hence, they are important tools in guiding spending for governments. Poverty mapping combines geographically-referenced survey and census data to generate poverty and inequality profiles at low levels of aggregation. Additionally, poverty maps based on highly disaggregated data, serve benchmarking, as well as monitoring and evaluation purposes.

For purposes of example, a poverty map of Southeast Asia based on non-disaggregated data is given below.

Table 3-2. Poverty Incidence in Southeast Asia with the Corresponding Gini Values

Country	National Poverty Incidence	Gini Coefficient[3]
Cambodia	36.10	00.37
Brunei Darussalam	-	-
Indonesia	18.20	00.36
Lao PDR	46.10	00.30
Malaysia	08.00	00.49
Myanmar	-	-
Philippines	36.80	00.49
Singapore	-	00.39
Thailand	12.90	00.44
Vietnam	37.00	00.35

[3] *The Gini coefficient is the most commonly used indicator of inequality. It ranges in value from 1 to zero, one being the situation wherein inequity is highest (only one individual owns the wealth) and zero being the situation wherein wealth is distributed equally.*

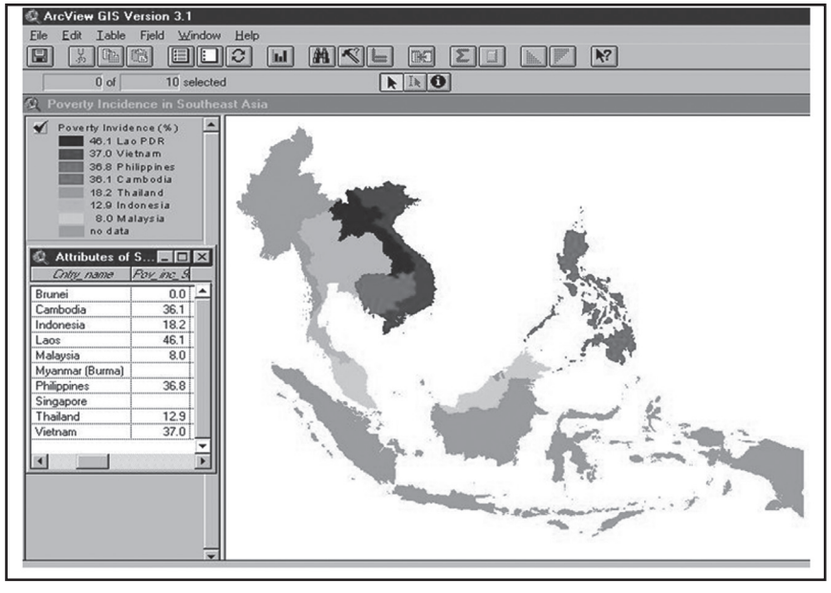

Figure 3-1. Poverty Map of Southeast Asia

A poverty map of the Philippines based on data disaggregated by region would appear like the following.

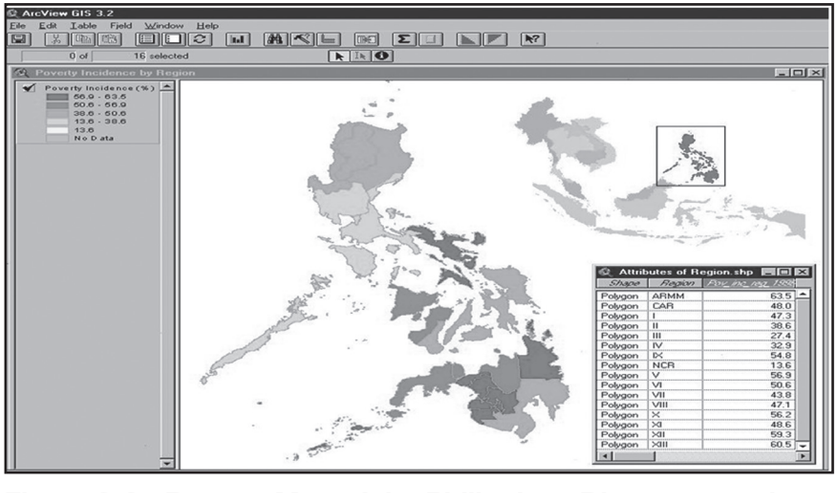

Figure 3-2. Poverty Map of the Philippines Disaggregated by Region

Further disaggregated by province, the following gives a poverty map of Mindanao.

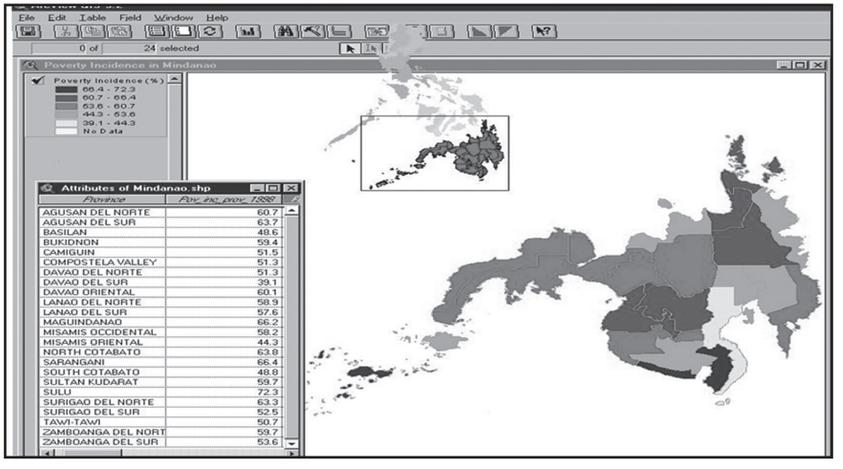

Figure 3-3. Poverty Map of Mindanao Disaggregated by Province

Nevertheless, the most useful poverty maps require large data sets representative at small geographical units such as municipalities and districts. Such data sets are difficult to acquire, thus making it impossible to generate detailed poverty and inequality profiles. An ADB project conducted in 2000, however, made use of highly disaggregated data on the province of Zamboanga del Sur, but of a different nature – road networks. [4] An output map shown within the ArcView GIS software window is reproduced herein for illustrative purposes.

Policy Advocacy

The second longest coastline in the entire world may be found in the Philippines. It is not surprising then to find that the poorest of the poor, composed of marginal fishers, are found in the coastal areas.

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[4] *Stephen P. Groff, Neil Thurston and Tom Chidley. Infrastructure for rural productivity enhancement: A GIS-based approach to rural development project management in the Philippines. Asian Development Bank: Manila, 2000.*

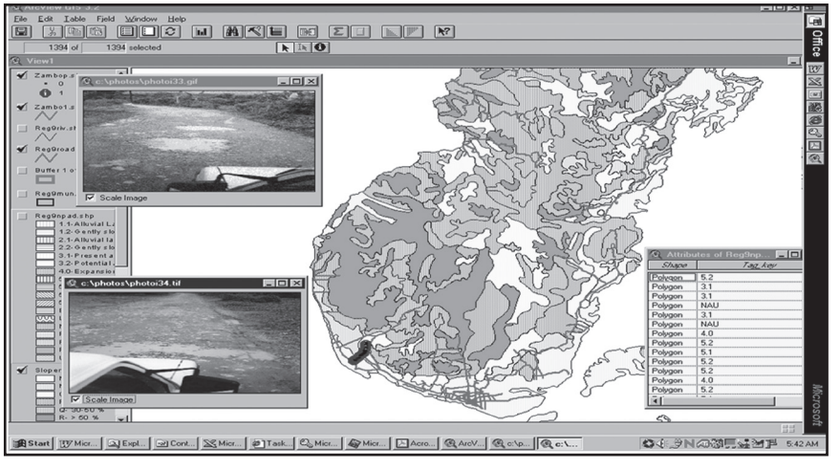

Figure 3-4. Output Map of the ADB Rural Productivity Enhancement Project

Three years ago, online information and educational exchanges between the Coastal Resource Management Project (Philippines), Silliman University, and the University of Washington were initiated through the financial support of USAID and the National Science Foundation. An interactive website entitled the Internet Center for Coastal Management (ICCM) was uploaded allowing threaded discussion, exchange of computer files, linkages to other websites, and recording of personal information. ICCM was password protected and was intended to function as a working area for people with a common interest in coastal management.

In March 2000, the CRMP-Philippines posted a draft Executive Order that was expected to be signed into law in June by President Joseph Estrada identifying integrated coastal management as a national policy. The EO was posted on the ICCM and was open for comment and review by various academic and government personnel. The ICCM experience is illustrative of the potentials of ICT for policy advocacy. However, in late 2000, the website had to be discontinued since a monitoring of its utilization revealed a minimum number of hits. This, of course, is to be expected because a special interest website cannot be expected to compete with commercial or broad-range content sites. The ICCM had very specific clientele with

defined uses for the site. Unfortunately, numbers mattered with the evaluators. Perhaps, an option that may be explored in the future for similar sites, is the linking up of the content with a program of related on-the-ground activities to ensure frequent and continued use.

Governance

The Okinawa Charter endorses the "active utilization of IT by the public sector and the promotion of online delivery of services, which are essential to ensure improved accessibility to government by all citizens".

Local governance, in fact, is one of the least explored, yet perhaps one of the most promising areas of ICT applications in Asia. For instance, databases on local government assets and community resources facilitate decision-making among local government executives and policy-making among members of local councils. Geographic information systems (GIS) make invaluable tools for land use planning and local government investments.[5] Multimedia applications such as digital video can be effective media for citizens' education, and process documentation of governance success stories.

Education

Much excitement in international development circles has been generated by the educational applications of ICT. In fact, some sectors are of the opinion that ICT can only effectively combat poverty directly through education. From South Asia to the Pacific Islands, experiences abound in the use of communication media and the Web for open learning and distance education. Best practices and lessons learned from these experiences should be collated and shared. Strategic options and potentials should likewise be explored.

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[5] *In the Philippines, the Internal Revenue Allotment (IRA) or the share of the municipal government in tax revenues, will only be released by the national government upon the submission of a Land Use Plan. Geospatial Information Systems are now being tapped by most progressive municipalities to generate such a Plan.*

The Okinawa Charter recommends "the development of human resources capable of responding to the demands of the information age through education and lifelong learning…". Foremost in the educational agenda is the development of ICT manpower that is versed not only with hardware and software expertise, but also with content development skills. A higher-level ICT professional who looks into the social and strategic impact of the technology should be produced by the educational sector.

LESSONS LEARNED

More than twenty-five years have passed since the first technical assistance project to apply information and communication technology to problems of underdevelopment, foremost of which is poverty. The World Bank Communications Technology for Rural Education (CTRE) Project, which began in 1975, made use of a network of community radio stations based in state colleges and universities in the Philippines. Technology has drastically changed since then, faster than our ability to apply the lessons learned. However, we could list a few lessons that are not technology-specific and would be applicable to a broader range of conditions.

The correlation of ICT and poverty is unmistakable. The international development assistance sector's awareness of this was highlighted by the G7/G8 Okinawa Summit in July 2000. Bridging the Digital Divide is now in the list of priorities of funding agencies and governments alike. In spite of this commitment, however, a realistic and feasible agenda to apply ICT for poverty alleviation purposes, appropriate for developing countries, seem to elude most development assistance agencies. Perhaps, the sector should invest more on program planning and development initiatives at this juncture. An indicative ICT research and development agenda, which form part and parcel of SEARCA's Knowledge Management Program, is appended in this paper. Nevertheless, the following lessons learned may serve to guide development agencies in firming-up their respective ICT agendas.

Firstly, technological interventions described in the CNN documentary *Virtual Villages* show that small independent projects are being done spontaneously by private agencies and nongovernmental organizations all over the world. Instead of ignoring these small initiatives, the international development assistance sector should take advantage of this trend by setting up an ICT for Poverty Alleviation Small Grants Fund that would facilitate, coordinate, and support these undertakings. The Fund may be micro-managed by appropriate regional agencies.

However, it should be emphasized that technological interventions alone cannot bridge the Digital Divide. More important than technology is the *content* made available to the user. Even more important is the *programmatic support* that would run parallel to the provision of hardware, software, and content. This is the lesson learned in the ICCM experience.

Additionally, financial trends in Southeast Asia picture an economy that transcends national boundaries, manifesting the drift towards globalization. ICT trends also exhibit a parallel behavior. Does this imply the desirability of a global ICT agenda? Globalization may prove to be too unwieldy at this point. A more manageable option would be intermediate between national and global. Hence, an ICT development assistance program will make more sense if it is neither national nor global, but *regional* in scope, an option that is being adopted by the knowledge networking initiatives described earlier.

This may pose problems among international lending institutions such as the World Bank, the Asian Development Bank, and the Japan Bank for International Cooperation since countries, not regions, apply for development assistance loans. Definitely, ICT infrastructure development should be country-specific, at the most. However, regional technical assistance should serve a coordinative role for network connectivity and compatibility purposes.

The Okinawa Charter likewise proposes the establishment of a Digital Opportunity Taskforce (Dot Force), which will "actively facilitate discussions with developing countries, international organizations,

and other stakeholders to promote international cooperation with a view to fostering policy; regulatory and network readiness; improving connectivity; increasing access and lowering cost; building human capacity; and encouraging participation in global e-commerce networks". If any progress is at all to be achieved in the area of regional knowledge networking, then the scientific community of Southeast Asia should address this recommendation, sit down and agree on common standards, platforms, and protocols for information exchange and knowledge sharing.

Lastly, education remains the most viable application of ICT considering the economic returns of a highly trained workforce. Studies conducted in the Indian Institute of Technology in Mumbai estimate a foreign exchange earning of US $3 Billion in 1999 for ICT products and services, a bulk of which were generated by hardware specialists and software programmers who have migrated to Europe, Australia, and the United States for lucrative careers.[6]

SUMMARY

In summary, this chapter forwards the following recommendations:

1. Efforts should be made to develop viable ICT Poverty Alleviation programs. These programs should be coordinated across agencies in the best spirit of networking, to ensure proper focus in resource use and synergy in development efforts.

2. A regional approach to program development should be adopted since ICT and poverty alleviation transcend national borders.

3. 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 mainstreamed and coordinated by putting up an ICT for Poverty Alleviation Small Grants Fund that can be micro-managed by regional agencies.

4. Technological interventions should be supplemented by strong content provision. It should run parallel with a development program, thus providing mutual reinforcement between ICT utilization and impacts.

5. Governments and government agencies within the same region (e.g., Southeast Asia) should initiate dialogues to determine standards, platforms, and protocols for information and knowledge exchange and re-use. A regional approach to knowledge networking should be adopted.

6. The use of poverty maps should be fully exploited through the collection of highly disaggregated census and economic data.

7. The educational applications of ICT should be fully supported for their economic potential.

Following these recommendations may enable us at the development assistance sector to ensure that wisdom is not lost in knowledge, and that knowledge is not lost in information in our poverty alleviation undertakings.

SELF ASSESSMENT QUESTIONS

1. How is poverty related with ICT ownership and access in Southeast Asia?
2. What are the four poverty paradigms?
3. What ICT interventions have been applied to poverty alleviation?
4. What lessons have been learned on ICT and poverty?

[6] *The Philippines, which ranks second to India in ICT manpower exports earned US$ 22 Million in the same period, according to some estimates.*

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UNIT II

SECTORAL AND THEMATIC APPLICATIONS

The international development assistance community has categorized the areas of development work according to sectors and themes. Sectors are made up of the following: infrastructure; industry; agriculture; natural resources; health; education; private; and public.

The concept of development assistance was officially introduced and implemented as part of post war reconstruction in the mid-1940s. Then, development assistance consisted mostly of infrastructure projects: vertical construction projects such as dams, ports, and buildings as well as horizontal construction projects such as roads and bridges. Nowadays, infrastructure still gets the lion's share of development assistance funds. Next in line are the industrial, agricultural, and natural resources sectors, the latter including mining, forestry, marine resources, coastal resources, and land. Then come the social sectors, i.e., health and education. Last but not the least, is private and public sector development assistance.

These sectors possesses common developmental themes. Environment, gender, participation, sustainable development, and governance form part of an ever-increasing list of themes, which recently included sub-regionalization, regionalization, and globalization.

ICT may be applied to any of the above sectors and themes. However, Unit II of this book will deal with three of the most extensively studied sectors: agriculture, inclusive of extension, poverty, and food security; education, inclusive of pedagogy, teacher training and governance; and rural livelihoods, addressing the sustainability theme.

CHAPTER 4.
ICT FOR AGRICULTURE

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Discuss how ICT can be used in agricultural extension;
2. Recall how ICTs were incorporated in development interventions for poor farmers in Indonesia; and
3. Argue for or against an information management system for food security.

KEY CONCEPTS

Research-Extension-Farmer Interface
Modalities of ICT for Agricultural Extension
Market Information
Agricultural Information Flows
Local and Indigenous Knowledge
Logical Framework
Subordinate Influential Factors
Superordinate Influential Factors
Last Mile Link
Electronic Networking
Institutional Networking
Community Networking
Central Information Repository

INTRODUCTION

Agricultural economies have been eclipsed by industrial and information economies. Nevertheless, agriculture is still considered as the primary economic sector.

Food, clothing, and shelter are the most basic of human needs. Agriculture produces food, raw materials for clothing, and wood by

which shelter is constructed. Speaking from a development-oriented point of view, agriculture is the most vital sector for ICT intervention.

This chapter views the agriculture sector from the technological perspective. It adopts a systems view of agricultural production where research and development (R&D), extension, and farming may be regarded as subsystems of the larger agricultural system. These subsystems have interfaces wherein information is largely exchanged. These information flows can neither be exclusively top-down nor bottom-up.

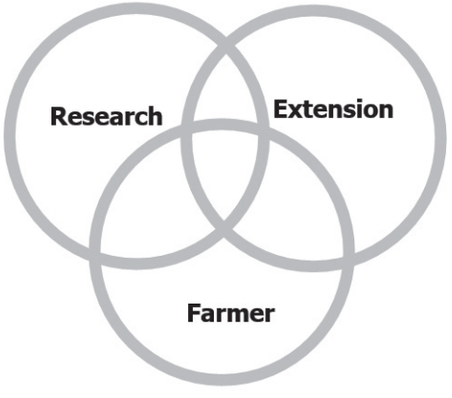


Figure 4-1. A Cyclic Research-Extension-Farmer Interface

In most developing countries, the research subsystem is implemented by national agricultural research institutes or NARIs manned by scientists and researchers. Scientists and researchers in the NARIs should not be considered as the only source of information within the agricultural production system. The farmer should also be recognized as a potential source, particularly of indigenous technology and local knowledge that may guide the sector's R&D agenda. Similarly, the flow of information cannot originate solely from the farmer.

Furthermore, the flow of information should not be compartmentalized, i.e., from the research subsystem to the extension subsystem, and then from the extension subsystem to the

farmer. Interfaces should exist between: the research subsystem and the farmer; the research subsystem and the extension subsystem; and the extension subsystem and the farmer. In other words, the chapter adopts a non-linear, cyclic framework characteristic of information flows in living networks. ICT comes to play within these networks.

Finally, systems do not merely mean electronic networks that most information systems refer to, but to institutional networks at the agency level, and social networks made up of extension workers, NGOs and farmers groups at the local level. The national agricultural information network has an institutional dimension composed of all agencies involved in information generation and dissemination. Local information networks on the other hand are mostly made up of social networks. Hence, agricultural information networks have electronic, institutional, and social dimensions.

ICT FOR EXTENSION

In the Philippines, the agricultural extension service has been severely emasculated by four factors: the abolition of the national agricultural extension system; decentralization or devolution of extension services; the top-down perception of agricultural extension; and rivalry between research and extension in the agricultural technology process. The Department of Agriculture's Bureau of Agricultural Extension was abolished and replaced by the Agricultural Training Institute during the Aquino administration. A few years later, front-line extension workers found themselves under the payroll of provincial and municipal governments, thus subjecting their budgets and extension priorities to local political forces. A dramatic shift in the attitude towards the Green Revolution of the 70s found extension workers being perceived not as change agents but as agents of the status quo. From the significant role that they played in the 70s, extension workers have been relegated a role merely supportive to research in the agricultural technology process.

Among the casualties of the emasculation of the national agricultural extension system was agricultural information and communications. In a devolved structure, there was no scope for national or regional

communication programs. Moreover, the devolved services just did not have the capability to launch their own localized information and communications campaigns. For instance, a television program that served merely one municipality (or one province for that matter) was not just cost-effective enough.

Those of us in the agricultural information and communications field observed with concern as this trend spread all over Asia with the exception of Thailand and Indochina. Soon after the Philippines, Indonesia followed suit with the dismantling of the Agency for Agricultural Extension and Training (AAET). The Balay Informasi Pertanian dan Penyuluhan (BIPPs) were transformed into Assessment Institutes for Agricultural Technology (AIATs). The contribution of information and communications in mainstream extension gradually diminished since these were not supported by the current structure.

However, it has been said that the Chinese characters for crises and opportunity are identical. This may probably be the case if the situation was reversed. If regional agricultural extension trends are indeed not favorable to information and communications, we may still safely say that information and communications is favorable to agricultural extension. That is, the *existing information and communications environment* is favorable to agricultural extension.

The existing development assistance environment is likewise most favorable for tapping information and communication technology for agricultural extension and technology transfer. The Okinawa Summit of G7/G8 nations has established the primacy of bridging the Digital Divide in the international development assistance agenda. In spite of the trends that have weakened the potential contributions of information and communications, the conditions are ripe for agricultural extension to make full use of the expanded set of tools available. The question now is, how should the agricultural extension system reposition itself vis a vis the existing information and communications environment? How should agricultural extension workers retool themselves within this new environment?

Two features of the agricultural extension system that were lost in decentralization and devolution were synergy and economies of

scale. Assuming that decentralization and devolution is an irreversible trend in developing countries, the extension service can still revive its integrity as a system and regain its synergy and economies of scale by establishing extension networks among its staff. These networks should go beyond provincial groupings, extending themselves to regional or even national systems. As networks, agricultural extension services can share information and communications resources, coordinate campaign activities, and conduct integrated, well-coordinated programs that extend beyond constraining local government boundaries. As network members, agricultural extension workers will be able to retool themselves within given standards that they themselves will set. Appropriately, the networking tools that are required for this initiative are information and communications technologies.

Convergence. By definition, ICT relates to convergence or the process of increasing the interface between two systems. Convergence in agricultural extension is finding a common platform for the research system, the extension system, the production system, and the marketing system for the sharing and re-using of knowledge. That platform has been made possible by and large by digital technology. In more concrete terms, ICT allows information generated by the researcher to be more efficiently accessed by the extension worker to be more effectively transferred to and applied by the farmer. A case in point is the UNDP Mango Information Network (MIN) that was established at the Philippine Council for Agriculture and Resources Research and Development in 1997. Research results on mango production, mango pests and diseases, and post-harvest technology were made available in the World Wide Web, specifically for nodes of extension workers based in strategic mango producing areas. The extension workers, in turn, transmitted these to the farmers. At times, the interface was so substantive that the roles between the researcher, the extension worker, and the farmer began to blur. Traditionally, the researcher is considered the *source* of information, the extension worker, the *channel*, and the farmer the *receiver*. However, in the MIN, the boundaries between these traditional roles at times dissolved. More progressive farmers accessed research information themselves through the Web without going through the extension workers. Occasionally, the farmers become sources of local information for the researchers.

Basically, ICT facilitates two elements critical in the Research-Extension-Farmer Interface and technology transfer process: *information access* and *networking*. The storage and retrieval of research results facilitates information access, while telecommunications facilitates networking. Both elements are found in some of the strategies and approaches discussed in the next section.

Modalities

Table 4-1 presents the communication modalities currently available as well as possible content.

Conventional and Digital Broadcasting. AM and FM radio, as well as VHF and UHF television remain the most cost-effective means of technology transfer in rural communities. However, they require economies of scale. This requirement prevents conventional radio and television from being interactive or individualized. Making audio and video products available over the World Wide Web allows the user to access these at his own time and pace, and to interact with his facilitators.

Another alternative available is digital broadcasting, which allows a wider range of audio and visual stimuli for the user, greater interactivity, and individualized instruction.

Comic Books. Among the array of print media that are available (i.e., leaflets, brochures, posters, magazines, wall newspapers, etc.) comic books offer the best potential in technology transfer. Localized, limited circulation comic books that would serve the requirements of devolved extension personnel are now possible though desktop publishing. Imaging technology, layout and design software supplemented by a good quality copier produce professional-looking comic books for distribution by extension workers.

Community Telecenters. The inability of rural farmers in general to have access to personal computers, VCDs, video cameras, and the Internet may be remedied by establishing ICT or telecenters in rural communities. These telecenters may be hosted by the local

government and would have facilities that may be utilized by the community. The basic equipment contained in the telecenters should include: an Internet-ready PC with a printer; a photocopier; a television set; a karaoke machine (to be used as a sound system); a video camera; a digital stills camera; and two cellular phones. Farmer groups should be able to avail themselves of the telecenters through the extension agents. In these facilities, low-cost communication materials may be produced with the participation of farmers, youth, and women's group representatives.

Using Low-End ICT. All over the world, small independent initiatives are being undertaken to employ information and communication technology in rural development. The most common of these initiatives is the actual introduction of low-end ICT (i.e., mobile phones, PCs, the World Wide Web, the Internet kiosk, and others) to impoverished communities.

Community Cable TV and Cable Modem Interface. Yet another modality is community cable TV interfaced with the cable modem. This technology is being proposed for extension activities in per-urban communities using the *Tambuli* model. One of the most innovative undertakings in the area of ICT implemented during the nineties was a ten-year UNESCO-DANIDA funded project implemented in the Philippines called *Tambuli*. The project sought to determine and monitor the impact of communications technology on rural areas that were hardly reached by media. Low-cost, limited-ranged FM transmitters were installed in eight extremely poor municipalities in Luzon, Visayas, and Mindanao. Local volunteers to operate the radio transmitters were trained by project staff. The programming and operations were essentially left to the host community.

Tambuli, which in Filipino means "clarion," thus established community FM radio stations in impoverished areas in the Philippines with the intention of improving the lives of people in these areas, through the provision of timely information that would assist in community mobilization, and the improvement of local government services.

Does cable television and the Internet hold as much promise in agricultural extension? *Tambuli II* will determine and monitor the impact of new ICTs on rural and peri-urban communities. There are three distinguishing characteristics of Tambuli II as compared to the original Tambuli. Firstly, the intervention will take the form of community cable TV and cable modem interface, thus making cable television transmission and production as well as high-speed Internet service available to the pilot communities. Secondly, the target beneficiaries are not exclusively the rural poor. Recognizing their role in the food security of urban areas and their impact on the urban poor, peri-urban communities form an important part of this study. Peri-urban communities are communities within the periphery of urban areas that serve as a buffer zone between the cities and the outlying communities. The urban poor are usually relocated in these areas. The potentials of peri-urban agriculture to ensure the food security of urban areas, and to provide livelihood to the urban poor, is now being vigorously pursued internationally. Thirdly, and perhaps most importantly, the scope of Tambuli II will be the Southeast Asian Region.

The objectives of Tambuli II are as follows:

- to determine the impact of new information and communications technologies (ICTs), specifically community cable TV and high-speed Internet on rural and peri-urban communities in Southeast Asia;
- to monitor the impact of these technologies on governance, education, micro-finance, commerce, peace and order, and agricultural production;
- to determine significant deviations in impact across countries and cultures; and
- to document these impacts for model building purposes.

In this project, it is proposed that information and communication technology interventions will be limited to community cable television and high-speed Internet through cable modem. The system offers a much broader bandwidth than what commercial Internet Service Providers offer. The cable modem system puts downstream data into a 6 MHz channel. Upstream data requires just 2 MHz since users download more information than they upload.

Access to cable television channels will be limited to appropriate networks.[1] Access will initially be governed by strategic considerations since the number of television receivers and workstations are limited. However, community residents who are able to afford these services on a token fee may avail themselves of a connection. Specifically, the users of these media are: local government agencies; schools; farmers' cooperatives; NGOs; utilities; development councils such as the BDCs, MDCs, MAFCs and FARMCs. Training will be provided to the community cable operators for the production of community cable television programs and for operating the facility. Training will likewise be provided to the Internet Service Provider, as well as the strategic users: LGUs, schools, cooperatives, and others.

Geographic Information System. Another potential modality for agricultural extension and technology transfer is the GIS output map. Fisher and Nijkamp (1992) define GIS or geographic information system as a computer-based information system which attempts to capture, store, manipulate, analyze, and display spatially referenced and associated tabular attribute data, for solving complex research, planning and management problems. ESRI (2000) describes it as a computer-based tool for mapping and analyzing things that exist, and events that happen on earth. GIS technology integrates common database operations such as query and statistical analysis, with the unique visualization and geographic analysis benefits offered by maps. In other words, GIS is a system that adds a spatial dimension to traditional databases by incorporating geo-referenced data.

Being closely attached to land, water, and ecosystems, agriculture almost always has a spatial dimension. Applied to agricultural research, GIS then becomes a powerful tool for the analysis, interpretation, presentation, and application of research results in on-farm trials or even farmers' fields. It produces accurate and contextualized, visual and locational representations of relationships between climate and commodities, soil type and recommended crops, productivity and cropping patterns, nutrition and land-use, agricultural technology, and poverty. GIS provides a value added service to research data by bringing in visual and contextual

[1] *In the Philippines, part of the licensure requirements of offering a community cable television service is the provision of one channel for community bulletin boards, programs, and special events announcements.*

elements that serve to concretize abstract concepts. An extension worker could better appreciate research results when seen in GIS output maps. Furthermore, he could easily arrive at its implications and is better able to relay it to his farmer-clients.

Table 4-1. Information and Communications Modalities

Information and Communication Modalities	*CONTENT*			
	Research-Extension	**Extension-Farmer**	**Extension-Market**	**Farmer-Market**
Knowledge Networks	Experts Network Knowledge bases	Farmers' Profile	-	-
Knowledge Bases	On-line publications Research Results	Research Results Technology Packages	Pricing Policy	-
GIS Output Maps	Agro-ecosystem Demographics	Precision Farming	-	-
Community Telecenters	-	Technology Market Information	Technology Market Information	Market Prices Potential Markets
Digital Broadcasts	-	Agricultural Technology	Prices and Markets	Prices and Markets
Digital Audio-Video	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories

Table 4-1. *(continued)*

Desktop Publishing	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories
Databases	Research Data	Farmers' Profile	-	-
Cellular phones	-	Market Prices	Market Prices	Market Prices
VHF/UHF TV	-	Agricultural Technology Market Information	Agricultural Technology Market Information	Market Prices Potential Markets
AM/FM Radio	-	Agricultural Technology Market Information	Agricultural Technology Market Information	Market Prices Potential Markets
Audio-Video	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories	Documentation of Best Practices and Success Stories
Print Media	Agricultural Technology	Agricultural Technology	Agricultural Technology	Market Prices Potential Markets
Folk Media	-	Agricultural Technology	Agricultural Technology	Market Prices Potential Markets

ICT FOR POOR FARMERS: THE CASE OF PFI3 INDONESIA

The poorest of the poor in Asia are found in farming communities within marginal rainfed areas. Indonesia is no exception. Poor farmers in Southeast Asia's largest country have failed to respond to market opportunities because of a lack of appropriate technologies, village-level investments in public goods, and access to information. While the Government is taking steps to fill the gaps in providing public goods support for agriculture, and increasingly for non-rice crops, additional support is needed to target village-level public investments to the needs of poor farmers, to increase the access of poor farmers to information, and to increase the availability of technologies needed by poor farmers.

In January 2003, the Government of Indonesia and the Asian Development Bank signed a loan agreement for the purpose of implementing the Poor Farmers' Income Improvement through Innovation Project. The agreement identified the Ministry of Agriculture as the Project Implementing Agency, with the Indonesian Agency for Agricultural Research and Development as the Executing Agency.

The long-term development goal of the Project is increased innovation in agricultural production and marketing by poor farmers. Its immediate objectives are as follows: (i) improved targeting of village-level public investments to locations-specific needs; (ii) increased access of poor farmers to information; and (iii) a reorientation of the focus of agricultural research to the needs of marginal rainfed areas.

Benefiting farmers in five districts with about 2.75 million people and an overall poverty rate of 66 percent (almost twice the national average), the Project responds to poverty in the Indonesian countryside by empowering farmers to undertake simple village-level investments, providing support for the development of proper technologies for rainfed areas, and providing them with the relevant information resources. It is comprised of four components

to be implemented over 5 years: (i) poor farmer empowerment, (ii) development of national and local agricultural information resources, (iii) support for agricultural innovation development and dissemination, and (iv) project management.

Like most ADB loans projects, PFI3P has a technical assistance package comprising mainly of international and domestic consulting inputs. The Project Administrative Memorandum states that Components 2 and 3 (development of national and local agricultural information resources, and support for agricultural innovation development and dissemination) will be implemented substantially by the Executing Agency with minimal consultant support.

Major Users

Based on existing documents (Bernardo, et al.), the major users of agricultural information in the Indonesian research, development, and extension sub sectors, listed in the order of their level of information utilization, are as follows:

Staff of NARIs. Scientists and researchers from national agricultural research institutes are the primary users of agricultural information in Indonesia. It may sound paradoxical but they are also the leading producers of agricultural information. The flow of information by nature is cyclical, hence, this situation.

Agricultural scientists and researchers from the private sector. Scientists from the private sector specializing in agricultural products and agribusiness rank next to NARI's staff as the major users of information.

Technical staff of the Ministry of Agriculture. The technical staff of the Ministry of Agriculture is the third largest users of agricultural information.

University faculty, staff, and students. Professors, lecturers, students, and researchers coming from Institut Pertanian Bogor, Gadja Madha University, Hasanudin University, and other leading universities with agricultural programs are the fourth largest users of agricultural information.

Private and government extension workers. Extension workers based at the Dinases and private firms such as Monsanto, Bayer, and Ciba Geigy also make use of agricultural information, particularly those packaged as extension materials by the Ministry.

Farmers. Finally, farmers come in as the fifth major user of agricultural information. Most of them are progressive well-to-do farmers or early adopters of new agricultural technology. Very few are poor farmers residing in marginalized areas.

This situation may be attributed to the following factors: low literacy rates among poor farmers; limited access to conventional media such as television and publications; close to zero computer literacy among them; lack of information and communication infrastructure in marginalized areas; relative lack of contact with extension workers; under-utilization of indigenous or popular media; and finally, a survival mentality among poor farmers that prevent them from participating in agricultural development programs.

The Director of the Central Java AIAT believes that land ownership is the biggest problem among poor farmers. The lack of information on technologies is merely a secondary concern. They cannot adopt these because of the lack of resources. They are operating in a *survival mode,* their main concern being where to find their next meal. Thus, the AIATs ordinarily involve well-off progressive farmers as cooperators because they are more receptive and cooperative. However, he believes that the new practices eventually reach the poor farmers because traditionally, communication flows in two-steps: from the extension worker to the farmer leader; then from the farmer leader to the individual farmers.

The Indonesian poor farmer can become the leading user of agricultural information if the situation described above can be addressed. Information management-wise, the Project can improve access to conventional media through its PIU-based rural agricultural information and communication centers. It can even pilot village-based rural agricultural information and communication centers. Furthermore, it may incorporate the use of indigenous and local media in its dissemination programs. Finally, it can increase

capacities for effective dissemination among staff at the NARIs, AIATs and Dinases through practical training.

However, the above mentioned interventions merely address the issue of access. The following section explores the issue of content.

Content

Technology Dissemination Agenda Setting. AIAT technologies for dissemination are not limited to biogeophysical technologies but may relate to social technologies as well. In the case of Central Java, the content disseminated cover: hybrid chicken and sheep husbandry; integrated farming systems management; agro-industrial products such as vanilla and prawn; marginal crops such as upland rice, potato, and corn; as well as community development. Indigenous knowledge is taken into consideration through the PRA process conducted by the BPTP in the villages.

Generally, the Governor's office and the *kabupatens* determine the technology for dissemination through the Provincial Technology Commission. Apart from the Governor's Office and the kabupatens, this commission is composed of the Head of the Provincial Contact Farmers and Fishermen's Organization, all heads of the Dinases, a representative from BAPPEDA, as well as representatives from the academe, NGOs, and the local governments. The Commission is chaired by the Director of the Central Java BPTP, although ordinarily, BPTP heads act as secretaries of these commissions.

Poor Farmers Information Needs. Farmers' needs are supposed to be represented in this body since the provincial contact farmers' head is elected by his district, sub-district, and village counterparts. The *Kontak Tani Nelayan Andala* may not be composed of poor farmers but they should represent the needs of their poorer fellows. This is a national network that stems from villages (*Kontak Tani Tingkat Desa*), sub-districts (*Kontak Tani Tinkat Kecamatan*), districts (*Kontak Tani Tengkat Kabupaten),* and the provinces. It is a formal nongovernmental organization, duly registered with and recognized by the GOI, which even possess some form of political clout during election time. However, their information needs may differ from that of the poor farmer.

Content most relevant to the poor farmer are those that would have immediate impact on his income: accurate, up-to-date price information; available assistance to source potential market outlets; low-input technologies for crops in marginal areas; and low-cost post-harvest technology that extends the shelf-life of his products.

Market Information and Technologies. In the Temanggung District, market information and technology on chili production and post harvest handling have been requested by farmers from the extension worker. Under the existing system, market information is gathered once a month at the *kacamatan* level by the extension worker using the statistical forms from the Agency for Agricultural Statistics. There is no written data gathered directly from the village. Observation and taxation form the bases of these figures. Formerly, the Pak Lurah brings monthly market data from the village during monthly meetings with the Camat. Now, this procedure is only applied for the population census.

FRAME 4-1. Info Pasar Billboard, Temanggung

Nevertheless, market info services are currently being done by other agencies at the local level. In Temanggung, a service known as Info Pasar is being delivered by the Department of Trade and Industry. These services include: market prices/ export demand available online through www.temanggung.go.id.

Agricultural commodities are reported weekly at the Kabupaten level. No official collaboration with the Dinas Pertanian has yet been established.

Information Management Needs

Information management needs of the Indonesian research, development, and extension sub-sectors revolve around three main topics: knowledge management; developing the “last mile” linkage for agricultural innovation dissemination; and intermediary training. Knowledge management has been explained in an earlier section of this report. Developing the “last mile” linkage refers to the interface between the National Farming Website and the poor farmer. At this point, there hardly is any interface between the two because of the lack of access. Hence, other information and communication channels may be employed such as conventional media (radio, TV and publications), folk media (*wayang kulit, wayang orang*, etc.) or popular media (*sandiwara, dangdut*, etc.). Furthermore, an intermediary in the person of the village facilitator may assume this last mile linkage role. In the case of the Central Java AIAT, technology dissemination is done through media (RRI, publications, VCD, TVRI), farmers’ visits, and demonstration plots. Folk media is not used. Popular media such as *sandiwara* is employed only in their project with the International Rice Research Institute. However, the agricultural research, development, and extension sub-sectors as a whole may not be adequately trained in these areas.

Researcher IM Needs. The *Impact Evaluation of ARMPII* found that sixty percent of the AIAT’s budget is allotted to the dissemination function. Although the researchers are trying their best to perform this function, they lack the requisite training to maximize their dissemination efforts. Very few of the AIAT staff have an information and communication background. Because of the lack of in-house capability, a substantial chunk of this budget (estimated at 70 percent) is used to contract out the design and production of communication materials.

Although information and communication materials design, production, and utilization is part and parcel of the technology assessment process, AIATs do not have an information and communication unit or an extension division for that matter. The key informants from the PIU feel that generally, the adoption rate of new technology is low. This situation is echoed in other areas such as the BAPPEDA of West Kalimantan. There were several factors

attributed to this: the high cost of inputs; farmers' attitudes towards new technology; budgetary problems caused by decentralization; and weak dissemination. In some cases, the extension function at the district level is not functional.

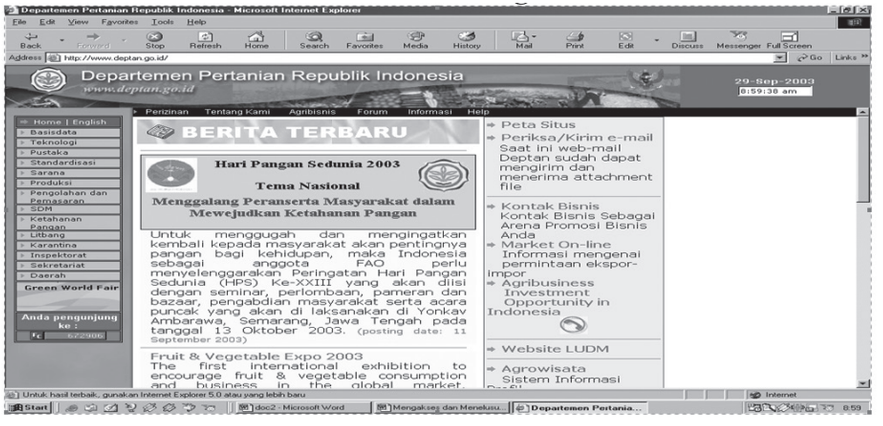
Capability Building Needs. Although both researchers and extension workers have tried their best to fulfill their dissemination function, they may not have succeeded significantly in building-up the capability of poor farmers. The dissemination function of the AIATs and NARIs is not supported by their organizational structure. There are very few well-equipped information management unit that could assist the researcher in performing a critical step in the technology assessment process, i.e., the design and production of information and communication materials. Furthermore, researchers are not generally trained in dissemination approaches, strategies, and skills. The lack of an efficient extension system in the district, sub-district, and municipal levels has exacerbated this situation. This conclusion is shared by almost all of the key informants.

Thus, the capacity for agricultural technology and information dissemination should be strengthened functionally, structurally, and operationally. Functionally, the IAARD should reaffirm the role of dissemination in technology assessment through a policy statement. Structurally, the AIATs, NARIs and Dinas staff should have an information management unit. Operationally, dissemination staff in the AIATs should undergo training in new information and communication strategies and techniques. Likewise, researchers should be trained in process documentation using digital tools such as digital photography, digital video, and digital journals entries. These digital products may be used by the information and communication staff as raw material for their communication materials. Lastly, long-term and short-term training programs for IAARD, NARIs, AIAT and Dinas staff are strongly recommended.

Existing National and Local Agricultural Information Systems

Insofar as its Component 2 targets are concerned, the Project is adequately fulfilling its two major deliverables: the establishment of national and local agricultural information systems where agricultural technologies are made available; and the setting up of a Web-based agricultural marketing information system.

FRAME 4-2. National Farming Website Interface



However, areas for improvement have been identified. Given the dynamic information and communication technology environment, it is but fitting for the research and development sub-sectors to invest on Web-based electronic networks. However, the national agricultural information network needs to have institutional and social dimensions as well, not merely focusing on the electronic dimension.

An institutional network would be made up of all the agencies involved in agricultural information and technology dissemination. The network must be coordinative in nature, preventing the duplication of efforts and overlapping of initiatives. With scarce resources available, this would make sense. Having an institutional dimension to information management entails the establishment of an active ICT4D Network for coordination among agencies and even across ministries.

For instance, under PFI3P, CADI is supposed to establish an agricultural market information system. However, as mentioned earlier, the Planning Division of the Directorate General of Processing and Marketing of Agricultural Products, Ministry of Agriculture, has already established a Web-based agricultural market information system. This service, called SINGOSARI, covers the entire nation but originates at the provincial level. Again as mentioned earlier, the

Ministry of Trade and Industry has a web-based market information system operating at the *kabupaten* level, which gathers and posts online agricultural market information every two weeks. These initiatives could have been merged had the appropriate institutional networking been in place.

Similarly, PFI3P plans to pilot rural information centers at the local level. The Ministry of Communication and Information has a similar nationwide initiative that will establish "community access points" at the *kabupaten* level. These two initiatives should merge somewhere down the road and could only do so if there is an institutional dimension to networking.

FRAME 4-3. Farmers Group in Purwosari Mosque

Furthermore, social networks at the village level should be strengthened and tapped by the Project. These networks not only involve formal groups such as the KTNA but informal groups that exist in every village. These should involve schools, youth/women groups, as well as opinion leaders such as *imams* and *dukhons*.

Information Flows

In the past two and a half decades, the Indonesian agricultural research-extension-farming sub-sectors have made some modest but concrete progress in cyclic and three-way interfaces. Interventions beginning with the UNDP-FAO Upper Solo Watershed Management Project through People's Participation and Income Generation (1980-83) and progressing to the World Bank PASIG and DAFEP (2000-03) projects as well as the ADB COFISH Project (1999-2002) have focused on non-linear, participatory approaches. This is apparent in the existing policy environment in spite of the problems resulting from the devolution of the extension service.

Information Flow at the Village Level: For PFI3P, the IM Specialist observed that the flow of information at the local level begins with the *Kacamatan* to the *Pak Lurah*, then to key *desa* leaders, to the sub-village, then finally to the informal farmer leaders who elect KID members. During the socialization process, a team from the *Kacamatan* invited 100 village representatives for a briefing on PFI3P. The sub-district meeting was meant to initiate the proposal preparation process. Proposals on farm to market roads and market structures were eventually submitted to the KID for endorsement and to the FAD for approval. Farmers who were involved were not from the KTNA but from informal groups based in each sub-village.

AIAT Technology Assessment Procedure. At the provincial level, the Technology Assessment Procedure of the AIATs involves the following steps:[2]

1. Participatory rapid appraisal (PRA) in identified sites;
2. Needs identification and assessment;
3. Proposal preparation and approval;
4. Technology assessment with local extension personnel;
5. Information and communication materials design and production;
6. Information and communication materials utilization; and
7. Monitoring and evaluation.

This process attempts to employ two-way information flows, involving farmers in PRAs, needs identification, technology assessment, and monitoring and evaluation.

National Agricultural Information System. The current national agricultural information system configured specifically by PFI3P has been designed to accommodate two-way in formation flows between and among the different project stakeholders from national agencies down to the level of the farmer.

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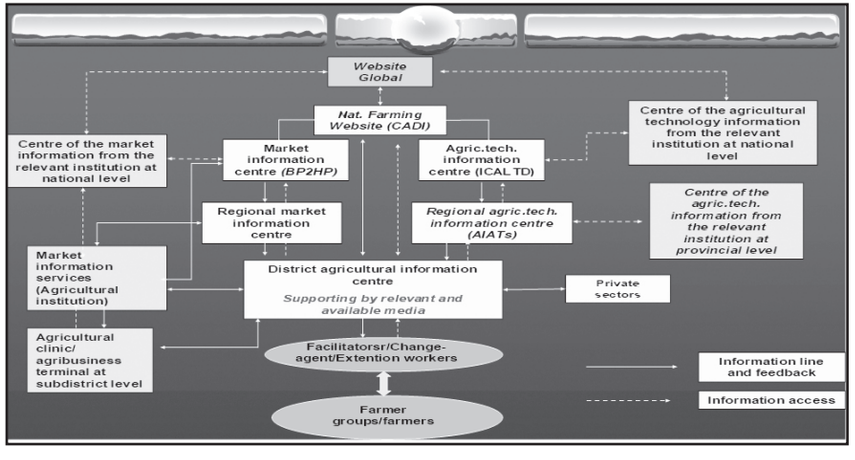
[2] *Bernardo, Fernando, Tito Contado, Daisy Fuentes and Arnulfo Garcia. 2002.* ***Impact Evaluation of the Agricultural Research Management Project II.*** *World Bank, Washington D.C.*

However, this system may be further strengthened by:

1. Incorporating into the National Agricultural Information System a feedback functionality from the farmers groups at the local level to national decision makers;
2. Incorporating an indigenous knowledge sub-system; and
3. Employing a mechanism through which poor farmers are involved in establishing the national and local agricultural research agenda.

FRAME 4-4. National Agricultural Information Flow[3]



An improved system may add on a functionality for poor farmers to participate in online discussion forums with the assistance of intermediaries based at the village level. These discussion forums may even deal with the formulation of the national or local research agenda of the NARIs and the AIATs, respectively. In China, such a functionality may be found in the website of the Central Agricultural Broadcasting and Television School (CABTS), whose enrollment at any one time total an estimated 900,000 farmers, rural housewives, youth and extension workers. This functionality was recently added to the CABTS website when the school shifted to digital learning.

[3] *Retno. 2004. Program Pengembangan Sumber Informasi Pertanian National Dan Local, PFI3P 2003-2007, Ministry of Agriculture (Jakarta).*

A very important sub-component for the national agricultural information system is the documentation, capture and uploading of indigenous and local knowledge found in the beneficiary villages.

Indigenous Knowledge. As a case in point, one may site that Purwosari farmers are known for their indigenous technologies and local knowledge on food processing. *Patolo*, a snack made from cassava originated from this village and is now distributed to Jakarta, Surabaya, even outside Java. When there was an acute shortage of food in the seventies, Purwosari farmers used the trunk of the *aren* palm to make *sago*, a flour-like ingredient. Years later, middlemen from Klaten were purchasing *aren* trunks from them at Rp.1M each, which in turn produces 500 kilos of *sago*. Since then, the Bupati has banned cutting of naturally growing *aren.* Now it is cultivated by the farmers.

Such knowledge have not been documented, captured, shared, and reused.

PFI3P can profit from information management models employed in development assistance undertakings of many countries. The next section describes this range of options in detail.

Recap of Situation Analysis

To sum up, the existing policy environment is very conducive for poor farmers' empowerment through information and communication.

In the order of levels of utilization, the major users of agricultural information are: scientists and researchers from national agricultural research institutes; scientists from the private sector specializing in agricultural products; technical staff of the Ministry of Agriculture; professors, lecturers, students, and researchers coming from leading universities; extension workers based at the Dinases and private firms; and finally, farmers, but not the poor ones.

The Indonesian poor farmer can become a leading user of agricultural information if sufficiently given attention to by the Project. Information management-wise, the Project can improve access to conventional

media through its PIU-based rural agricultural information and communication centers. It can even pilot village-based rural agricultural information and communication centers. Furthermore, it may incorporate the use of indigenous and local media in its dissemination programs. Finally, the Project can increase capacities for effective dissemination among staff at the NARIs, AIATs, and Dinases through practical training.

Content most relevant to the poor farmer are those that would have immediate impact on his income: accurate, up-to-date price information; available assistance to source potential market outlets; low-input technologies for crops in marginal areas; low-cost post-harvest technology that extends the shelf-life of his products.

Information management needs of the Indonesian research, development, and extension sub-sectors revolve around three main topics: knowledge management; developing the “last mile” linkage for agricultural innovation dissemination; and intermediary training. Long-term and short-term training programs for IAARD, NARIs, AIAT, and Dinas staff are strongly recommended.

Insofar as its information management targets are concerned, the Project is adequately fulfilling its two major deliverables: the establishment of national and local agricultural information systems where agricultural technologies are made available; and the setting up of a Web-based agricultural marketing information system.

However, areas for improvement have been identified. Firstly, the national agricultural information network needs to have institutional and social dimensions, as well not merely focusing on electronic networks. This entails the establishment of an active ICT4D Network for coordination among agencies and even across ministries. For instance, the CADI and SINGOSARI agricultural market information systems should merge into one Web-based service. Furthermore, social networks at the village level should be strengthened and tapped by the Project.

In the past decade, the Indonesian agricultural research-extension-farming sub-sectors have made progress in cyclic and three-way

interfaces. This is apparent in the existing policy environment in spite of the problems resulting from the devolution of the extension service. The cyclic information flows between and among the research-extension-farming sub-sectors can be further strengthened by: incorporating into the National Agricultural Information System, a feedback system from the farmers groups at the local level to national decision makers; incorporating an indigenous knowledge sub-system; and employing a mechanism through which poor farmers are involved in establishing the national and local agricultural research agenda.

Information Management and Networking Plan

The objectives of the Plan are:

- To identify problems and constraints in the existing information management network of PFI3 based on the findings of the IM needs assessment.
- To trace the subordinate and superordinate influential factors or the symptoms/ causes and root causes of these problems and constraints.
- To enumerate the users and other stakeholders of PFI3 information management based on the IM needs assessment.
- To specify the components of an information management network that addresses the needs of the stakeholders in the Indonesian agricultural sector particularly the poor farmers, based on the findings of the IM needs assessment.
- To describe the features and functions of these components consistent with the Project Administration Memorandum.
- To define the implementation strategy for PFI3 information management.
- To develop a road map for information management and networking activities of Components 2 and 3.

General Approach. Consistent with the Needs Assessment Study, a *knowledge management* approach be adopted in this planning exercise. Firstly, it is the optimum solution that ICT can offer to any undertaking, be it agricultural R&D or otherwise. Knowledge management (KM) is a newly emerging discipline that combines

organizational dynamics, knowledge engineering, and ICT to manage the intellectual assets of an organization or as in the case of PFI3P, a *system,* the Indonesian agricultural R&D system. For PFI3P, KM may be defined as managing the intellectual capital and knowledge assets of the agricultural R&D sector for the benefit of the Indonesian poor farmer. The goal of knowledge management is the sharing and reuse of knowledge.[4] For PFI3P, this goal can be restated as the sharing and reuse of technology, innovations, and indigenous and local knowledge for the economic benefit of the Indonesian farmer.

Furthermore, as in the Needs Assessment Study, this *network planning* adopts a general systems (GST), i.e. *living systems,* perspective. Research and development, extension, and the farming sub-sectors may be regarded as subsystems of the larger agricultural and natural resources system. These subsystems have interfaces wherein information is largely exchanged. These information flows can neither be exclusively top-down nor bottom-up.

We reiterate that scientists and researchers in the National Agricultural Research Institutes or NARIs should not be considered as the only source of information. The Indonesian poor farmer should also be recognized as a potential source, particularly of indigenous technology and local knowledge that may guide the sector's R&D agenda. Similarly, the flow of information cannot originate solely from the poor farmer.

Additionally, the flow of information should not be compartmentalized, i.e., from the research subsystem to the extension subsystem, and then from the extension subsystem to the farmer. Interfaces should exist between: the research subsystem and the farmer; the research subsystem and the extension subsystem; and the extension subsystem and the farmer. In other words, the study adopts a non-linear, cyclic framework characteristic of information flows in living networks.

[4] *Matthias Leibmann, A Way to KM solutions: Things to Consider When Building Knowledge Management Solutions with Microsoft Technologies. World Wide Technical Services, 1999. Microsoft Corporation.* www.microsoft.com

Finally, living systems do not merely mean electronic networks that most information systems refer to. The information system for this project should be multi-dimensional involving the electronic network of the National Farming Website, institutional networks at the agency level, and social networks made up of extension workers, NGOs and farmers groups at the local level. The terms of reference allude to "national and local agricultural information resources." The national agricultural information network has an institutional dimension composed of all agencies involved in information generation and dissemination. Local information networks on the other hand are mostly made up of social networks. Hence, the information network of PFI3P has electronic, institutional, and social dimensions, all of which this needs assessment study is addressed to.

***Policy Framework*.** Planning was likewise conducted within the framework of GOI policies and guidelines on Information and Communication Technology and agricultural extension. As stated in the Needs Assessment Study, the policy environment for information management within this framework is generally conducive for growth due to the following:

- *Presidential Decree Number 3 of 2003* promulgates the application of eGovernance all throughout Indonesia. Yet, two laws have severely impacted on the information and communication capacities of the agricultural research and extension interface in Indonesia, although not relating directly to information management.

- *Republic Act Number 22 of 1999*, otherwise known as the Local Government Code has decentralized the agricultural extension function from the Ministry of Agriculture to the *Dinas Pertanian* of the devolved local governments. It may well be worth mentioning that there are several *Dinas's* responsible for agriculture. Aside from the *Dinas Pertanian*, the major ones are the *Dinas Perkanakan*, for animal husbandry and the *Dinas Perhutanan* for forestry. Prior to the implementation of this Code, the then Agency for Agricultural Extension had a network of 32 Agricultural Training Centers (BLPPs) and 343 Rural Extension Centers (BIPPs) based in

the provinces and districts (*kabupatens*), respectively. These centers were equipped with what was then considered as high-end information and communication hardware. When the responsibility for these centers was transferred to the *Dinas*, most of them went exclusively to one *Dinas*, marginalizing the others from utilizing it.[5]

- *Republic Act Number 25 of 1999*, distributed the budget for agricultural extension to the local governments, which had the liberty to reallocate it for other pressing priorities. Hence, money that was meant for extension activities were sometimes channeled elsewhere. This effectively weakened the information and communication capabilities of the agricultural extension force. As of today, the number of productive BIPPs have dwindled 343 to 28. Of the 32 BLPPs, seven were retained by the Ministry and are operational.

- The IAARD has made a strategic decision not to devolve its Assessment Institutes for Agricultural Technology (AIATS). In other words, Indonesia's agricultural R&D network is still intact in spite of decentralization.

- *Republic Act Number 8 of 2003* has limited the number of *Dinases* in each district to three unless certain criteria are met for establishing more. Additionally, the Ministry, although unable to exert any direct influence in decisions regarding agricultural extension programs at the local level, has decided to play its financial card. It has set guidelines in the release of budgets meant for extension.

***Planning Framework*.** Like the Poor Farmers' Income Improvement through Innovation Project wherein it is subsumed under, this Plan adopts the Logical Framework Approach (LFA) to planning. LFA is an analytical and presentational management tool which can help planners: analyze the existing situation; establish a logical hierarchy of means by which objectives will be reached; identify the potential

[5] *Alexander G. Flor.* ***Rapid Assessment of Extension Applications of Information and Communication Technology in Indonesia, Sri Lanka and Thailand****. Food and Agriculture Organization Regional Office for Asia and the Pacific, 2004 (Bangkok).*

risks to achieving the objectives, and to sustainable outcomes; establish how outputs and outcomes might best be monitored and evaluated; present a summary in a standard format; and monitor and review the implementation of the plan.[6]

A distinction should be made between the Logical Framework Approach and the Logical Framework Matrix. LFA involves problem analysis, stakeholder analysis, developing a hierarchy of objectives and selecting a preferred implementation strategy. The result of this approach is the Logical Framework Matrix or simply, the Logframe. This matrix summarizes the basis of the plan and its specific activities, as well as the key assumptions, outputs, and outcomes**.** Table 4-2 is a tabular description of the Logframe.

Problem Analysis. The Logical Framework for PFI3 information management and networking begins with the problems identified by the Needs Assessment Study and the RRP. Problem analysis involves identifying what the main problems are and establishing the cause and effect relationships between these problems. The key purpose of this analysis is to try and ensure that 'root causes' are identified and subsequently addressed in the plan, not just the symptoms of the problem(s). This initial step provides the foundation for the log framework and the plan itself.

The primary tool employed for problem analysis is the Problem Tree or *problematique,* technically the French word for "a complex cluster of problems." Based on the Needs Assessment Study, the main problem being addressed by PFI3 information management is the *information-poor farmer.* This problem can be analyzed in detail with the following problem tree.

This problem analysis is based upon the information-rich and information-poor typology. In today's Information Age, to be information-poor is also to become resource-poor.[7] This does not

[6] *AusAID.2003.* ***The Logical Framework Approach****. Commonwealth of Australia, Canberra.*

[7] *Alexander G. Flor.* ***The Information-Rich and the Information-Poor: Two Faces of the Information Age in a Developing Country****. University of the Philippines at Los Baños, 1986.*

Table 4-2. Logical Framework Matrix

Project Description	Performance Indicators	Means of Verification	Assumptions
Goal: The broader development impact to which the project contributes – at a national and sectoral level.	Measures of the extent to which a sustainable contribution to the goal has been made. Used during evaluation.	Sources of information and methods used to collect and report it.	
Purpose: The development outcome expected at the end of the project. All components will contribute to this.	Conditions at the end of the project indicating that the Purpose has been achieved and that benefits are sustainable.. Used for project completion and evaluation.	Sources of information and methods used to collect and report it.	Assumptions concerning the purpose/goal linkage.
Component Objectives: The expected outcome of producing each component's outputs.	Measures of the extent to which component objectives have been achieved and lead to sustainable benefits.. Used during review and evaluation.	Sources of information and methods used to collect and report it.	Assumptions concerning the component objective/purpose linkage.
Outputs: The direct measurable results (goods and services) of the project which are largely under project management's control	Measures of the quantity and quality of outputs and the timing of their delivery. Used during monitoring and review.	Sources of information and methods used to collect and report it.	Assumptions concerning the output/component objective linkage.
Activities: The tasks carried out to implement the project and deliver the identified outputs.	Implementation/work program targets. Used during monitoring.	Sources of information and methods used to collect and report it.	Assumptions concerning the activity/output linkage.

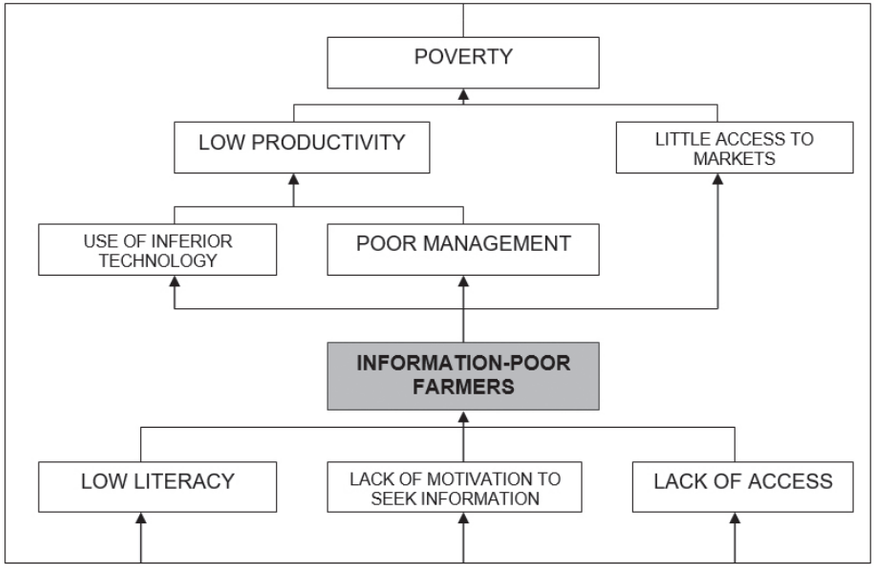


Figure 4-2. The Information-Poor Farmer *Problematique*

mean, however, that poverty is exclusively the result of the lack of information. It is clear that poverty has other root causes such as structural, economic, cultural, and individual.[8] However, since this Plan concerns information management, the problem tree will only focus on the information dimension.

The large numbers of Information-poor farmers in Indonesia is generally caused by three factors: low literacy; lack of motivation to seek information; and lack of access to information. Low literacy among marginal farmers prevent them from reading about new agricultural technologies and from tapping conventional sources of information, such as leaflets and published articles. The same farmers usually lack motivation to seek information not only because of low literacy, but because they are preoccupied with what they feel are more basic and urgent concerns, such as putting food on the table as discussed in the previous technical paper. Perhaps the most significant contributory factor is the lack of access to conventional and digital media, and media materials. These factors combine to produce the Information-Poor Farmer.

[8] *Ila Virgina C. Ongkiko and Alexander G. Flor.* ***Introduction to Development Communication****. SEAMEO SEARCA and the UP Open University, 2003).*

In turn, the lack of information has led the farmer to employ poor agricultural management practices and to utilize inferior technology. These factors lead to low productivity. The lack of information likewise leads to little access to markets. Low productivity and lack of access to markets bring about poverty.

But it does not stop there. Poverty, in turn, results in low literacy, lack of motivation to seek information, and lack of access to media and materials - the factors that lead to increasing numbers of Information-Poor Farmers. Hence, it has become a vicious cycle that the Project will attempt to break by addressing two of the three root causes: the lack of motivation to seek information; and the lack of access to media and materials and subsequently, appropriate agricultural production and marketing. Cutting these roots hopefully will eradicate the problem and break this vicious cycle.

To reiterate, this Plan should address two root causes: the lack of motivation to seek information; and the lack of access to appropriate agricultural production and marketing.

Stakeholder Analysis. For purposes of this Logframe, the main objectives of stakeholder analysis are: to better address distributional and social impacts of the plans; and to identify existing or potential conflicts of interest, and factor appropriate mitigation strategies into the Plan. Stakeholder analysis is about asking the questions: "Whose problem?" and, if a strategy or plan is proposed: "Who will benefit?" Stakeholder analysis is thus an essential element of poverty analysis.[9]

A review of the situation analysis points towards the following findings:

- The Indonesian poor farmer can become a leading user of agricultural information if sufficiently given attention to by the Project. Information management-wise, the Project can improve access to conventional media through its PIU-based rural agricultural information and communication centers. It can even pilot village-based rural agricultural information and communication centers. Furthermore, it may incorporate the use of indigenous and local media in its dissemination programs. Finally, the Project can increase capacities for effective dissemination among staff at the NARIs, AIATs and *Dinases* through practical training.

- In the order of levels of utilization, the major users of agricultural information are: scientists and researchers from national agricultural research institutes; scientists from the private sector specializing in agricultural products; technical staff of the Ministry of Agriculture; professors, lecturers, students, and researchers coming from leading universities; extension workers based at the *Dinases* and private firms; and finally, farmers, but not the poor ones.[10]

Obviously, the primary stakeholder of this Plan is the Information-Poor Farmer. The current situation has led to low productivity and limited market access. And yet, their motivation to participate may be moderate, at best, since they do not consider this as a significant concern.

Other Stakeholders. Given the conclusions of the Needs Assessment Study, other stakeholders would include: the NARIs, AIATs and Dinases; members of the academe, and extensions workers who are users of agricultural information. We should add local governments or PEMDAs and nongovernmental organizations or LSMs to this list, since the provision of and access to information have a bearing on their operations.

The research and development sector represented by the NARIs, AIATs and *Dinases* are affected by the Information-Poor Farmer Problematique since their information products are less utilized by the sector that needs these most as traced in the information flow study of the Needs Assessment. [11] Extension workers likewise are affected by this situation since it impairs their ability to achieve their annual targets. The academe's stake in this *problematique* is its reduced relevance to agricultural realities that affect the poor farmers. The PEMDA, on the other hand, is affected by this situation since the problem decreases the productivity of PEMDA

[9] *AusAID, 2003, Op. Cit.*

[10] *Flor, 2005 Op Cit.*

[11] *Ibid*

constituents. Lastly, the effectiveness of the LSM's services in rural areas is diminished by this problem situation. Table 4-3 presents a stakeholder matrix of the Plan.

Table 4-3. Stakeholder Matrix

STAKEHOLDER	HOW AFFECTED BY THE PROBLEM	CAPACITY /	RELATIONSHIP
Poor farmers	Low productivity; little market access	Moderate	Partnership
NARI/ AIAT/ DINAS	Less utilization of research output	Moderate	Partnership
Extension Workers	Impaired ability to achieve targets	High	Partnership
Academe	Reduced relevance to agric realities	Low	Undetermined
PEMDA	Decreased productivity of constituents	Moderate	Partnership
LSM	Diminished effectiveness of services	High	Partnership

Hierarchy of Objectives. Utilizing the Logical Framework Approach, the hierarchy of objectives is composed of the Goal, the Purpose, and the Objectives of the Plan. These will be arrived at by translating the superordinate and subordinate influential factors identified in the problem tree.

Poverty is the end result or the "fruit" of the problem tree. Our Goal, then, is reduced poverty or specifically *increased incomes among poor Indonesian farmers.*

The purpose of the Plan is to negate the root causes identified. These are: low literacy levels; the lack of motivation to seek information; and the lack of access to agricultural production and marketing. Negating these statements we arrive at the following:

- High literacy levels
- Increased motivation to seek information
- Increased access to agricultural production and marketing

The first statement is the concern of the educational sector and thus, goes beyond the scope of this Project. The second and third statements may be combined and qualified further to refer to agricultural technology and innovation. Thus, the Plan's purpose may be stated as: to increase access to and motivation for agricultural technology and innovation among Indonesian farmers**.** This purpose may be operationalized by establishing three types of networks: institutional networks; electronic networks; and community networks. Hence, the Plan's objective is*: to establish institutional, electronic, and community networks to increase access to and motivation for agricultural technology and innovation*.

Institutional Networking Component. The specific objective of this component is to establish an institutional network that coordinates information management activities within the Ministry of Agriculture to increase access to and motivation for agricultural technology and innovation among Indonesian farmers.

As discussed in the Needs Assessment Study, an institutional network would be made up of all the agencies involved in agricultural information and technology dissemination. The network should be coordinative in nature, preventing the duplication of efforts and overlapping of initiatives. With scarce resources available, this would make sense. Having an institutional dimension to information management entails the establishment of an active ICT network for coordination among agencies and even across ministries. Such a network may be formalized as the ICT Council of the Ministry of Agriculture.

Tentatively, the ICT Council may be composed of CADI, BPHP, ICALTD, the NARIs, and the AIATs. The network may be expanded to accommodate other agencies directly involved in information management. Farmers' organizations should also be represented in this Council. Initiatives have already started for the integration of the diverse information systems within the Ministry of Agriculture.

There are several options for integration or interoperability, among them: complete restructuring towards one system, which is wasteful and expensive; higher-level integration, which superimposes another management level over existing systems using metadata; or phased integration, which is gradual and economical. This body will operationalize such initiatives and will help determine the most viable and practical option for the Ministry.

Preliminary meetings of such an ICT network have already been organized by the Project in April. This should be followed up by an organizational meeting that identifies the formal membership, the Chair, and officers of the Council. A committee should be tasked to determine the tasks and Terms of Reference of the Council. Depending on the integration or interoperability strategy, common standards involving platforms, protocols, software, database templates, and base maps for GIS should be agreed upon. These will be presented to the Ministry for endorsement and policy formulation. A set of guidelines/ policies will then be drafted for implementation.

Attendant to the common standards to be adopted, a common approach to outreach should likewise be agreed upon. The PCMU has just completed the first draft of the PFI3 Prototype Outreach Program Manual. Location and agency specific versions of this manual will be prepared by the NARIs, AIATs, and *Dinases.* Before the preparation of localized versions, an Outreach Workshop will be conducted to introduce as well as to pretest the prototype. It is hoped that this Outreach Program Manual will result in a unified, coherent, and common approach to outreach or extending the information products of the Indonesian agricultural research and development sector.

Lastly, the regularization of information management and communication staff should be seriously considered by the different agencies involved in outreach. Information management and communication should not be considered merely as a support function but also as part of the mandate and thus the regular structure of a research and development agency. A policy on the regularization of information management and communication staff will considerably improve outreach efforts.

Electronic Networking Component. The objective of this component is to establish an electronic network to increase access to and motivation for agricultural technology and innovation among Indonesian farmers.

In the Needs Assessment Study, it was stated that the Project is adequately fulfilling its two major deliverables: the establishment of national agricultural information system by ICALTD where agricultural technologies are made available; and the setting up of a Web-based agricultural marketing information system by CADI. Both systems share the same front-end, the National Farming Website.

However, areas for improvement have been identified. The existing system may be further strengthened by:

1. Incorporating into the National Agricultural Information System a feedback functionality from the farmers groups at the local level to national decision makers;
2. Incorporating an indigenous knowledge sub-system; and
3. Employing a mechanism through which poor farmers are involved in establishing the national and local agricultural research agenda.

Using the same front-end, an improved system may add-on a functionality for poor farmers to participate in online discussion forums with the assistance of intermediaries based at the village level. These discussion forums may even deal with the formulation of the national or local research agenda of the NARIs and the AIATs, respectively. In China, such a functionality may be found in the website of the Central Agricultural Broadcasting and Television School, whose enrollment at any one time total an estimated 900,000 farmers, rural housewives, youth, and extension workers. This functionality was recently added to the CABTS website when the school shifted to digital learning.

A very important sub-component for the national agricultural information system is the documentation, capture and uploading of indigenous and local knowledge found in the beneficiary villages.

Community Networking Component. The objective of this component is to establish a community network within the pilot *desas* to increase access to and motivation for agricultural technology and innovation among Indonesian farmers. PFI3P plans to pilot rural information centers at the village level. The Ministry of Communication and Information has a similar nationwide initiative that will establish "community access points." Community networking, however, goes beyond these access points to accommodate localized conventional media, indigenous media as well as social networks. The latter, in fact, should be strengthened and tapped by the Project. These networks not only involve formal groups such as the KTNA but informal groups that exist in every village. These should involve schools, youth/ women groups, as well as opinion leaders such as *imams* and *dukhons*.

For this Plan, the community networking component shall focus on the following outputs: an operationalization of the Outreach Program Manual or the Outreach Manual Vol. II which provides specific procedures and guidelines for utilizing community media, digital media, and indigenous media; trained intermediaries; and pilot rural information centers at the *desa* level or Community eCenters.

For the first output, the Domestic Information Management Specialist will consolidate pretest findings of Volume I. Based on the pretest findings, the International Information Management Specialist will write Volume II of the Outreach manual with the assistance of the PCMU and ICALTD. This will then be translated to *Bahasa Indonesia* and pretested on its target audience, i.e., NARI's outreach officers, AIAT dissemination officers, PIU staff and NGO facilitators. The manual will be revised and localized or agency-specific versions will be developed.

Intermediaries are the links between the farmer and the front-end of the National Farming Website as well as to conventional media such as radio and television. At the community level, intermediaries may be the PIP officer, NGO facilitators, extension workers, or farmer-housewife-youth leaders. Intermediaries need to be trained for their role before deployment.

Finally, the community-networking component provides for the piloting of rural information centers or Community eCenters at the *desa* Level. This output entails: the conduct of feasibility studies to determine RIC sites; the identification of hardware, software and connectivity specifications; the equipping of the centers; the training of community operators; and the conduct social mobilization campaigns for awareness and participation purposes.

The following section provides the logical sequencing of these components vis avis the Plan's goal and purpose.

***Planning Matrix*.** The following table at the next page presents the planning matrix resulting from the logical framework.

Implementation Strategy
A Road Map for a PFI3 Network

Best Case Scenario or End Game. As in all road maps, this Plan should have a destination or what Game Theorists would refer to as the End Game. The End Game should be seen from the perspective of the stakeholders. Actually, the best-case scenario is the inverse or opposite of the "how affected" statements in the stakeholder matrix found in Section III.

The matrix identified poor farmers as the target group or primary stakeholder. The NARIs, AIATs, and Dinases, extension workers or PPLs, academe, PEMDAs or local governments and LSMs or NGOs constitute other stakeholders of the Plan.

Restated in the inverse, the "how affected" statements would read:

Poor Farmers. Because of access to agricultural technologies and innovations as well as to market information, marginal farmers will experience increased agricultural productivity and more market access one year before the Project ends.

NARIs/ AIATs/ Dinases. National agricultural research institutes, assessment institutes for agricultural innovation, and Dinases will

Table 4-4. Information Management Networking Logframe

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Goal: Increased incomes among poor Indonesian farmers	Average incomes Productivity rates Access to markets.	Ex-post Evaluation	Pricing policy for agricultural commodities is sound.
Purpose: To Increase access to and motivation for agricultural technology and markets among Indonesian farmers	Adoption rates of agricultural production and marketing.	Terminal Evaluation Final Report	Agricultural research and development is geared towards poor farmers.
1. Institutional Networking Component **Objective**: To establish an institutional network that coordinates information management activities within the Ministry of Agriculture to increase access to and motivation for agricultural technology and markets among Indonesian farmers.	Level of farmers' access to technology & innovations Level of motivation for technology & market information Sustainability of levels of access and motivation	Terminal Evaluation Midterm Evaluation Final Report Midterm Report Annual Report	The Ministry of Agriculture is moving towards interoperability or integration of ICT systems and initiatives.
Output 1.1. ICT Council Activity 1.11. Organizational meeting among members of ICT Network Activity 1.12. Draft tasks and TOR. Activity 1.13. Formalize Council	No. of member agencies Comprehensiveness of tasks and TOR No. of meetings held Attendance in meetings	Periodic monitoring and evaluation. Annual reports Quarterly reports Minutes of Council mtgs.	
Output 1.2. Common Standards Policy Activity 1.21. Conduct Info Resources Audit Activity 1.22. Develop interoperability/ integration strategy Activity 1.24. Obtain interoperability/ integration policy from Ministry Activity 1.24. Develop guidelines/ policies Activity 1.25. Implement guidelines/ policies	No. of databases merged No. of common standards (platform, protocol, software, database template, base map, etc.) adopted Comprehensiveness of guidelines and policies	Periodic monitoring and evaluation. Annual reports Quarterly reports	Parallel to the establishment of common standards, adequate retooling and reconfiguration of ICT infrastructure is conducted.
Output 1.3. Outreach Manual Vol. I Activity 1.31. Draft Prototype Manual Activity 1.32. Conduct Outreach Workshop Activity 1.33. Pretest Prototype Manual Activity 1.34. Finalize Prototype Activity 1.35. Develop Localized or Agency Specific Outreach Manual	Understandability of manual Comprehensiveness of prototype manual No. of workshop participants No. of location-specific manuals written No. of agency-specific manuals produced	Periodic monitoring and evaluation. Annual reports Quarterly reports	Outreach is accepted as an important function of agricultural R&D agencies.

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
2. Electronic Networking Component **Objective**: To establish an electronic network to increase access to and motivation for agricultural technology and market information among Indonesian farmers.	Level of farmers' access to technology & market info Level of motivation for technology & innovations Sustainability of levels of access and motivation	Terminal Evaluation Midterm Evaluation Final Report Midterm Report Annual Report	
Output 2.1. National Farming Website Activity 2.11. Establish agricultural market information system Activity 2.12. Upload and maintain agric technology databases Activity 2.13. Develop distributed Web-based information portal	Comprehensiveness of fields No. of entries in AMIS Frequency of AMIS updates No. of agri tech entries Relevance of tech entries No. of online queries	Periodic monitoring and evaluation. Annual reports Quarterly reports	

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Output 2.2. NARIs Knowledge Banks Activity 2.21. Conduct knowledge audit of NARIs MIS Activity 2.22. Identify knowledge gaps. Activity 2.23. Restructure databases to knowledge bases	Comprehensiveness of knowledge audit No. of gaps knowledge gaps identified No. of databases upgraded into knowledge bases	Periodic monitoring and evaluation. Annual reports Quarterly reports	All 15 NARIs have MIS units
Output 2.3. District Info Centers (PIPs) Activity 2.31. Equip PIUs Activity 2.32. Ensure bandwidth availability Activity 2.33. Capacity Building/ Training Activity 2.34. Upload/ maintain site websites	No. of operational PIPs Level of activity of PIPs Connectivity of PIPs No. of websites uploaded. Website: dynamic or static?	Periodic monitoring and evaluation. Annual reports Quarterly reports	There is adequate bandwidth in all four project sites
3. Community Networking Component **Objective:** To establish a community network within the pilot *desas* to increase access to and motivation for agricultural technology and market information among Indonesian farmers.	Level of farmers' access to technology & market information Level of motivation for technology & innovations Sustainability of levels of access and motivation	Terminal Evaluation Midterm Evaluation Final Report Midterm Report Annual Report	Project management recognizes the role of community or village level networks in PFI3

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Output 3.1. Outreach Manual Vol. II Activity 3.11. Consolidate pretest findings of Volume I Activity 3.11. Write Vol II Outreach Manual Activity 3.13. Pretest Vol II Outreach Manual Activity 3.14. Develop localized or agency-specific versions. Activity 3.15. Reproduce and distribute	Understandability of manual Comprehensiveness of manual No. of location-specific manuals written No. of agency-specific manuals written No. of manuals reproduced/ distributed	Periodic monitoring and evaluation. Annual reports Quarterly reports	
Output 3.2. Trained Intermediaries Activity 3.21. Identify intermediaries: PIP officer, NGO facilitators, extension workers, farmer-housewife-youth leader Activity 3.22. Training of trainers (TOT) Activity 3.23. Train intermediaries	No. of intermediaries identified No. of intermediaries trained Level of activity of intermediaries	Periodic monitoring and evaluation. Annual reports Quarterly reports	PIP officers, NGO facilitators and extension workers have adequate time to serve as information intermediaries.

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Output 3.3. Pilot Rural Information Centers or Community eCenters at the *Desa* Level Activity 3.31. Conduct feasibility studies to determine RIC sites. Activity 3.32. Determine hardware, software and connectivity specifications. Activity 3.33. Equip Rural Info Centers Activity 3.34. Train community operators Activity 3.35. Conduct social mobilization campaign	Income of Rural Info Centers No. of community users Frequency of use Community awareness levels	Periodic monitoring and evaluation. Annual reports Quarterly reports	PFI3 revises its policy on the purchase of ICT equipment using village investment funds. Adequate bandwidth is available in the pilot sites.

experience higher adoption rates of agricultural production and marketing one year before the Project ends.

Extension Workers. The PPLs based in the *kacamatans* will acquire better abilities to achieve their targets due to increased motivation among farmers to seek agricultural technologies and innovations two years before the end of the Project.

Academe. Agricultural universities and its professors, scientists, researchers, and students become more relevant to farmers in the conduct of their instruction, research and extension functions at the end of the Project.

PEMDA. There will be increased productivity of local government constituents one year before the end of the Project.

LSM. The services of Non-Governmental Organizations in rural and remote areas have become more effective one year before the end of the Project.

Milestones. In the PFI3 Information Management Networking Plan we have identified nine milestones for the Road Map:

Milestone 1. Council formalized. This milestone scheduled for 2 January 2006 is under the Institutional Networking Component and indicative of the fulfillment of Output 1.1, an ICT Council that coordinates information management activities within the Ministry of Agriculture to increase access to and motivation for agricultural technology and innovation among Indonesian farmers.

Milestone 2. Adoption of Guidelines for the ICT Network. The second milestone, tentatively scheduled for 31 August 2006, points toward the fulfillment of Output 1.2, a set of common standards for the use of information and communication technologies. These include: platforms; protocols; software; database templates; GIS base maps; and others. The guidelines should work towards interoperability or integration, either on actual data entries or at a higher level (metadata) depending on the most practical and least expensive options available.

Milestone 3. Outreach Manual implemented. The PFI3 Outreach Manual provides a guide to the national agricultural research institutes, the assessment institutes for agricultural technology; and the *Dinases* on how they can make their research results available to farmers, housewives, and rural youth. As discussed in the previous section, a prototype manual will be prepared by the PCMU, and pretested with AIAT workshop participants. Location specific or agency specific outreach manuals will then be prepared by the NARIs, the AIATs, and the *Dinases,* with the assistance of the PIU. Once these manuals are reproduced, disseminated and implemented, by 30 December 2005, this milestone would have been reached.

Milestone 4. Distributed Portal launched. The distributed information system is a Web portal proposed by the international Information and Communication Specialist for decentralized entry and maintenance of four types of databases: an agricultural expert's directory; a project directory; a documents or publications database; and a factual database for indigenous technology. Reaching this milestone by 1 January 2007 completes Output 2.1, the National Farming Website under Component 2.

Milestone 5. Knowledge Bases uploaded. Under the Electronic Networking Component, it was suggested that the fifteen national agricultural research institutes upgrade their existing management information systems (MIS) into knowledge systems or knowledge banks. Thus, Output 2.2. refers to NARIs Knowledge Banks. Once these knowledge bases are uploaded along with the agricultural technology database of ICALTD by 30 June 2006, then this milestone would have been attained.

Milestone 6. PIPs operational. As previously discussed, the PIPs or project information centers at the district level has been identified as Output 2.3 of the Plan. Once these PIPs are operational by 30 December 2005, this milestone is reached.

Milestone 7. Outreach Manual Vol. II implemented. For the Plan's Community Networking Component the initial deliverable would be

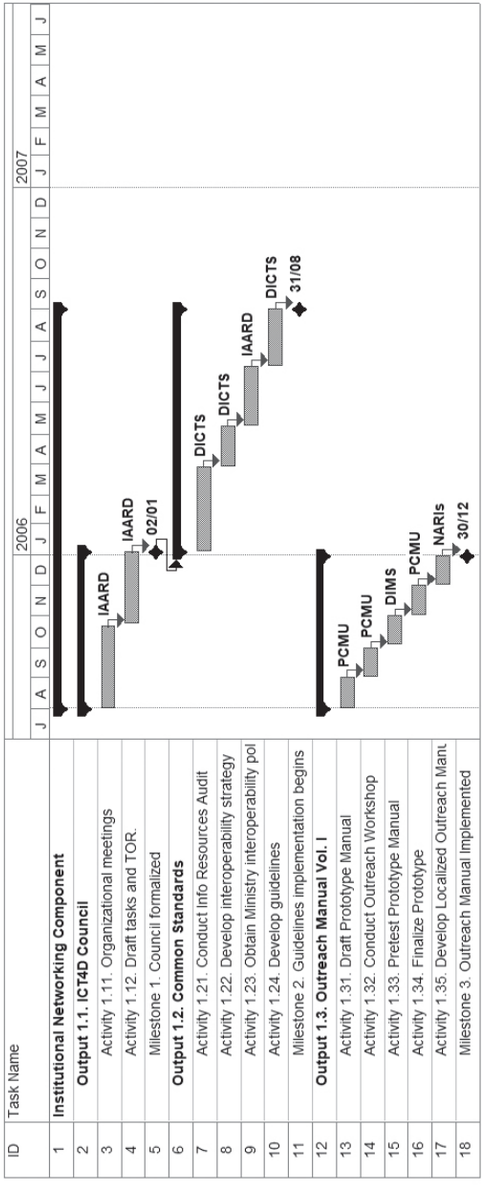
the operational version or Volume II of the Outreach Program Manual. This volume will be prepared by the International Information Management Specialist as his support to training for establishing the operational network, since the manual will likewise be used in the training of trainers for the outreach program. It will then be translated into *Bahasa* Indonesia and localized to specific agencies. Volume II will contain guidelines for the utilization of conventional, digital, and indigenous media. The implementation of these guidelines by 30 June 2006 is indicative of attaining Milestone 7 of the Plan.

Milestone 8. Intermediaries deployed. Output 3.2 of the Community Networking Component are trained Intermediaries at the *desa* level. As discussed in the previous section as well as in the Needs Assessment, intermediaries are the links between the farmer and the front-end of the National Farming Website as well as to conventional media such as radio and television. The intermediaries need to be identified and trained. Once they are deployed by 30 June 2006, then it can be said that Milestone 8 of the Plan has been reached.

Milestone 9. Desa Info Centers inaugurated. Finally, Output 3.3 of the Community Networking Component refers to Pilot Community eCenters at the *desa* level. As already discussed, these Community eCenters may be financed by the local government as provided for in the PAM. Alternatively, it may be a village investment option that offers telecommunications (telephone, fax and email services) to the community as well as a one-stop shop for agricultural information and innovation. Its inauguration scheduled on 1 January 2007 signals the attainment of the Plan's final milestone.

Timeframe. The Plan's timeline is presented in the following Gantt Charts for the Institutional Networking, Electronic Networking, and Community Networking Components:

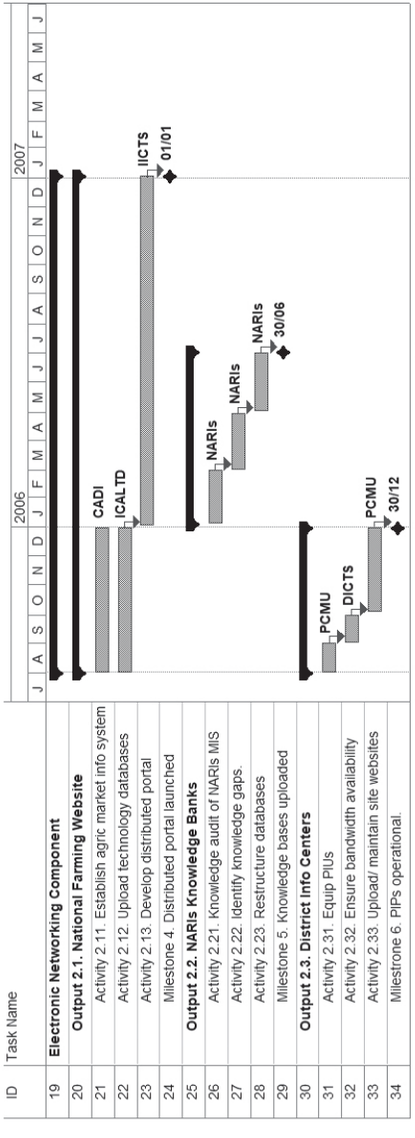
Table 4-5A. Gantt Chart: Institutional Networking Component



*Institutional Networking***.** The Institutional Networking Component has three milestones representing: the formalization of the ICT Council within the Ministry of Agriculture; the implementation of guidelines for the adoption of common standards for ICT use within the MOA; and the implementation of guidelines contained in the Outreach Program Manual.

*Electronic Networking***.** The Electronic Networking Component likewise has three milestones representing: the launching of the distributed Web-portal containing experts and project directories, a publications database, and an indigenous knowledge base; the uploading of the knowledge banks maintained by the NARIs; and the initiation of operations among the district PIPs.

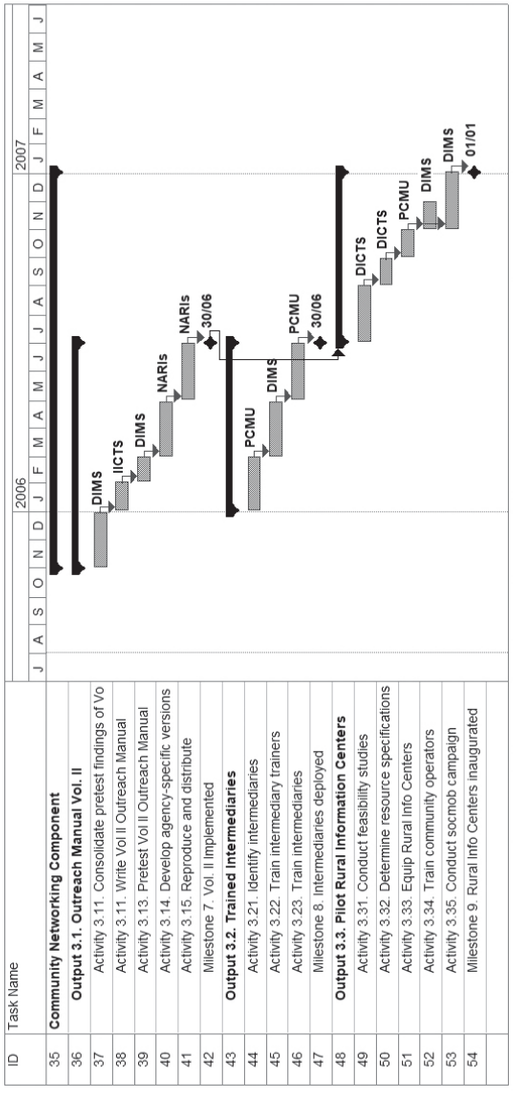
Table 4-5B. Gantt Chart: Electronic Networking Component



Output 2.1 is the joint responsibility of CADI and ICALTD. However, the International ICT Specialist is expected to design and develop the distributed Web-portal and train users to populate the online databases contained in it. Output 2.2 will be implemented by the fifteen national agricultural research institutes covered by the Project. Output 2.3, on the other hand, will be jointly established by the PCMU and the Domestic ICT Specialist.

Community Networking. The Community Networking Component has three milestones representing: the implementation of guidelines contained in Volume II of the Outreach Program Manual; the deployment of intermediaries; and the inauguration of the *desa*-based Community eCenters.

Table 4-5C. Gantt Chart: Community Networking Component



The statement of the End Game, the enumeration of milestones, and the Gantt Chart present a composite Road Map towards the PFI3 Information Management Network. Within the Network, however, is a very critical node that links the Project to the Last Mile.

The Last Mile Linkage. It has often been said that a chain is only as strong as its weakest link. This maxim may not be true with networks, particularly the information management (IM) network of the Poor Farmers Income Improvement through Innovation Project. On the contrary, for PFI3, the IM Network may only be as strong as its "last mile link."

The Situation Analysis has defined the "last mile link" as the node that actually brings information to the farmer. The concept of the last mile may have been inspired by the "missing link hypothesis" forwarded by the International Telecommunications Union in the early 90s that states

that telecoms infrastructure development in most parts of the Third World will not prosper unless it is linked with thematic-sectoral concerns such as health, agriculture, environment, and governance. But linking IT or ICT to these sectors is easier said than done considering its costs and the lack of readiness among users in these thematic sectors or the last mile, if you will, coming mostly from rural and remote areas. Hence, intermediaries are needed to link this last mile to the benefits attendant to ICT use. These links may be two-step or multi-step.

Thus, the Plan has proposed three overlapping networks: an institutional network in the form of the ICT Council; an electronic network with the National Farming Website as the front end; and a community network with the last mile link as its hub. This last mile link or intermediary operates at the *desa* level. He may be the NGO facilitator or even a farmer leader who has the following traits.

- First of all, he must be willing to take on the role of an intermediary, explaining technologies to farmers while relaying feedback from the beneficiaries to the Project.
- Secondly, he is not only computer literate but has undergone training on how to utilize the Web resources of the Project. He can participate in online discussion forums as the mouthpiece of the farmer groups.
- Thirdly, he possesses appropriate media skills such as visual acumen, writing and presenting.
- Fourthly, he has integrity and excellent human relations.
- Lastly, he is familiar with the IM Network of the Project as well as its various nodes and has a direct line to the PIU, the *Dinases* and the PPL.

Figure 4-3 illustrates the central role that the intermediary plays in the PFI3 IM Network. It likewise presents the interrelationships between the institutional network (red), the electronic network (blue) and the community network (green).

Without the intermediary, the PFI3 Information management network will fall apart. He/she is the node that holds the center.

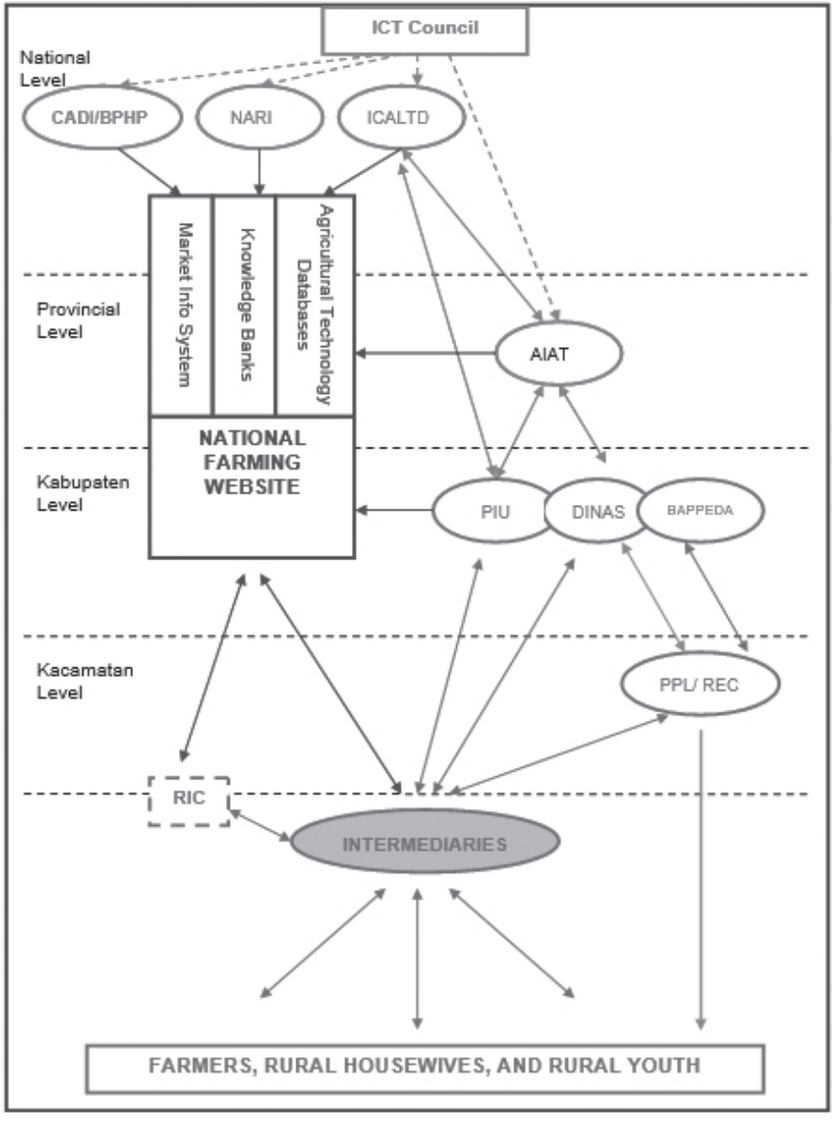


Figure 4-3. Network Configuration

ICT FOR FOOD SECURITY: THE CASE OF SAIMS

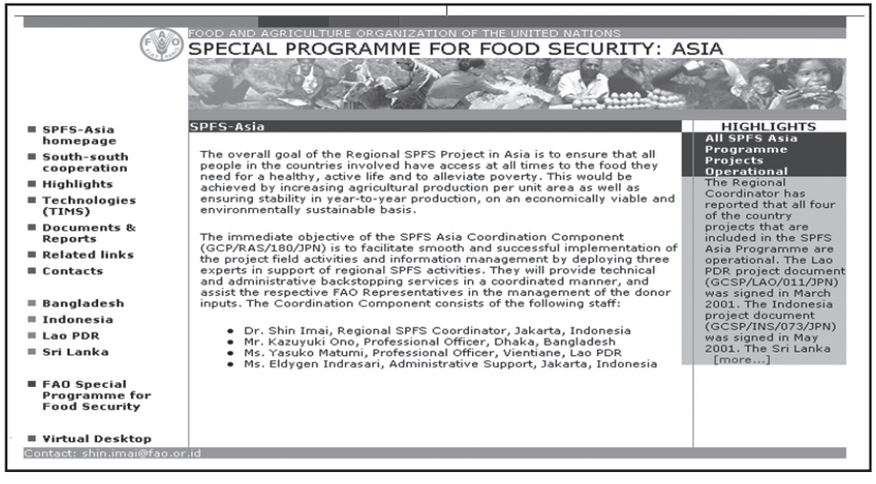
Overview

Since 1995, Japan has been a major sponsor of the Special Program for Food Security (SPFS) of the Food and Agriculture Organization of the United Nations (FAO). Japan's support has been targeted at four Asian countries: Bangladesh, Indonesia, Lao PDR, and Sri Lanka. This support includes the setting-up of a Coordination Component and an Information Management Component under the FAO/Japan Trust Fund Agreement.

The Information Management Component covers the development of the SPFS Asia Information Management System; a Web-based system centrally maintained and administered but allows for decentralized input of content. The system was designed, developed, and launched by FAO. SAIMS became available to the Bangladesh, Indonesia, Lao PDR, and Sri Lanka PMUs by the late 2002. With technical support from GILF, TCOS and FAORAP, the PMU and RCO staff were trained on data entry and approval.

SAIMS was meant to reduce the workload of data management, and eliminate the need to respond to individual requests for data from other SPFS stakeholders. Information in SAIMS can be made publicly available through the SPFS Asia Website (www.fao.org/spfs/asia.) or restricted to a limited group of predefined user who will have varying rights to access and update information.

The project design provided for country project management units or PMUs, a Regional Coordination Office (RCO) and other groups as appropriate to input documents, data and metadata into SAIMS via the Internet. In most other cases, other users are limited to viewing information. The PMUs would navigate the SAIMS Website to retrieve information from other PMUs with technical and operating guidelines provided by the RCO and FAO. The RCO, governments of project countries, FAO and donors can use SAIMS to monitor the progress, developments and outputs of the project sites through one single information system. The



FRAME 4-5. SPFS Asia Web Interface

community of public users would access SAIMS to learn about SPFS implementation and how it is improving food security in Asia.

Hence, SAIMS was originally conceived as: (i) a central information repository for the four national projects; and (ii) as a common Web-based platform for accessing information and data produced by each PMU, associated experts and consultants. The repository would include general information about SPFS Asia and the national projects, reports and data from assessment, fieldwork and monitoring activities, and tested field technologies. In the course of the project, difficulties in incorporating a monitoring and evaluation (M&E) sub-system within SAIMS became evident and eventually were put on hold before being Beta tested. The information that was uploaded and made available in the public SPFS site became limited to program highlight and field-tested technologies (Riggs, 2002).

***Reasons for Establishment*.** SAIMS was primarily established to provide information support to SPFS Asia. One of the major obstacles to the enabling function of the SPFS is the lack of access to relevant information, as well as standardized

classifications and definitions that would insure comparability and integration of the results of SPFS projects.

SAIMS was meant to reduce the time spent to fulfill reporting requirements and responding to information requests. It was supposed to serve as an authoritative source of information on SPFS Asia activities and outputs for project stakeholders and a wider public audience. It would offer comparisons and consolidations of success stories and technologies produced by the four different countries, and improve communication among the project stakeholders.

The main objective of the Special Program on Food Security (SPFS) is to help Low-Income Food-Deficit Countries (LIFDCs) to improve their national food security - through rapid increases in productivity and food production, and by reducing year-to-year variability in production - on an economically and environmentally sustainable basis. The extent to which recipient countries derive lasting benefits from the SPFS, and their own national efforts to promote and enhance food-security, depends to a great extent on their ability to collect, analyze, interpret, disseminate, and provide access to information relating to nutrition, food security, and agricultural development among all sectors of society. This in its turn depends upon their ability to acquire and develop the technologies to add value to these resources, by integrating modern information technology and applications into their development strategies.

It was argued that SAIMS will be useful for better coordination of efforts and overall effectiveness of the SPFS at the national and regional levels, and thereby have direct impact in improving food security. The grassroots level data collected and exchanged would be important for getting timely and accurate assessments of the situation in the recipient country. It will also be useful for the donor community in formulating their own programs (Riggs, 2002).

***Stakeholders*.** As conceptualized, SAIMS targets a range of stakeholders in the SPFS, including farmers' organizations,

information professionals, researchers, senior managers and policy makers. However, these are *potential* stakeholders whose participation is contingent to a number of factors that are beyond the system's control. The primary stakeholders are the end-users: SPFS staff at the PMU level that would profit most from the system.

Thorough consultations with the stakeholders were conducted during the initial phase:

> *We were acutely aware from the outset of this project of the need to ensure the usefulness of SAIMS to the PMUs while balancing the needs of other stakeholders. The initial activities in the project included a thorough consultation with all the stakeholders, especially the PMUs, to determine the functional requirements of the system from all perspectives. The design that resulted was circulated for comment, and there was considerable consultation during the development of the website/ system (Rudgard, 2005).*

***Inputs*.** Project inputs may be categorized under four main headings:

System Design and Development. The system was designed, developed and launched by GILW with the active participation of FAORAP.

Hardware/ Software Provision. Work stations, notebook computers and digital cameras were provided to each PMU and the RCO.

System Maintenance and Backend Administration. The system is maintained from Rome. The Information Management Officer of FAORAP administers the backend.

Capacity Building. Training programs on SAIMS were conducted for each of the four PMUs and for the RCO. During these

programs PMU editors, PMU approvers, RC editors and RC approvers were identified and trained on their roles and functions. Simulations were conducted as well as specialized follow-on training courses.

Helpdesk and List Serve Support. The help desk is manned by. A list serve was initiated in 2003 for the sharing of comments and suggestions on the workflow.

Technical Assistance. Technical assistance is regularly provided by supplemented by occasional consultant's inputs. Short-term consultants were engaged for capacity building and content development.

Outputs. The intended outputs of the project were:

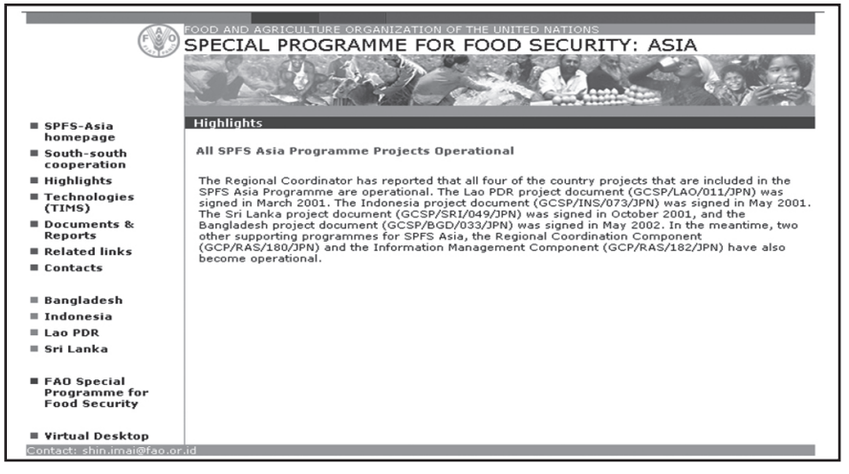
- a database of technologies developed/tested and lessons learned through the SPFS;
- improved national capacities of the four countries to manage information for food security and agricultural development;
- collaborative links for information exchange in the Asia/Pacific to special interest networks, non-governmental organizations and other relevant international, regional, and national organizations, building upon the experience and knowledge available in FAO's WAICENT.

The outputs were intended to be sustainable through improved capacities at the national and regional level and the continuing support from FAO's Program of Work.

Products. SAIMS publishes information in the four national SPFS Asia WebPages and the regional SPFS Asia Website. As stated, the system generates two types of information for these Websites: SPFS Program Highlights at the country and regional levels; and SPFS Technologies.

A Highlight is an SPFS program or project event or an activity that should be documented and shared. This event may be at the regional or national level. A Technology, on the other

hand, is a method or material employed in SPFS projects. It may be a process, a procedure, an ingredient or an element that would contribute to food security. It may be a product of scientific research or it may be generated by local or indigenous knowledge.



Upon completing a process of entering and approving at the PMU and RCO levels, the Highlight or Technology is published in the public site. An example of a published highlight is found in Frame 4-6.

Workflows. There are two workflows employed to publish Highlights in SAIMS: the national and the regional. Figure 4-4 gives the algorithm for the publishing of SAIMS Highlights.

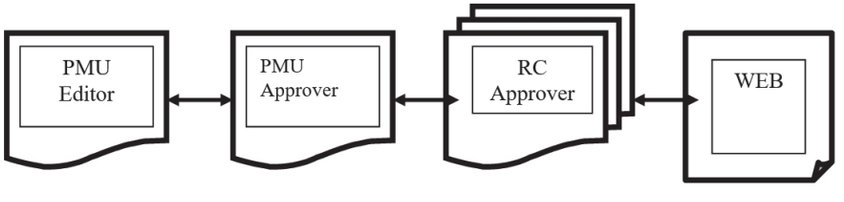


Figure 4-4. SAIMS Workflow

*National Workflow***.** There are four steps in publishing a SAIMS Highlight on a national web site. A user with specific responsibilities and tailored access to the system implements each step. The roles are:

- **PMU Editor** - can insert initial Highlight record and send to PMU
- **Project Management Unit (PMU)** approver - can modify, send back, or approve Highlight record and send on to FAOR for further approval.
- **Regional Coordination Approver (RC)** - can modify, send back, publish record as well as modify and unpublish the Highlight record once it is live on the web.

A similar workflow is employed in publishing SAIMS Technologies.

Regional Workflow. There are two steps to publishing a SAIMS Highlight on the regional web site. A user with specific responsibilities and tailored access to the system implements each step. The roles are:

- **Regional Co-ordination Editor** - can insert initial Highlight record and send to RC approver.
- **Regional Co-ordination Approver (RC)** - can modify, send back, publish record as well as modify and unpublish the Highlight record once it is live on the web.

PMU Editor. The editor is allowed to create a highlight and send it for further editing by the PMU Approver. The editor also modifies and deletes records. Once a record has been sent to the PMU Approver it can not be recalled or modified by the Editor.

Regional Coordinator Editor. The editor is allowed to create a highlight and send it for further editing by the RC approver. The editor also modifies and deletes records. Once a record has been sent to the RC Approver it can not be recalled or modified by the Editor.

PMU Approver. The Project Management Unit (PMU) Approver can modify, send back, or approve Highlight records and send them on to the RC for further approval. The PMU approver clears all the

Highlights regarding her/his country. Once a record has been sent to the RCO, it can not be recalled or modified by the PMU approver.

Regional Coordinator Approver. The Regional Coordinator (RC) is the final node in the web publishing workflow. The RC role is to approve Highlight records for publication and then publish them directly on the web. The Regional Coordinator clears both the national and regional highlights to be published in the respective web site.

Initially, an FAOR Approver occupied a role between the PMU Approver and the RC Approver to be consistent with information flows and protocols within the organization. However, this step in the workflow was done away with due to feedback from the Lao FAOR. In the succeeding analysis, it may be gleaned that some of the PMUs also felt that this additional step made the process more cumbersome.

Logical Framework

Narrative Summary**.** For purposes of review the system, this section reconstructs the SAIMS logical framework.

Goal. From an analysis of the project documents, SAIMS was meant to contribute to the overall goal of food security through rapid increase in productivity and food production supported by information management.

Purpose. The following development objectives represent the purpose of SAIMS:

Improved national food security**.** This would be achieved though the mobilization and development of human capacities at the regional, national and local levels for effective participation in SAIMS. Furthermore, this will be supplemented by the development of a framework for the exchange of expertise on technical, institutional and socio-economic issues related to the identification, characterization, management and dissemination of information on food security. Improved access and contribution to FAO's information resources and its institutional experience and lessons

learned on the implementation of WAICENT may also contribute to this purpose. Lastly, this would entail the creation of a specialized information/knowledge system containing the experience (lessons learned and best practice) gained through the SPFS.

Improved collaboration between agencies and sectors**.** This would be achieved through the development of information exchange systems for mobilizing resources from the public and private sector in the area of food security, including policies, strategies, programmed priorities, guidelines for implementation and project portfolios. Moreover, close partnerships with other international organizations active in this area, such as UNDP, IFAD, WFP, ITU, and UNESCO would be encouraged.

Objectives. Initially, the immediate objectives of the Information Component included:

- assessment of needs and development of an "Information Management Toolkit;"
- establishment of the network and initiation of capacity building for access and participation; and
- expansion of fields, programmed development and implementation of documentation electronic publishing system.

However, it was decided that the first objective be subsumed under a separate program. Hence, this review will limit itself to the last two objectives.

Outputs. Given the aforementioned objectives, the outputs to be evaluated are: the SAIMS Network; and the database of technologies developed/tested and lessons learned through the SPFS. Performance indicators for Output 1 are: the establishment of a functional system; and the existence of an operational network. Performance indicators for Output 2 are as follows: volume of technologies published; quality of technologies published; volume of highlights published; quality of highlights published.

Inputs. As discussed in the previous section, the project inputs of SAIMS are: system design and development; hardware/ software

provision; system maintenance and backend administration; capacity building; helpdesk and list serve support; and technical assistance.

***Key Factors for Relevance, Effectiveness and Efficiency*.** To assess relevance, effectiveness and efficiency, the study will make use of FAO's framework for Bridging the Rural Digital Divide. This framework enumerates eight factors that spell the success or failure of information systems employed to bridge the rural digital divide. These factors are: locally adapted content to context; building on existing systems; addressing diversity; capacity building; access and empowerment; strengthening partnerships and participation; adopting a realistic approach to technologies. These so called "eight pillars" were translated into performance criteria that served as the basis for the analysis of key issues (Section 6). Furthermore, they served as the framework's assumptions for achieving project objectives.

Restating these factors as assumptions, we assume that SAIMS is relevant, effective and efficient if it:

- It builds on existing systems.
- It builds capacities.
- It strengthens partnerships and participation.
- It utilizes a realistic approach to technologies.
- It generates locally adapted content.
- It addresses diversity.
- If it provides access and empowerment.
- It considers information costs.

Reconstructed Logframe Matrix for Terminal Evaluation. The project cycle generally provides for four evaluation points in a project's lifetime: ex-ante evaluation; mid-term evaluation; terminal evaluation; and ex-post evaluation. While ex-ante evaluation is a benchmarking exercise conducted at the very beginning of the project, both mid-term and terminal evaluations are conducted to assess project relevance, effectiveness and efficiency given project inputs, objectives and outputs.

Table 4-6. Logframe Matrix for Evaluation

NARRATIVE SUMMARY	PERFORMANCE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS/ RISKS
Goal: Food security through rapid increase in productivity & food production supported by information management.	Impact Indicators Sustainability Indicators	Ex-Post Evaluation	
Purpose1. Improved national food security **Purpose 2. Improved collaboration between agencies and sectors**	Impact Indicators Sustainability Indicators	Ex-Post Evaluation	
Objective 1. Establishment of network & initiation of capacity building for access and participation **Output 1:** SAIMS Network	Functional system and operational network	Review and Evaluation Study: *Documents Analysis*	SAIMS is Relevant, Effective and Efficient if it: . It builds on existing systems . It builds capacities . It strengthens partnerships and participation: . It utilizes a realistic approach to technologies . It generates locally adapted content . It addresses diversity . If it provides access and empowerment . It considers information costs
Objective 2. Expansion of field program, development & implementation of documentation-electronic publishing system. **Output 2:** Database of technologies developed/tested and lessons learned through the SPFS	Volume of Technologies Published Quality of Technologies Published Volume of Highlights Published Quality of Highlights Published	Review and Evaluation Study: *Secondary Data* *Problematique Analysis*	
Inputs: System Design and Development Hardware/ Software Provision SAIMS Training Programs Helpdesk		Review and Evaluation Study: *Secondary Data* *Documentation*	

Terminal evaluation usually does not cover impact and sustainability since it would be premature to measure both immediately after a project ends. Ex-post evaluation, generally conducted two years after project termination, would address project impact on the overall goal/ purpose and sustainability of effects.

Evaluations are based on logical frameworks. Since the initial objectives of SAIMS were changed, a logical framework for purposed of this terminal evaluation was reconstructed. Table 4-6 provides the reconstructed logical framework matrix. The shaded portion is not part of this review.

This review may be considered as a terminal evaluation study and, hence, will not touch on SAIMS' impact on the overall goal nor on the achievement of its purposes. It will deal primarily with assessing relevance, efficiency and effectiveness of the project in achieving its stated objectives and outputs. Furthermore, it will attempt to determine the factors inhibiting relevance, effectiveness, and efficiency through the problematique technique.

(a) Findings

***On SAIMS Inputs*.** The findings on SAIMS Inputs are quite straightforward. Based on the documents analyzed and key informant interviews, all project inputs of SAIMS - system design and development; hardware/ software provision; system maintenance and backend administration; capacity building; helpdesk and list serve support; and technical assistance – have been adequately fulfilled.

System design and development was completed in 2002. System maintenance, backend administration and the helpdesk are ongoing commitments of GILF and FAORAP. Training courses on data entry and approval were conducted in 2002, 2003 and 2005. A list serve was established in 2002 and is still operational. Short-term technical assistance were mobilized for the training in 2002-2003, content provision in 2005 and this review. In other words, there were no lapses on the Input side of the equation.

On SAIMS Outputs. The findings on Output 1, the SAIMS Network, are similarly direct. The system is functional and the network is operational. SAIMS currently has a regional network of national and regional nodes composed of editors and approvers for highlights and technologies in all four SPFS Asia countries. In all of these nodes, SAIMS data gathering, composition and entry is an add-on job, which is maintained actively if not regularly. Actively, since the PMUs continue to assume and have no intention of reneging upon this responsibility; not regularly, since the effort is occasional and not sustained.

*Technologies and Highlights***.** Output 2, which pertains to the database of technologies developed/tested and lessons learned through the SPFS, is a bit more complicated since the evaluation is not limited to the establishment and functionalities of the SAIMS database. It also deals with both volume and quality of content. For purposes of this review, both highlights and technologies databases were assessed.

Volume of Technologies Published According to Source. An analysis of the SAIMS backend would reveal that the Technologies Database is substantively populated.

From 2002, forty-three technologies or best practices were published by SAIMS. The majority (39.58 %) of the entries was contributed by the Indonesia SPFS PMU. The second highest number (31.25 %) of entries came from the Lao PDR PMU. Sri Lanka contributed eight (16.66 %) entries. Bangladesh has five (10.42 %) published technologies while the Regional Coordinating Office published one (2.08 %). Since the technologies should originate from the SPFS project sites, it is understandable that the RCO would have the least number of contributions. The second lowest number of contributions came from Bangladesh. This may be attributed to the fact that Content Specialists were hired as consultants by the PMUs during the latter half of 2005 except for Bangladesh. The Content Specialists contributed significantly to populating the Technologies Database and the publication of technologies in the SPFS Website.

Table 4-7 gives the frequency distribution of technologies published among the SAIMS nodes.

Table 4-7. Technologies Published per Source

NODE	TECHNOLOGIES PUBLISHED	PERCENTAGE
Bangladesh PMU	5	10.42
Indonesia PMU	19	39.58
Lao PDR PMU	15	31.25
Sri Lanka PMU	8	16.66
RCO	1	02.08
TOTAL	48	100

Volume of Technologies Published According to Year. With 48 published technologies from 2002 to 2005, the average number of publications amounts to 12 per year. However, contributions were not spread over this duration. As a matter of fact, there were no technologies published in 2002 and 2003. Most (68.75 %) of the entries were published in 2005. Only 10 (20.83%) entries were published in 2004. Table 4-8 gives the frequency distribution of technologies published on an annual basis from 2002 to 2006.

The Year 2005 had the highest number of technologies contributed since this coincided with the hiring of a Content Specialist in three of the four PMUs. It may be noted that the Bangladesh SPFS PMU had more entries published in 2004 than in 2005 while the rest of the PMUs increased their output from 300 to 1200 percent in a year's time. It would be safe to assume that data entry in SAIMS depended primarily on the Content Specialist.

Table 4-8. Annual Comparisons of Published Technologies

NODE	TECHNOLOGIES PUBLISHED					
	2002	2003	2004	205	2006	
Bangladesh PMU	0	0	3	2	0	5
Indonesia PMU	0	0	5	13	1	19
Lao PDR PMU	0	0	1	12	2	15
Sri Lanka PMU	0	0	0	6	2	8
RCO	0	0	1	0	0	1
TOTAL	0	0	10	33	5	48
PERCENTAGE	0	0	20.83	68.75	10.42	100

Volume of Highlights Published According to Source. With the number of published entries in the Highlights Database at 71, highlights content is substantively more than those of technologies. However, trends similar to the above are easily discernable except for the source of the majority of highlights. The highest number (36.62 %) of highlights publications originated from Sri Lanka; followed by Indonesia (23.94 %), Bangladesh (18.30 %) and Lao PDR (12.68 %). The RCO accounted for six (12.50 %) highlights entries.
Table 4-9 gives a frequency distribution of highlights published according to source.

Table 4-9. Highlights Published per Source

NODE	HIGHLIGHTS PUBLISHED	PERCENTAGE
Bangladesh PMU	13	18.30
Indonesia PMU	17	23.94
Lao PDR PMU	9	12.68
Sri Lanka PMU	26	36.62
RCO	6	12.50
TOTAL	71	100

Volume of Highlights Published According to Year. The distribution of published SAIMS highlights approximates the trend found for the technologies with a distinct difference. There were entries published during 2002 (15.49 %) and 2003 (21.13 %). However, there was a noted increase (13 %) of published entries in 2005. As stated earlier, Sri Lanka posted the highest number of highlights. It was noted during the data gathering that the Content Specialist in Sri Lanka focused on highlights entries during most of 2005 until he was advised to concentrate on technologies.

Table 4-10 gives the frequency distribution of highlights published on an annual basis from 2002 to 2006.

What do these figures tell us?

Firstly, although both technologies and highlights databases are substantively populated, the volume of entries was low most of the

Table 4-10. Annual Comparisons of Published Highlights

NODE	HIGHLIGHTS PUBLISHED					
	2002	2003	2004	2005	2006	TOTAL
Bangladesh PMU	3	2	0	8	0	13
Indonesia PMU	5	5	7	0	0	15
Lao PDR PMU	2	0	4	3	0	9
Sri Lanka PMU	0	7	4	15	0	26
RCO	1	1	3	1	0	6
TOTAL	11	15	18	27	0	71
PERCENTAGE	15.49	21.13	25.35	38.02	0	100

time. Secondly, the increase in volume was due for the most part to the Content Specialists. The Bangladesh PMU inadvertently acted as a control in an experiment by not engaging this consultant. The number of technology and highlights published by Bangladesh are significantly low compared with other PMUs. Had the Content Specialists not been hired by the other PMU, they would not have fared better than Bangladesh. Lastly, the number of highlights was significantly higher than technologies, implying that PMU staff may prefer writing highlights to technologies.

Observations on Volume from Other Stakeholders. Some stakeholders have critically considered the published output of SAIMS. The GILF has been aware of these observations particularly the difficulty of the PMUs to contribute technology entries from 2002 to 2004. In email exchanges among concerned stakeholders in Rome, Bangkok and Jakarta, the causes of these difficulties have been inferred and solutions have been forwarded, such as the engagement of short-term Content Specialists. In a letter to the RCO, the Chief of GILF expressed his misgivings on two observed causes of the problem: low commitment of PMU staff to information submission/sharing; and the complicated process for review and approval of content inputs.

Quality of Technologies and Highlights Published. To measure the quality of the technologies and highlights published, the

evaluator randomly sampled approximately twenty percent of each database and assessed the entries on the basis of the following: understandability; presence of grammatical errors; adherence to Web writing guidelines; and number of typographical errors.

Out of the 10 sampled published technologies: five were difficult to understand; seven did not follow Web writing guideline; one had grammatical errors; and none had typographical errors. Out of the 15 sampled published highlights: two were difficult to understand; four broke Web writing guidelines; and none had neither grammatical nor typographical errors. As seen in Table 4-11, there were a total of nineteen cases of quality problems found in approximately twenty percent of the published technologies and highlights.

Table 4-11. Cases of Quality Problems in Published Entries

TYPE	DIFFICULT TO UNDERSTAND	HAD ERRORS IN GRAMMAR	INADEQUATE WEB WRITING	HAD TYPO ERRORS	TOTAL
Technologies	5	1	7	0	13
Highlights	2	0	4	0	6
TOTAL	7	1	11	0	19

It should be noted that SAIMS is an English medium system. Three of the PMU editors are professionally trained Content Specialists. However, none of the editors and approvers were native English speakers/ writers. Considering this, the quality problem cases would be understandable. However, given the fact that they are published in the Web, we may consider this problem situation from the point of view of the project.

By reviewing the status of the achievement of objectives and outputs, this study validates that SAIMS is indeed encountering a complex problem situation. The next section provides an in-depth analysis of what may be referred to as the *SAIMS problematique*.

***On the SAIMS Problematique*.** Based on the preceding discussion, this review defines the SAIMS problematique as a cluster of problems with two major symptoms: low volume of SAIMS published

highlights and technologies; and quality difficulties operationalized as grammatical and typographical errors, as well as writing and Web-writing styles. The succeeding analysis attempts to trace the subordinate influential factors (minor causes that may be symptoms of major causes themselves) and superordinate influential factors (root causes) of the problematique. As the analysis progressed, it became apparent that most of these influential factors were shared among the PMUs.

Bangladesh PMU. The Bangladesh PMU is perhaps the most successful among the four national offices in terms of field projects and achieving SPFS targets. This success is due, for the most part, to the staff. The zonal coordinators are committed and dynamic, spending most of their working hours in the project sites reporting only to Dhaka once a month for coordination purposes. The acting team leader is quite capable and very determined to make SPFS work in Bangladesh. An experienced APO provided by the Government of Japan effectively backs up the team. Through its National Project Director, the Bangladesh PMU enjoys the full support from the MOA Department of Agricultural Extension where it is based.

During data gathering, the external evaluator conducted key informant interviews with the staff on a one on one basis. The final data gathering session was a focus group discussion employing the participatory evaluation procedure. The evaluator presented his preliminary assessment to the group for validation purposes on a factor-by-factor basis. The SAIMS Problematique in Bangladesh indeed suffers from the aforementioned symptoms of low volume of highlights and technologies and quality difficulties in published entries.

FRAME 4-7.
Bangladesh PMU FGD

Low Volume of Highlights and Technologies. The group identified four

subordinate influential factors for the low volume of entries. Firstly, the timing was not favorable for abundant entries. At the early stages of SPFS, the zonal coordinators cannot be expected to identify mature technologies for sharing and reuse. Secondly, the workflow was deemed cumbersome and prohibitive.

Thirdly, there were limited technology options available since as prescribed in Farmers Group Development Planning, farmers themselves identify technologies employed in SPFS sites. As specialists in their own respective areas, the zonal coordinators are familiar with a variety of technology options available. The application of these options is narrowed down to the choices of the farmers. Lastly, due to a shift in the project planning approach, the workload of the zonal coordinators and specialists almost doubled sometime after SAIMS was introduced to them.

Three superordinate influential factors caused the workload situation. There was a shift to Farmers' Group Development Planning, which demanded more involvement in terms of time and effort from the zonal coordinators. They had to facilitate bottom-up processes and participatory planning cycles in their respective zones, leaving little time for documentation and content development for SAIMS. Secondly, less priority was given to SAIMS since content development did not form part of their specified deliverables as zonal coordinators. In other words, compared to other SPFS components, there was an apparent lack of ownership of SAIMS among the staff. Furthermore, there were no perceived incentives to utilize their limited time for SAIMS.

Much as they were interested in the system, there was a tendency to put it off for more pressing priorities. Thirdly, the Bangladesh PMU had significant staff movements alongside these developments. The National Project Director was changed. More critically, the Team Leader resigned with no official replacement until now. The Deputy Team Leader had to assume management responsibilities alongside his role as PMU Approver.

Quality Difficulties. On the other hand, quality difficulties had two superordinate influential factors. These are: the need for a Content

Specialist; and the need for additional skills. There is a perception that the latter is partially caused by the lack of networking with other PMUs who could have shared their SAIMS learnings.

Although the zonal coordinators are subject matter specialists, they are not experts in crafting and packaging content for the information system. Additional skills include: feature writing; technical writing; Web writing; and editing, all in the context of SAIMS as an agricultural information system and English as a second language. These skills are generally assumed in the course of practice among senior technical experts such as the zonal coordinators. Furthermore, SAIMS has its own set of unique requirements. Hence, the PMU felt that they could learn much from sharing of insights and comparing experiences with other PMUs.

A graphic illustration of the SAIMS Problematique in the SPFS Bangladesh PMU is found in Figure 4-5.

Indonesia PMU. **The Indonesia PMU, on the other hand, would have a less complicated problematique. The PMU is based in the Center for Food Distribution of the Ministry of Agriculture in Jakarta. Its proximity to the Regional Coordination Office had been equated by some as personal proximity to the Regional Coordinator. This situation certainly benefits the Indonesia PMU since it can take advantage of early and direct interventions from the RCO.**

Nevertheless, the Indonesia PMU has also not published any technologies during 2002 and 2003.

Low Volume of Highlights and Technologies. Like Bangladesh, Indonesia attributes its low volume of highlights and technologies on a prohibitive workload. However, this workload is not attributable to the adoption of the FGDP since the Indonesia PMU employed this approach ahead of the others. The workload has been made prohibitive by the need to for the PMU to adopt the GOI's financial management system. This included adhering to the financial calendar, bidding, contracting, monitoring, liquidating and reporting

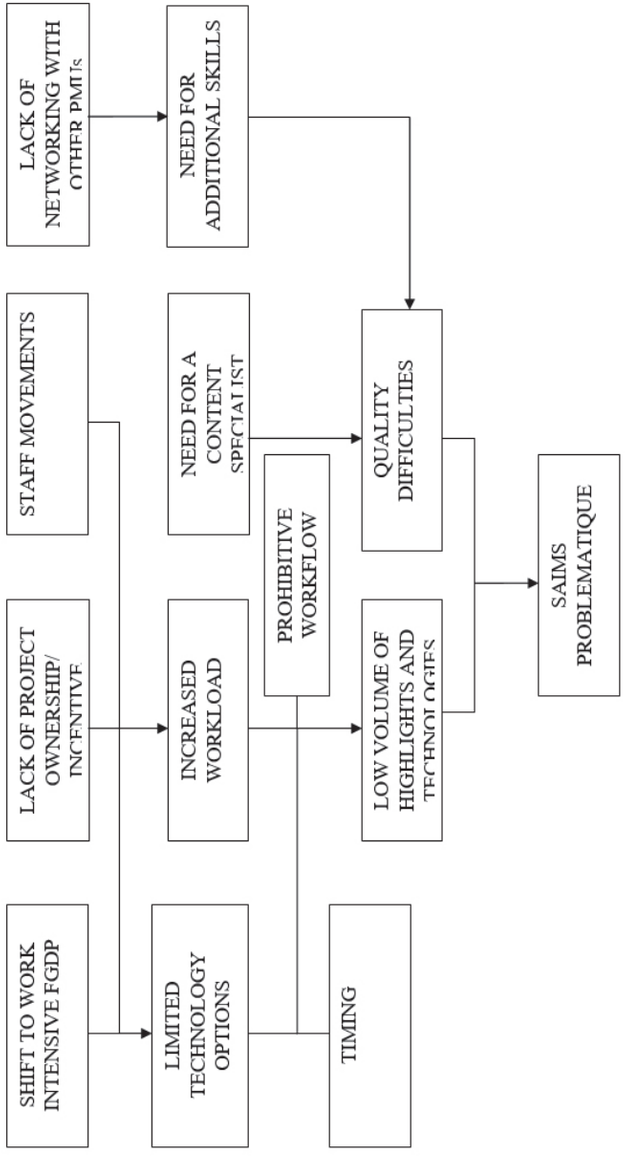


Figure 4-5. SAIMS Problematique Map (Bangladesh)

financial transactions. The PMU is subject to the accounting and auditing procedures of the Ministry of Agriculture wherein they are based. Thus, the PMU staff is being burdened with administrative responsibilities more than their counterparts in other PIUs.

Furthermore, there have been connectivity and bandwidth problems within the Indonesian MOA complex. Most of the time in 2004, the PMU was either offline or experienced slow and intermittent service. This discouraged the editors to enter their contributions since they would most certainly be timed out. The staff in general had very little opportunity to visit the SPFS Website under the conditions preventing them from receiving positive reinforcement by viewing the highlights that they published in 2002 and 2003.

There were also staff movements within the PMU. Several of the staff, including the Team Leader, resigned. Only two of the original PMU staff remained. This necessitated additional training for the new staff as well.

Then there was a problem with the workflow. In 2005, the technologies and highlights were also approved at the FAOR level before being processed by the RCO. From January onwards, it was nearly impossible for the FAOR to perform its approval function in the workflow because of the Aceh Factor.

Indonesia had been hardest hit by the December 2004 tsunami. The amount of aid and technical assistance that the FAOR had to process and coordinate immediately after the natural disaster up to the present is way beyond the capacity of the existing staff. The FAOR approver just did not have the time to edit and comment on SAIMS entries from the PMU.

Hence, the lack of technologies and highlights published by the Indonesia PMU were caused by four superordinate influential factors: administrative responsibilities; Internet connectivity; staff movements; and the Aceh Factor.

FRAME 4-8. Indonesian PMU Office

Quality Difficulties. The difficulties encountered concerning the quality of entries had two superordinate influential factors. Firstly, the editors were of the opinion that the format for technologies was too prohibitive in terms of style and visual content. Secondly, the English language medium was also felt to be the major contributing factor. Unlike in Bangladesh and Sri Lanka, English is not necessarily used as a second language in Indonesia even among the educated, in general, and professionals, in particular.

Figure 4-6 gives the problematique map for the Indonesia PMU.

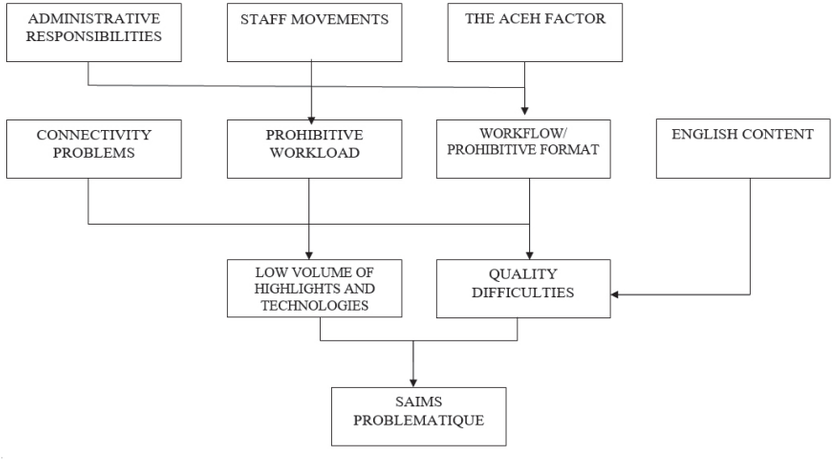
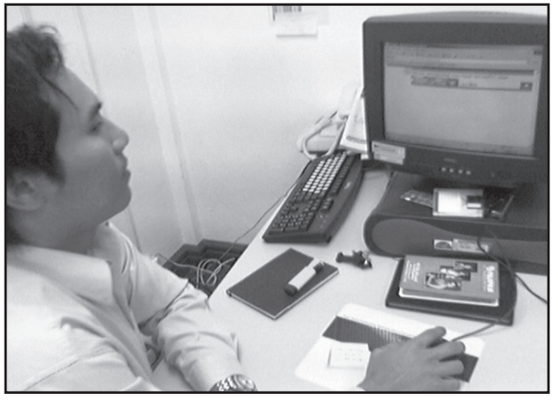


Figure 4-6. SAIMS Problematique Map (Indonesia)

Lao PDR PMU. The Lao PDR problematique map is quite similar to that of Indonesia. The PMU is based in the National Agriculture and Forestry Extension Service or NAFES but it enjoys the full support of the Assistant FAOR in Vientiane..

FRAME 4-9. Lao SAIMS Content Specialist



Low Volume of Highlights and Technologies. As in the Indonesian case, the Lao PMU is plagued by connectivity problems and a prohibitive workload caused by staff movements. However, the workload also appears to be a function of the inaccessibility of SPFS project sites due to poor road infrastructure. It literally takes days to get to some of the project sites, sometimes on foot. The hiring of a Content Specialist has solved this.

In effect, three superordinate influential factors caused the low volume of highlights and technologies published. Connectivity problems discouraged would be contributors from online entry. The inaccessibility of project sites left little time to compose technologies and highlights. Staff movements, which included the Team Leader and NPD, also added to the load of the remaining staff.

Quality Difficulties. On the other hand, quality difficulties had one superordinate influential factor: the use of English as the SAIMS medium. As in the case of Indonesia, English is not used as a second language in Lao PDR.

The Lao PDR SAIMS Problematique Map is presented in Figure 4-7.

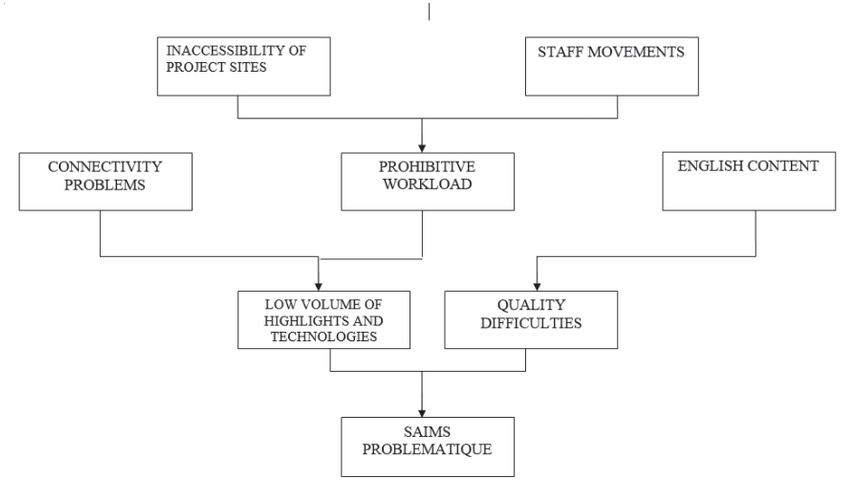


Figure 4-7. SAIMS Problematique Map (Lao PDR)

Sri Lanka PMU. The Sri Lanka PMU is based in the Ministry of Agriculture and Livestock compound in Colombo. The former SPFS Team Leader is now the Assistant FAOR and has been closely coordinating with the PMU from the time the project started. Like in other PMUs, the staff members in Sri Lanka have impressive credentials in their respective areas of specialization and are fully committed to the SPFS approach. Among the editors and approvers trained in 2002 and 2003, the Sri Lanka PMU staff appears to have profited the most from the training in terms of skills and knowledge gained. Yet, like in other PMUs, there were difficulties in posting technologies during the first three years of SAIMS. In other words, they were not exempted from the SAIMS problematique.

It may be noted that the problematique map given in Figure 4-8 is symmetrical. This implies that in the case of Sri Lanka, the same superordinate influential factors or root causes are perceived to have resulted in the low volume of highlights and technologies and quality problems of the published entries.

FRAME 4-10. Sri Lanka PMU FGD

These superordinate influential factors are four in number. Firstly, connectivity problems have prevented the PMU staff from uploading highlights and technologies. These have also reduced the quality of their published highlights and technologies, because of the limited time that can be spent in the SAIMS backend. Secondly, as in the case of Indonesia, the Sri Lanka staff have had to deal with administrative concerns that added to their workload. Thirdly, the number of their project sites increased significantly to 27 allowing little time for information sharing work.

Fourthly, in their list of priorities, the staff had little choice but to relegate a minor role to SAIMS. Other targets had to come first since their performance as specialists and coordinators were clearly judged through these. The fact that the highlights and technology database entries were not part of their signed-up deliverables made a difference when the crunch came.

These four factors caused both the low volume and quality difficulties of the content generated.

Analysis of Key Issues

The Eight Pillars given in the Bridging the Rural Digital Divide framework were meant to guide the design and development of rural networks or information systems of which SAIMS obviously is not. The primary users of SAIMS are not the farmers, fisherfolk, rural housewives and rural youth who are the ultimate beneficiaries of SPFS. The primary users are the staff members of SPFS Asia who were meant to profit from the so-called *network effect,* wherein

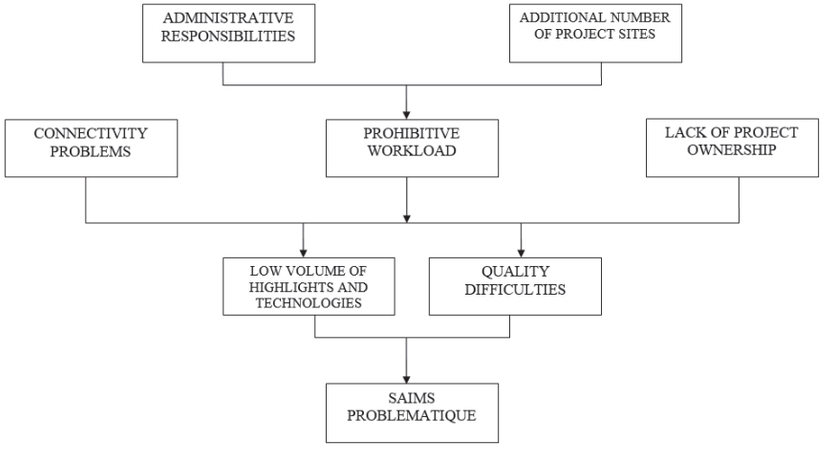


Figure 4-8. SAIMS Problematique Map (Sri Lanka)

synergies are released within a network through mutual reinforcement and the sharing of experiences and insights. However, the Pillars can serve as a basis for assessing relevance, effectiveness and efficiency.

Relevance, Effectiveness, Efficiency

Did SAIMS build on existing systems and work within existing policies? The SAIMS project document states that it would avoid the duplication of services or information, making the most effective use of existing infrastructure and capabilities. Indeed, SAIMS made use of existing infrastructure and capabilities within FAO.

However, even if intensive stakeholder consultation were conducted at the beginning, SAIMS may have overlooked fundamental organizational processes within the PMU by assuming that the assigned editors and approvers may make adequate amounts of time available. Furthermore, the organizational culture within developmental agencies adheres strictly to terms of reference and targets. Considering that information sharing was not part of the contractual obligations of the actors, it would be difficult to assume that these would be prioritized when workloads are strained.

Moreover, institutional incentives that drive information sharing and reuse may have been neglected. There were no perceived or expected incentives to individuals for contributing information.

Did SAIMS build capacities? Yes, SAIMS built capacities within the PMUs for data entry and the use of Web tools. These are knowledge and skills that would otherwise have eluded many of the PMU staff considering their profiles, backgrounds and current careers. A retired Ph.D. or government official with specialized skills and knowledge in agriculture may no longer be expected to imbibe new skills particularly database delivery and Web writing.

Did SAIMS strengthen partnerships and participation? SAIMS was designed to do so but it fell short of this outcome for reasons stated above.

Did SAIMS utilize a realistic approach to technologies? Connectivity problems and their attendant disincentive for data inputting due to system time outs may not have been realistically considered.

Did SAIMS generate locally adapted content? Yes. Perhaps the preoccupation for locally adapted content limited the options of the editors thus preventing them to contribute a wider range of technologies. The emphasis on locally adapted technologies may not have been a prerequisite for SAIMS. However, it stems from the Framers Group Development Planning process, which was adopted by the PMUs.

Did SAIMS address diversity? The structured nature of the technologies database (or any database for that matter) made it difficult to embrace diversity.

Did SAIMS provide access and empowerment? Yes and no. SAIMS allowed access to the backend but it did not empower its users to change or modify it.

Did SAIMS consider information costs? SAIMS has not been able to consider the volume of work involved in the writing and editing of

useful, publishable technologies. Many undertakings treat this as a full-time professional job. Perhaps it was too much to expect non-professionally trained editors who have limited English proficiency to assume these roles. In other words, SAIMS may not have considered the cost of publishable information.

The Primacy of Content

Among information and knowledge managers, there is a tendency to be preoccupied with hardware-software-networking technology. This tendency is reflected in the pecking order assigned to the systems administrator, network administrator and the Web Master. The latter, who generates the content, often occupy the lesser role. However, there is no dearth of past lessons on the primacy of content in an information system.

The case of SAIMS again reminds us of this principle. During 2002 – 03, there was little content published because there were few technologies to feature considering the process that the SPFS projects underwent in all the countries. Nevertheless, some stakeholders tended to assess SAIMS in the light of the volume of its content in spite of the realities in the field.

Furthermore, the hiring of Content Specialists in Indonesia, Laos and Sri Lanka dramatically improved the volume of content. Bangladesh, which was unable to engage such a specialist, had difficulties in approximating the volume of content generated by the other countries.

To ensure the sustainability of these gains, memoranda of agreement (MOAs) between FAO and national institutions in two countries were signed in December for the provision of content. In Indonesia, the Center for Agricultural Data and Information would provide this service to the SPFS PMU.

Generalizations

Ten years ago, the father of knowledge management, Thomas Davenport, argued that knowledge management systems have

three prerequisites. Firstly, one needs a good IT infrastructure with respectable bandwidth to accommodate the functionalities and applications associated with the storage, sharing and reuse of digitized or captured knowledge. Secondly, one requires an appropriate workflow or process for knowledge sharing and reuse. Lastly, the organizational environment or culture for knowledge sharing and reuse is an absolute imperative.

Davenport was writing about corporations and private organizations that can leverage their intellectual assets for profit. However, these prerequisites hold true in the development sector as well, with one main difference. The goal of knowledge management in the development context is not limited to the sharing and reuse of knowledge to increase the bottom line but covers a much more complicated set of outcomes, which we refer to as the Millennium Development Goals. The third prerequisite – a conducive organizational environment or organizational culture for knowledge sharing – seems to be the factor that has generally been neglected in Web-based information systems.

Does the proper organizational culture exist for knowledge sharing and reuse? Do workflow nodes and focal points, mainly agricultural staff already overworked with monthly targets, consider the inputting of electronic forms and uploading of information as part of their core business? Or is it another chore similar to the regular reports that they need to file while at the office? In other words, does the *push* exist for them to perform these tasks? Furthermore, are they rewarded for sharing information? In other words, does the *pull* exist?

At the level of potential partners and identified intermediaries, is there a sense of ownership for the system? Perhaps not, because at times this feeling of ownership is associated with the location of the server or the office of the systems administrator, which in the case of SAIMS is in Rome. Furthermore, it is not difficult to see why project ownership becomes an issue among information networks considering the almost authoritarian control of the backend structure by the systems developers, which of course is the norm in any system.

Conclusions

Did SAIMS achieve its objectives? SAIMS achieved its objective of establishing a functional system and an operational network. It has adequately fulfilled its first targeted output.

Likewise, SAIMS achieved its objective of compiling databases of technologies and highlights. Both databases are substantively populated. However, there are concerns regarding the volume and quality of published entries.

Is SAIMS relevant, effective and efficient? There are serious questions regarding the relevance, effectiveness and efficiency of SAIMS given the volume and quality of published entries.

It may have overlooked fundamental organizational processes within the PMUs by assuming that the assigned editors and approvers may make adequate amounts of time available. Considering that information sharing was not part of their contractual obligations, it would be difficult to assume that this would be prioritized when workloads are strained. Moreover, institutional incentives that drive information sharing and reuse may have been neglected.

Connectivity problems and their attendant disincentive for data inputting due to system time outs may not have been realistically considered. Additionally, the structured nature of the technologies database (or any database for that matter) made it difficult to embrace diversity. Furthermore, it allowed access to the backend but it did not empower its users to change or modify it. Lastly, SAIMS may not have considered the cost of publishable information.

On the other hand, SAIMS built capacities within the PMUs for data entry and the use of Web tools.

What factors inhibit relevance, effectiveness and efficiency of SAIMS? The factors that inhibited the relevance, effectiveness and efficiency of SAIMS were: prohibitive workloads, which in turn were caused by a variety of factors including the shift to the FGDP approach, staff movements, expansion and inaccessibility of project sites, administrative responsibilities, connectivity problems and the Aceh factor; connectivity problems; English language problems; and the lack of project ownership and built in incentives.

Lessons Learned

The following lessons may be learned from the case of the SPFS Asia Information Management System.

Information Networks work better if embedded into the organizational culture. There should be a culture of knowledge sharing between and among agencies, between and among officials and the rank and file, between and among colleagues. Knowledge sharing should be considered part and parcel of the agency's core business. Agricultural personnel should be provided with adequate incentives for expending time and effort into knowledge sharing activities. In other words: the mandate should exist; the priorities should be clear; and the reward system should be in place.

Data, information and knowledge come with a cost. Providers require adequate resources of time and manpower to generate quantity and quality of content. Some agencies estimate that content can actually account for 70 percent of an information systems' budget. We can only expect system output that is commensurate to resources input particularly where content is concerned. Hence, the provision of material or non-material incentives may be in order.

Partners should be imbibed with a sense of ownership of the network. This may require a rethinking of acknowledged principles, known procedures and rigid protocols in system administration and maintenance. Participation should not be constrained to specific entry points excluding the design and development process. Access should not be limited to the front-end.

ICT STRATEGY FOR AGRICULTURE AND FORESTRY: A DESIGN FOR LAO PDR

Situation Analysis: The Context for the MAF ICT Strategy

The vision document is based on the assumption that the realization of a national ICT strategy for agriculture and forestry is contingent upon three factors: (1) theories of change consistent with sector development plans that recognize ICT as interventions, not as externalities; (2) a tacit recognition that ICT is not merely sectoral (i.e., IT and telecoms) but also thematic covering the agriculture sector as well; and (3) an acceptance among Ministry officials that ICT is not merely supportive of programs but constitutes a program in itself. The contexts presented by the situation analysis are framed within these parameters.

The Lao Agriculture Context. Agriculture and forestry is one of the highest performing sectors in the Lao economy in spite of economic fluctuations and natural disasters. In the past decade, significant gains have been recorded in food security, commercial production, agricultural exports, and enhancement of quality and productivity.

The Ministry of Agriculture and Forestry intends to further these gains and contribute to upgrading Laos from Least Developed Country status through a Five Year Agriculture and Forestry Sector Development Plan (2016-2020) that is based on a Ten Year Agriculture Development Strategy (2016-2025) guided by a Vision to Year 2030. The Agriculture Development Strategy and the Vision to Year 2030 are embodied in a document referred simply as ADS 2025 approved by Prime Ministerial Decree dated 20 February 2015.

ADS 2025 has two goals: (1) to ensure national food security through food production; and (2) to develop agricultural commodity production. These goals form the basis of the Five-Year Agriculture and Forestry Sector Development Plan, which in turn focuses on three areas: food production; commercial agriculture; and forestry.

The objective of the food production thrust is to ensure food and nutrition security through increased availability, accessibility and stock of food products.

The objective of commercial agriculture is the growth of the agriculture sector by ensuring quantity and quality of products focusing on domestic, regional and international markets through a combination of factors including the development of farmers' organizations and associations/cooperatives or producers and processors.

The objectives of the forestry thrust are: to improve the legal framework that promotes fair and equal use of forest resources; to increase forest cover to 70 percent; to secure 51 forest production areas equivalent to 3.1 million hectares; to restore forest production in 500 thousand hectares; to plant 500 thousand hectares of forest; to improve forest management in 1500 villages through sustainable planning; and to reduce carbon emissions from deforestation and degradation.

These objectives will be achieved through ten parallel action plans: food production and food security; crop/livestock commercial production; forest resources management; rural employment; infrastructure development; land development and management; action-research; extension; disaster risk-reduction and management; and human resources development.

The timing of these developments presents an opportunity for the adoption of an ICT for agriculture and forestry strategy. The proposed ICT strategy will dovetail with ADS2025 and its Five Year Agriculture and Forestry Sector Development Plan. It will accelerate agricultural modernization and industrialization. Likewise significant is the participation of Lao PDR in the ASEAN Economic Community and ASEAN Integration that would begin on 1 January 2016. The seamless incorporation of an ICT strategy into the agriculture sector's five year development plan makes Lao PDR the first ASEAN country to do so. It may serve as a model among ASEAN countries for the integration of an ICT strategy into agriculture sector development planning.

***The Lao ICT Environment*.** Nine priority areas characterize Lao PDR's ICT strategy: Access; Enterprise and Industry; Research and Development; Applications; Human Resource Development; Legal Framework; Awareness; Poverty Alleviation; and Standardization and Localization. The national government intends to establish a Universal Service Program expanding telecommunications services to the most rural and remote areas, particularly in the northern provinces. It promotes software, hardware and protocol standards. Furthermore, the government will implement a public awareness campaign on the benefits, advantages and importance of ICT in achieving the MDGs. To ensure inclusive growth, it supports the use of ICT for the development of participatory social networks.

The Lao ICT strategy is operationalized under three main programs: eGovernment, eTourism, and eBanking. The flagship program, eGovernment, has four components: infrastructure development; eApplications; human resource development; and the provision of IT facilities. Currently, fiber optic connections are only available in 22 ministry and agency offices at the central level as well as 8 offices and centers at the provincial level. Under infrastructure development, eGovernment plans to connect 150 government lines to 150 agencies at the central level, 16 offices and 320 departments at the provincial level, 143 offices at the district level, and 2000 offices at the village level. Additionally, it intends to enable videoconferencing among 50 offices at the central level, 16 offices and 80 departments at the provincial level, and 50 offices at the district level.

Under the eApplications component, eGovernment will develop a set of applications covering the spectrum of administrative services including eDocuments. Under the human resource development component, the program will train 10,000 users, 2,000 IT staff and 2000 information services personnel apart from engaging 20,000 stakeholders in workshops and seminars. Under the provision of IT facilities, it will establish an ePortal to service the information needs of the entire government. eGovernment will tap public-private partnerships (PPP) with the intention of achieving specific component targets by Year 2020.

The ICT policy environment presents another opportunity for a Lao ICT strategy for agriculture and forestry. The strategy must piggy-back on the four components of the eGovernment program, accelerating agricultural modernization as envisioned in ADS2025.

***Status of Lao ICT for Agriculture and Forestry*.** The Ministry of Agriculture and Forestry has seven technical departments and one national research institute: the Department of Forest Inspection (DoFI); the Department of Forestry (DoF); the Department of Livestock and Fisheries (DoLF); the Department of Agriculture (DoA); the Department of Irrigation (DoI); the Department of Agricultural Land Management (DALAM); the Department of Agricultural Extension and Cooperation (DAEC); and the National Agriculture and Forestry Research Institute (NAFRI). All eight agencies maintain their own legacy systems for *sector data collection and analysis*, three (DoF, DoI and DALAM) of which are geospatial systems. Four agencies (DoF, DoA, DALAM and NAFRI) use ICTs for *research and innovation data management*. All except DoI have established *databases on agricultural production and value chains*. All are implementing *agricultural knowledge sharing programs* online (Websites, Messaging, CMS) and offline (publications, TV, video, radio,).

From 2000 onwards, there had been an increasing number of independent and isolated databases, portals and systems, mostly developed on a project basis, which result in a fragmented and uncoordinated data landscape (Selim and Bastide, 2015) and expensive systems that are lacking in synergy. Considering the start-up investments made on these legacy systems and their integration into staff operations, it becomes unrealistic to expect the departments and offices to relinquish them in favour of centralized or, at least, interoperable systems. Nevertheless, there are ongoing attempts to make geographic information systems within the Ministry interoperable by integrating geospatial databases and employing one common basemap. Furthermore, the Ministry is an active partner in Lao DECIDE, a joint initiative by the Government of Lao and the Center of Development and the Environment of the University of Berne, which aims at improving cross-sectoral data sharing and integration among government agencies to strengthen well-informed decision-making.

Unfortunately, ICT for agriculture and forestry theories of change have not been constructed parallel to sector development plans. Among several stakeholders, ICT is not recognized as interventions but as externalities. Some harbor the sentiment that ICT is the sectoral concern of information technology and telecommunications not a thematic concern that covers other sectors such as health, education and agriculture. Majority of Ministry officials consider ICT as supportive to their operations but hardly consider it as a development program under agriculture in itself.

However, ICT for agriculture and forestry in Lao PDR has a robust community of advocates and champions who are more than willing to bring an ICT for agriculture strategy into fruition. This community is made up of Lao-based officers of international development agencies, expatriate ICT technical advisors, Lao IT chambers of commerce, and senior staff members of the Ministry of Agriculture and Forestry. MAF has established an ICT Steering Committee that has drafted a Ministry-wide ICT Improvement plan.

The Lao agriculture and forestry sector needs a strategy that would provide an umbrella program that brings coherence, policy support, efficiencies and synergies to existing dispersed initiatives. Furthermore, the ICT for agriculture and forestry community is composed of national and international champions. They may be considered as one of the ICT strategy's biggest strengths and assets.

ICT for Agriculture and Forestry Entry Points

Given the situation analysis, the vision document identifies the following ICT entry points to ADS2025:

***Agriculture and Forestry Sector Development Plan*.** To design, develop and maintain:

- a results-based *Monitoring & Evaluation System* that rigorously measures outputs, assesses the progress towards outcomes, determines impacts of the Five Year Plan, provides actionable information and leads to optimum planning and coordination decisions of MAF officials

- collaborative platforms for sub-sectoral policy dialogue

***Food Production*.** To design, develop and implement ICT programs, applications and advisory services:

- for rural farmers, extension workers and other stakeholders ensuring increased availability, accessibility and stock of food products. Indicative Programs: *ICT Infrastructure Improvement Program; Rural Radio/ Community Cable TV*

- that improve food management through efficient information flow, data gathering and analysis, traceability, transactions and supply chain management. Indicative ICT Services: *Cross Sectoral Data Sharing and Integration (e.g. DECIDE); Decision Support System*

- that reduce uncertainty and enhance preparedness and response to climate change, disasters and other agricultural risks. Indicative ICT Services: *Disaster Risk Reduction and Management System; and Climate Change Adaptation Knowledge Management System*

Commercial Agriculture. To design, develop and implement programs, applications and value added ICT services:

- that improve the way actors in agricultural value chains collect, analyze, store and share agriculture information for their daily decision making purposes. Indicative Programs: *Capacity Development Program on ICT; Alternative learning Systems for Farmers Field Schools*

- that contribute to greater efficiencies in rural markets by lowering transaction costs, decreasing information asymmetries, improving market coordination and transparency in rural markets. Indicative ICT Services: *Land Resources Information Management System; Market Information Systems*

- that facilitates the development of trust-based networks for agricultural information sharing within and among farmers' organizations and associations/ cooperatives or producers and

processors. Indicative ICT Services: *Rural Advisory Services; Mobile Information Networks*

Forestry. To design, develop and implement applications and ICT services that help:

- increase forest cover to 70 percent; secure 51 forest production areas equivalent to 3.1 million hectares; restore forest production in 500 thousand hectares; and plant 500 thousand hectares of forest. Indicative ICT Service: *Forest Cover GIS*

- improve forest management in 1500 villages through sustainable planning. Indicative ICT Service: *Forest Protection Database*

- reduce carbon emissions from deforestation and degradation. Indicative ICT Service: *Carbon Emission/Sequestration Simulation/ Monitoring System*

ICT for Agriculture and Forestry Visioning

Vision Statement. The ADS2025 Vision reads: "Ensuring food security, producing potential agricultural products, developing clean, safe and sustainable agriculture on the basis of industrialization and modernization linking with rural development contributing to the National Economic Infrastructure."

The ADS2025 Vision may be rearticulated into the following ICT for agriculture and forestry vision statement: *National food security and regionally competitive agricultural commodity production capacity through ICT-enhanced, sustainable agriculture industrialization and modernization.*

***Mission Statement*.** The mission of the ICT for Agriculture and Forestry Strategy is to provide synergies and efficiencies to programs, applications and ICT services for MAF departments and units that: contributes to meeting ADS2025 goals; results in positive changes and impact on the livelihoods of people in the agricultural sector; improves investment potential of the agricultural sector; and reduces individual and institutional risks

Goal Statement. The goal of the ICT for Agriculture and Forestry Strategy is to ensure sustainable national food security, a regionally competitive agricultural commodity production, and ICT enhanced agriculture industrialization and modernization by Year 2025.

***Areas of Intervention*.** The Strategy will be applied to the following areas: sector-wide data collection and analysis; research and innovation data management; production and value chain support services: and agricultural knowledge management.

Outcomes. Sixteen outcomes are expected from the ICT for Agriculture and Forestry Strategy:

- Increased accuracy and timeliness of monitoring and evaluation data for the Five Year Agriculture and Forestry Sector Development Plan (2016-2020).
- More effective planning and monitoring of forest cover and forest production
- More effective monitoring of carbon emissions and sequestration
- Increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management
- Increased effectiveness in agricultural decision making among stakeholders
- Improved capacities to collect, analyze, store and share agriculture information for their daily decision making purposes
- Decreased transaction costs in agricultural marketing
- Decreased information asymmetries in agricultural marketing
- Improving coordination and transparency in rural markets
- Strengthened networks for agricultural information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors
- Improved access to ICT services among rural farmers, extension workers and other stakeholders
- Improved access to agricultural production and post production technologies
- Increased knowledge, better attitudes and improved

agricultural practices
- Reduced uncertainty due to climate change
- Enhanced preparedness and response to disasters and other agricultural risks
- Increased resiliency due to knowledge on climate change adaptation

Priorities and Strategic Thrusts

Given the findings of the situation analysis, this initiative will prioritize four component areas for strategic purposes: ICT infrastructure, services and applications development; capacity development on information and communication technologies and the efficiencies that they produce; standards for and inter-operability of ICT systems; content integrity and security management; and knowledge management, sharing and advisory services.

Pillars. However, the implementation of the ICT Strategy will be structured on or framed according to four pillars: ICT for Sectoral and Sub-Sectoral Governance, Operations and Policy Dialogue; ICT for Human Resource Development; ICT for Agricultural Research; and ICT for Extension. Each pillar will have a program where projects, systems and services may be situated under.

***Strategic Framework*.** The ICT for A&F Strategic Framework may be summarized into the following matrix:

VISION STATEMENT	The ICT for Agriculture and Forestry strategy envisions national food security and a regionally competitive agricultural commodity production capacity for Lao PDR through ICT-enhanced, sustainable agriculture industrialization and modernization.
MISSION STATEMENT	The mission of the ICT for Agriculture and Forestry Strategy is to provide synergies and efficiencies to programs, applications and ICT services for MAF departments and units that: contributes to meeting ADS2025 goals; results in positive changes and impact on the livelihoods of people in the agricultural sector; improves investment potential of the agricultural sector; and reduces individual and institutional risks
GOAL STATEMENT	The goal of the ICT for Agriculture and Forestry Strategy is sustainable national food security, regionally competitive agricultural commodity production, and ICT enhanced agriculture industrialization and modernization by the Year 2025.

OUTCOMES PER INTERVENTION AREA	**Areas of Intervention**	**Outcomes**
	Sector-wide Data Collection and Analysis	• Increased accuracy and timeliness of monitoring & evaluation data on the Five Year Agriculture and Forestry Sector Development Plan • More effective planning and monitoring of forest cover and forest production • More effective monitoring of carbon emissions/ sequestration • Sounder management decisions influenced by timely/ accurate data and actionable information
	Research and Innovation Data Management	• Increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management • Increased effectiveness in agriculture and forestry decision making among stakeholders MAF officials, farmers and other stakeholders • Improved capacities to collect, analyze, store and share agriculture and forestry information for daily decision making purposes
	Production and Value Chain Support Services	• Decreased transaction costs in agricultural marketing • Decreased information asymmetries in agriculture and forestry marketing • Improving coordination and transparency in rural markets • Strengthened networks for agricultural and forestry information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors
	Agricultural Knowledge Management	• Improved access to ICT services among rural farmers, extension workers and other stakeholders • Improved access to agriculture and forestry production and post-production technologies • Increased knowledge, better attitudes and improved agricultural and forestry practices • Reduced uncertainty due to climate change • Enhanced preparedness & response to disasters & other risks • Increased resilience due to climate change adaptation info
PRIORITIES/ STRATEGIC THRUSTS	ICT Infrastructure, Services and Applications Capacity Development Standards and Inter-Operability Content Integrity and Security Management Knowledge Management, Sharing and Advisory Services	

PILLARS	ICT for Sector and Sub-Sector Governance, Operations and Policy Dialogue ICT for Agricultural Human Resource ICT for Agricultural Research ICT for Extension	
PROGRAMS, PROJECTS, SYSTEMS AND SERVICES	**Programs**	**Current and Indicative Projects, Systems and/or Services**
	ICT for Sector and Sub-Sector Operations, Governance and Policy Dialogue Program	*ICT Infrastructure Improvement Program* *ADS2025 Monitoring and Evaluation System* Animal Diseases Database Plant Genetic Resources/ Bioinformatics Forest Protection Database *Disaster Risk Reduction and Management System* *Climate Change Adaptation Knowledge Management System* *Collaborative Platforms for Sub-Sector Policy Dialogue*
	ICT for HR Program	*Capacity Development Program on ICT* *Alternative Learning Systems for Farmers Field Schools*
	ICT for Research Program	Cross Sectoral Data Sharing and Integration (e.g. LAO DECIDE) Land Resources Information Management System Forest Cover Monitoring GIS Carbon Emission Simulation/Monitoring System REDD
	ICT for Extension Program	Rural Advisory Services to Producers' Organizations (LURAS) *Mobile Information Networks* *Market Information Systems* Agricultural Extension Through Rural Radio/ Community Cable TV Agricultural Decision Support System

Strategy Implementation, Operationalization and Administration

The implementation, maintenance and administration of the systems and services will be the responsibility of the host departments, institutes or units. However, each initiative will be situated under one of the four programs corresponding to the four strategic thrusts.
The body responsible for the implementation, operationalization and administration of the ICT Strategy is the MAF ICT Steering Committee with its Secretariat and Technical Working Group. Eventually, the Secretariat should be staffed with fulltime personnel and transformed into a line office (MAF Information and Knowledge Center) based in

NAFRI with its own budget. The TWG should be made into a Task Force.

Additional Functions for the ICT Steering Committee. Currently, the MAF ICT Steering Committee has policy making, advocacy, planning and decision-making functions. The ICT Steering Committee Secretariat, on the other hand, provides documentation, analysis and IT solution concept functions. The Committee is composed of eleven representatives from the different departments and Chaired by the Vice Minister. Two IT focal persons from each department make up the Technical Working Group.

For the implementation of the proposed ICT Strategy, it is recommended that the Secretariat assume coordinative and oversight functions as well. The following tasks should be added to the MAF ICT Steering Committee's terms of reference:

- The ICT Steering Committee proper will:
  - serve as a *clearinghouse* of internally and externally funded ICT for agriculture and forestry projects
  - propose annual plans and budgets to operationalize the Five-Year ICT for MAF Strategic Plan
- The ICT Steering Committee Secretariat will:
  - identify and fill-in gaps in ICT for agriculture and forestry systems and services as per the Five Year Development Plan
  - liaise between the Ministry of Agriculture and Forestry and the Ministry of Posts and Telecommunications eGovernment program for coordination of infrastructure initiatives
- The Technical Working Group will:
  - ensure content integrity and manage security levels
  - promote synergies between and among ICT for agriculture systems and services by working towards standardization and interoperability

- o fuel efficiencies of and ensure scalability among ICT for agriculture and forestry systems and services

Criteria for Clearinghouse Decisions. The ICT Steering Committee's endorsement of proposed ICT-related projects for MAF should be guided by certain criteria. Proposed projects should:

- o ensure increased availability, accessibility and stock of food products;
- o improve food management through efficient information flow, data gathering and analysis, traceability, transactions and supply chain management;
- o reduce uncertainty and enhance preparedness and response to climate change, disasters and other agricultural risks;
- o improve the way actors in agricultural value chains collect, analyze, store and share agriculture information for their daily decision making purposes;
- o contribute to greater efficiencies in rural markets by lowering transaction costs, decreasing information asymmetries, improving market coordination and transparency in rural markets; or
- o facilitate the development of trust-based networks for agricultural information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors.

Coordination Responsibilities. While overall coordination of the MAF's ICT umbrella program rests upon the Secretariat, each program will be coordinated by a focal agency represented in the TWG.

The ICT for Sector and Sub-Sector Governance, Operations and Policy Dialogue Program will be coordinated by the Department of Planning. The ICT for Human Resource Development Program will be coordinated by the Department of Personnel and Institutions. The ICT for Research Program will be coordinated by NAFRI. The ICT for Extension Program will be coordinated by the Department of Agricultural Extension and Cooperation.

Financing. The MAF ICT Office/Center will be based in NAFRI. The Office and the Task Force supervised by the ICT Steering Committee should have its own operating budget. Furthermore, it should have access to a revolving fund that would finance infrastructure, services and applications development. The revolving fund will be financed by the relevant donors and the private sector. Thus, an investment strategy for this revolving fund should be designed incorporating government financing, donor inputs and public-private partnerships.

For bridge financing purposes, a seed fund should be sourced from existing and planned ICT for agriculture and forestry projects. The seed fund would finance ICT Steering Committee Secretariat operations prior its transformation into a line office.

ICT4AF Investment Plan

I. ICT for Agriculture Strategic Framework

A. Vision, Mission and Goal Statements

The Ministry of Agriculture and Forestry (MAF) envisions national food security and a regionally competitive agricultural commodity production capacity for the Lao Peoples' Democratic Republic. This vision may be attained expeditiously by implementing an information and communication technology strategy that enhances sustainable agriculture industrialization and modernization. This strategy is referred to as the *ICT for Agriculture and Forestry (ICT4AF) Strategy*.

The mission of ICT4AF is to provide synergies and efficiencies to programs, applications and ICT services for MAF departments and units that: contribute to meeting ADS2025 goals; result in positive changes and impact on the livelihoods of people in the agricultural sector; improve investment potential of the agricultural sector; and reduce individual and institutional risks

The goal of ICT4AF is sustainable national food security, regionally competitive agricultural commodity production, and ICT-enabled agriculture industrialization and modernization by the Year 2025.

B. Outcomes

The outcomes of ICT4AF may be classified according to four *areas of intervention*:

Sector-wide Data Collection and Analysis. ICT products, services and interventions under sector-wide data collection and analysis will result in: increased accuracy and timeliness of monitoring and evaluation data on the Five Year Agriculture and Forestry Sector Development Plan; more effective planning and monitoring of forest cover and forest production; more effective monitoring of carbon emissions/ sequestration; and sounder management decisions influenced by timely/ accurate data and actionable information

Research and Innovation Information Management. ICT products, services and interventions under research and innovation information management will bring about: increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management; increased effectiveness in agriculture and forestry decision making among stakeholders; and improved capacities among MAF officials, farmers and other stakeholders to collect, analyze, store and share agriculture and forestry information for daily decision making purposes.

Production and Value Chain Support Services. ICT products, services and interventions under production and value chain support services will give way to: decreased transaction costs in agricultural marketing; decreased information asymmetries in agriculture and forestry marketing; improved coordination and transparency in rural markets; and strengthened networks for agricultural and forestry information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors.

Agricultural Knowledge Management. ICT products, services and interventions under agricultural knowledge management will lead to: improved access to ICT services among rural farmers, extension workers and other stakeholders; improved access to agriculture and forestry production and post-production technologies; increased knowledge, better attitudes and improved agricultural and forestry

practices; reduced uncertainty due to climate change; enhanced preparedness and response to disasters and other risks; and increased resilience due to climate change adaptation knowledge.

C. Strategic Thrusts and Pillars

ICT4AF has five strategic thrusts:

- Infrastructure, Services and Applications
- Capacity Development
- Standards and Inter-Operability
- Content Integrity and Security Management
- Knowledge Management, Sharing and Advisory Services

Its operationalization is supported by four pillars:

- ICT for Sector and Sub-Sector Governance, Operations and Policy Dialogue
- ICT for Agricultural Human Resource
- ICT for Agricultural Research
- ICT for Extension

II. Elements of the Investment Plan

A. Investment Requirements

Infrastructure Development. The ICT4AF involves the construction of adequate network telecommunications infrastructure from the national to the provincial to the district and village levels to provide ICT access to MAF staff, clients and partners.

Hardware-Software Procurement. The strategy provides for the procurement of appropriate hardware and software for use of MAF staff, clients and partners.

Content Development. A major concern of ICT4AF is content development. Adequate investments on content development should be made to enable ICT4AF to achieve its goals.

Staffing. ICT4AF assumes that information technology, information management, software engineers and computing staff will man

the ICT systems of MAF. They should be supported by adequately trained content developers and communication staff.

Capacity Development. ICT4AF involves the provision of capacity development programs on ICT design, development and utilization among staff, clients and partners of MAF at all levels. These include: readiness training among users; content management training among content providers; cybersecurity training among administrators; and others. Capacity development likewise cover short term and long-term (formal degree program) training.

B. Investment Modes

The Investment Plan recognizes four types of monetary inputs for information and communications technology:

Regular Budget Appropriations. Programs and projects under ICT4AF may be funded through regular budgetary releases to the Ministry of Agriculture and Forestry by the national government. This includes a basket fund wherein different departments, divisions and projects contribute a portion of their ICT maintenance budget to a common fund that finances the MAF's core ICT4AF unit to be established in NAFRI.

Loan Assistance. ICT4AF will be part-beneficiary of future financing from the World Bank, Asian Infrastructure Investment Bank (AIIB), Asian Development Bank (ADB) and other funding agencies on telecommunications infrastructure channeled through eGovernment.

Project Funding. Funding of limited scale infrastructure development, hardware-software procurement, short to medium-term staffing and capacity development can be availed upon through project investments from the Food and Agriculture Organization (FAO), the International Fund for Agriculture Development (IFAD), the Japan International Cooperation Agency (JICA), the Swiss Agency for Development and Cooperation (SDC) and others.

Public Private Partnerships. Perhaps, the most viable but least explored investment mode is the public private partnership (PPP)

model. The PPP experience in ICT for education featured private sector fund sourcing over and above start-up, operational and transfer management.

C. Investment Sources

1. Goal

Ministry of Agriculture and Forestry. Annual budget appropriations from the national government to the Ministry should include maintenance and operating expenses of ICT networks, hardware and software.

eGovernment. The basic infrastructure requirements will be part of the eGovernment program of the Ministry of Posts and Telecommunications. The mandate of eGovernment covers infrastructure development, establishment and maintenance of data centers and security management. Currently, twenty-two ministries and agencies in Vientiane have fiber optic connections. eGovernment optical fiber connections are also available in provincial offices of eight provinces (Vientiane, Luangprabang, Udomxay, Borikhamxay, Huaphan, Savanhnaket and Champasack). By 2020, eGovernment will connect 150 government agencies at the central level, 16 provincial offices, 320 provincial departments, 143 district offices and 2000 village offices. ICT4AF shall tap eGovernment fiber connections and, when necessary, establish last mile linkages for its end-users and data sources (MAF staff, farmers and cooperators) at the district and village levels. ICT4AF shall also receive cybersecurity support from eGovernment.

2. Development Partners

Asian Development Bank. ADB is currently implementing a regional technical assistance project for the Greater Mekong Subregion titled Core Agriculture Support Program (CASP) II. CASPII has a robust information and communications component that involves: the design, development, demonstration and maintenance of a regional information service for the agriculture sector through 2017; ensuring consensus and buy-in for regional data sharing agreements,

data use protocols, and analytical reporting agreements; building a regional information network and its data population; national and regional capacity building to operate the regional and the subsequent analytics that may be demanded; supporting national governments with the design, establishment and operation of national level data portals and information services connected to the regional information service network; and development of a business plan for the preferred regional information service network beyond 2017.

Asian Infrastructure Investment Bank. AIIB was launched in 2014 with 50 countries signing its Articles of Agreement, including Lao PDR, which subscribed to 430 shares of the Bank's authorized capital stock. One of the priority investment areas of AIIB is transportation and telecommunications. The major stockholder of AIIB, the People's Republic of China, has in the past two decades been sponsoring large scale telecommunications infrastructure and ICT for education projects in Lao PDR. AIIB's support to ICT4AF would be course through the eGovernment Program and may include: the expansion of telecommunications services from the provinces to the districts down to the villages; and the utilization of four Lao satellite transponders for last mile connection to Community eCenters (including the provision of additional VSAT units to villages).

DFAT. Traditionally, the Australian Government has been one of the major donors in human resource development of Lao PDR. Considering that HR holds the second highest priority in the 8th Five Year Plan, DFAT investments on ICT4D capacity development may increase, particularly in the provision of short-term and long-term training.

FAO. Within the international development assistance community of Lao PDR, the champions of ICT for development are found in the agriculture sector. The drafting of an ICT4AF Strategy was financed by FAO. There are medium to long-term ICT4AF projects in the FAO pipeline including: the *Strengthening Agro-Climatic Monitoring and Information Systems to Improve Adaptation to Climate Change and Food Security in Lao PDR;* and *the Capacity Development in Agricultural Innovation Systems.* Additional ICT4AF project support is expected from FAO.

IFAD. The International Fund for Agricultural Development will be supporting various aspects of ICT4AF including further development a Management Information System for MAF under the GAFSP Project.

JICA. From November 2015 to October 2020, the Ministry of Natural Resources and the Environment Department of Forest Resource Management and the MAF Department of Forestry will be implementing the Sustainable Forestry Management and REDD+ Project II with JICA support. Its project purpose is to increase capacity for sustainable forest management through improved forest resource information. It will establish a comprehensive geographic information system of forest resources using the most accurate basemaps and database systems.

SDC. The Swiss Agency for Development and Cooperation is currently funding the Lao Upland Rural Advisory Service (LURAS). Among other things, the project will make available last mile link services between MAF and rural farmers through innovative extension networks and mechanisms. Approximately five million Swiss Francs have been allotted to this project until October 2017. Furthermore, it is presently funding Phase III of Lao DECIDE Info, which may be tapped by the agricultural sector for policy and decision making purposes.

3. Private Sector

***Lao ICT Chamber of Commerce*.** The services of medium and large information technology and telecoms enterprises and service providers in the country range from training and capacity development to hosting and infrastructure development. The majority belong to the Lao ICT Chamber of Commerce or Lao ICT Commerce Association. The members of the chamber of commerce are eager to participate in ICT4AF undertakings under joint venture or PPP arrangements.

E-AGRICULTURE: A DESIGN FOR THE PHILIPPINES

Background on E-agriculture

E-agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. Globally, the challenges facing agriculture have grown in number and in scale. These include: hunger; malnutrition; post-harvest loss and wastage; unsafe food; unsustainable farming practices; loss of biodiversity; and loss of arable land exacerbated by floods, drought and extreme weather conditions brought about by climate change. These problems may be addressed in whole or in part by an equally global phenomenon, the development and spread of new information and communication technologies (ICTs), services and solutions.

E-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICT in the rural domain, with a primary focus on agriculture. In recent years, opportunities for ICTs in agriculture have grown exponentially from low-end technologies (rural radio, mobile phones and SMS) to high-end solutions (drones and the Internet of Things) encompassing precision agriculture, remote sensing, early warning systems and connected networks.

E-agriculture includes standards, norms, methodologies, tools, development of individual and institutional capacities, and policy support. A national e-agriculture strategy will help rationalize financial and human resources, harness ICT opportunities and address challenges in the agricultural sector. A comprehensive national strategy prevents E-agriculture projects from being implemented in isolation and develops efficiency gains from intra and inter sector synergy. The Food and Agriculture Organization (FAO) and the International Telecommunications Union (ITU) have developed an E-agriculture Strategy Guide to facilitate decision makers in developing a national E-agriculture vision, action plan and implementation strategy. The Guide has been used to assist countries such as Bhutan, Sri Lanka, Lao PDR, Papua New Guinea,

Fiji and Vanuatu in identifying and developing sustainable ICT for agriculture solutions and services. This document presents a proposed Philippine E-agriculture strategy prepared with technical assistance from FAO and ITU.

Philippines Country Profile and Policy Environment

***Geography*.** The Philippines is an archipelago made up of 7,107 islands covering an area of 300,000 square kilometers, 298,170 of which are land. It ranks 73rd in terms of area among the countries in the world. It has no land boundaries. Its coastline stretches 36,289 kilometers second only in length to Indonesia. It claims exclusive economic rights over a zone covering 200 nautical miles from its coastlines. Its climate is tropical marine with a northeast monsoon prevailing from November to April and a southwest monsoon from May to October. Its terrain is mostly mountainous with narrow to extensive coastal lowlands having a mean elevation of 442 meters.

Philippine natural resources include timber, petroleum, nickel, cobalt, silver, gold, salt and copper. Forty-one percent of its land area is considered agricultural but only 18.2 percent is arable, 17.8 percent with permanent crops and 5 percent permanent pasture. Its forests cover 25.9 percent of its land area as of 2015 but it is continually shrinking. Its irrigated area totals 16,270 sq. km as of 2012.

In terms of geo-political positioning, the Philippines is strategically located alongside main water bodies such as the South China Sea, the Pacific Ocean and the Sulu-Celebes Sea. However, its location is not at all an idyllic geophysical. It serves as the initial land buffer to the increasingly destructive storms that form in the Pacific as air heated by warming seas interact with cooler breezes from the north. Its uniquely vulnerable geographical position along the typhoon belt is aggravated by natural hazards such as landslides, earthquakes, tsunamis and significant volcanic activity in close proximity to human populations. As if by design, its exposed location and natural hazards are exacerbated by: uncontrolled deforestation especially in watershed areas; soil erosion; air and water pollution in major urban centers; coral reef degradation; and increasing pollution of coastal mangrove swamps that are important fish breeding grounds.

Food security is severely threatened by this three-pronged menace: climate change; natural disasters; and man-made environmental problems. It is no wonder that the 2014 Vulnerability Index of Germanwatch named the Philippines as second most prone to climate change disasters after Bangladesh.

Demography. As of July 2016, the Philippines has a total estimated population of 102,624,209, the 13th largest in the world. Catholics make up the majority (82.9%). The biggest ethnic group, the Tagalogs occupying the middle part of Luzon, consist of 28.1 percent of the population. The official languages are Filipino and English. The following are some interesting facts on Philippine demographics:

- As of 2015, 44.4 percent of the population comes from urban areas. Metro Manila itself has almost 13 million residents.
- Male to female ratio is almost equal at 1.01. The birth rate of 24 births/ 1,000 outnumbers its mortality rate of 6.1 deaths/ 1,000 by 17.9. Total fertility is 3.06 children born/ woman. Life expectancy is 65.7 for males and 72.9 for females.
- Most (36.86%) Filipinos occupy the 25 to 54-age bracket. The median age is 23.4.
- The risk of contracting major infectious diseases is high. The most prevalent food or waterborne diseases are bacterial diarrhea, hepatitis A, and typhoid fever.
- Among children under the age of five years, 19.9 percent are underweight.

Economy. In its Philippine country profile, the US Central Intelligence Agency reports that the country's economy has been resilient to global economic shocks due to lower exposure to troubled international securities, less dependence on exports, relatively resilient domestic consumption, large remittances from about 10 million overseas Filipino workers and migrants, and a rapidly expanding outsourcing industry. Economic growth has accelerated, averaging more than 6.0 percent since 2011. As of 2016, the estimated GDP of the Philippines is USD801.9 billion the 30th largest in the world. Its growth rate of 6.4 percent ranks as the 16th highest. However, its per capita GDP (PPP) of USD7700 ranked only 154th in the world. Thus, challenges to achieving more inclusive growth remain.

The poverty rate is almost 25 percent. Among the poor, more than 60 percent live in rural areas, a challenge to raising rural farm and non-farm incomes. Only 9.7 percent of its GDP is attributed to agriculture compared to 30.5 percent to industry and 59.8 percent to services. From its 42.8 million strong labor force, 29 percent are agricultural workers; 16 percent are industrial workers while 55 percent are service workers or information workers.

Policy Context for E-Agriculture. The preceding statistics reveal several threats to food security:

1. The dwindling manpower engaged in agriculture.
2. The country's vulnerability to climate change exacerbated by natural disasters and man-made environmental problems.
3. The steady rise of the population.
4. The incidence of malnutrition.
5. The lack of food safety especially with regard to food borne diseases.
6. The fact that 60 percent of the poor come from rural areas.

Consequently, Chapter 4 of the Philippine Development Plan 2011-2016 has targeted three rural development goals: food security improved and incomes increased; sector resilience to climate change risks increased; and policy environment and governance enhanced.

One positive development is that with 59.8 percent of the country's GDP attributable to the tertiary sector and 55 percent of its workforce categorized under information labor, the Philippines has clearly leapfrogged from an agricultural based economy to an information based economy or an *information society*. Within a thriving information society, information, communication and knowledge resources can be brought to bear successfully on rural development and agricultural problems. The development of a robust E-Agriculture Strategy for the Philippines will contribute to all three goals by improving security, increasing resilience to climate change, and supporting policy and governance.

Agriculture, Development Goals and Challenges

***Philippine Agriculture System*.** If indeed the Philippines has leapfrogged from an agricultural society to an information society, this development has been fairly recent. The country's economy has been branded as agricultural for so long. It has been known as a rice and corn producing country and an exporter of sugar, copra, bananas, cassava (manioc, tapioca), pineapples, mangoes, and fish products. Its beef, pork, poultry, and egg production has also been extensive. Agriculture was not only the major economic driver. It triggered cultural, social and political upheavals as well.

The Philippine Agricultural System is steered by Department of Agriculture (DA). It is the government agency responsible for the promotion of agricultural development by providing the policy framework, public investments, and support services needed for domestic and export-oriented business enterprises.

DA is a giant of a bureaucracy. It operates seven bureaus: the Agricultural Training Institute (ATI); the Bureau of Agriculture and Fisheries Standards (BAFS); the Bureau of Animal Industry (BAI); the Bureau of Agricultural Research (BAR); the Bureau of Plant Industry (BPI); the Bureau of Soils and Water Management (BSWM); and the Bureau of Agricultural and Fisheries Engineering (BAFE). It has an equivalent number of attached agencies: the Agricultural Credit Policy Council (ACPC); the Bureau of Fisheries and Aquatic Resources (BFAR); the Philippine Fiber Industry Development Authority (PhilFIDA); the Philippine Council for Agriculture and Fisheries (PCAF); the National Meat Inspection Service (NMIS); the Philippine Carabao Center (PCC); and the Philippine Center for Postharvest Development and Mechanization (PhilMech). It also has seven attached corporations: the National Dairy Authority (NDA); the National Tobacco Authority (NTA); the Quedan and Rural Credit Guarantee Corporation (QuedanCor); the Sugar Regulatory Administration (SRA); the Philippine Fisheries Development Authority (PFDA); the Philippine Rice Research Institute (PhilRice); and the Philippine Crop Insurance Corporation (PCIC). Additionally, it maintains 17 regional field offices nationwide.

It should be noted that the DA manages an active Information and Communications Technology Service (ICTS), which is the logical hub for a national E-Agriculture Strategy.

***Agriculture Sector Goals and Priorities*.** In the fulfillment of its mandate, DA's primary concern is to improve farm income and generate work opportunities for farmers, fishermen, and other rural workers. It encourages people's participation in agricultural development through sectoral representation in agricultural policy-making bodies so that the policies, plans, and programs of the Department are formulated and executed to satisfy their needs. It uses a bottom-up self-reliant farm system approach that will emphasize social justice, equity, productivity, and sustainability in the use of agricultural resources.

Vision. The Department's vision is a competitive, sustainable, and technology-based agriculture and fishery sector, driven by productive and progressive farmers and fisherfolk, supported by efficient value chains and well integrated in the domestic and international markets, contributing to inclusive growth and poverty reduction.

Mission. Its mission is to help and empower the farming and fishing communities and the private sector to produce enough, accessible, and affordable food for every Filipino and a decent income for all.

Priorities. Additionally, the Duterte doctrine underscores the: "… moral obligation to provide available and affordable food for my people." The Secretary of the Department Emmanuel F. Piñol has lined up his agricultural agenda in consultation with the President that ushers the country's agriculture and fisheries program back to the basics: to produce food; and to address poverty. Thus, the agriculture system is now focused on the three agricultural sector priorities: staple food commodities; high value crops to generate foreign earnings; and food sufficiency.

Ten-Point Agenda. The Department of Agriculture has likewise adopted the following ten-point agenda:

1. Development of a national color-coded agriculture and fisheries map.
2. Conduct of a national food consumption quantification study.
3. Institutional restructuring and paradigm resetting for the Department and its officials and employees.
4. Intensive technology updating and sharing modernization & mechanization program.
5. Easy access financing program for farmers, fishermen and agriculture and fisheries stakeholders.
6. Strategic and effective post-harvest, storage and processing facilities.
7. A government-initiated and supported aggressive marketing campaign promoting high-value cops for foreign markets.
8. Coordinated program with other agencies to ensure protection and preservation of water sources, especially watersheds.
9. Relentless campaign for the enforcement of agricultural and fisheries laws especially on land conversion and illegal fishing.
10. Re-introduction of basic agriculture in the primary and basic education in the Philippine school system with emphasis on value of the land, water and seas and the maximum but prudent utilization of these resources.

An E-Agriculture Strategy for the Philippines should dovetail the Department of Agriculture's ten-point agenda.

Agriculture Sector Issues and Challenges

In the Philippines, sixty percent of the poor live in rural areas. The Department of Agriculture has taken it upon itself to serve in the frontline in the fight against poverty. According to the Philippine Statistics Authority (PSA) the ten provinces with the highest poverty incidence per household include Lanao del Sur (67.3%), Eastern Samar (55.4%), Apayao (54.7%), Maguindanao (54.5%), Zamboanga del Norte (48%), Sarangani (46%), North Cotabato (44.8%), Negros Oriental (43.9%), and Northern and Western Samar (both with 43.5%).

The DA has initiated the Special Area for Agricultural Development (SAAD) project in these provinces. SAAD will allow the DA to look at the weak points of each area and its key potentials in food production and agricultural livelihood programs. According to Secretary Piñol, a SAAD project management team, composed of technical people from the DA and the province, will be established to identify the problems confronting each area and recommend solutions. Based on these solutions, the DA, along with other agencies will implement programs and fund livelihood projects.

It is among the poorest of the poor where malnutrition is rampant. Thus, the DA is also considering the implementation of a national feeding program in these provinces.

Agriculture Sector Opportunities and the DA ICTS

Development communication as an academic discipline originated in the Philippines in the sixties and seventies as an offshoot of its Green Revolution experiences. The country has had a long history of employing information and communication technologies for agricultural and rural development. E-Agriculture has sprouted its roots here early on. If the Department of Agriculture is the hub of the Philippine agriculture system, it can very well be expected that the nucleus as well as all the other nodes in this network has been, is, and will be maintaining E-Agriculture projects.

We should note that each of the items in the DA's ten-point agenda could very well be supported by information and communication technologies and services. Many of the initiatives under each item have already built in E-Agriculture solutions. Take the case of SAAD with its Barangay Network Project that would provide connectivity and IP telephony to far-flung areas.

The DA Information Communication Technology Service (ICTS) is the main office responsible for carrying out the initiatives involving information and communications technology. The mandate of ICTS is based on the Agriculture and Fisheries Modernization Law of 1997 that directs the DA to establish the National Information Network (NIN). The NIN links various stakeholders to have easy access of data on agriculture and fisheries.

ICTS has four (4) divisions, namely: the ICT Planning and Standards Division (ICTPSD); the Database Management Division; the Systems and Application Development Division; and the Network Operations and Management Division (NOMD). The divisions are tasked respectively to: provide ICT standards and policies; manage agricultural databases; design and develop ICT applications; and maintain the ICT infrastructure in support of the programs of DA.

As stated by its Director, Dr. Clint Hassan, the ICTS has formulated an approach to attain ICT reforms in the next six years. This strategic proposal is encapsulated in the following crosscutting thematic framework dubbed as SMART-AGRI, which has the following features:

1. Seamless interconnectivity;
2. Mainstreaming of ICT in Disaster Risk Reduction & Management (DRRM), Climate Change Adaptation (CCA) and Gender and Development (GAD);
3. Agribusiness links and networks;
4. Real-time exchange of information;
5. Transparent governance and delivery of services;
6. Alignment of ICT initiatives in DA business processes and competency development;
7. Geo-database of agricultural resources and interventions;
8. Risk management of ICT resources and services; and
9. Inter-operability of systems and applications.

Director Hassan further reports that ICTS provides leadership in the development and implementation of reliable and cost effective information and communications technology system of the Department at all levels of implementation. It undertakes measures to ensure the system's security, integrity, and reliability. The ICTS also provides the overall orchestration and guidance on ICT of all DA agencies in making the most of knowledge that are managed, stored, or shared within the Department. The multiplicity of stakeholder agencies and groups involved in the agricultural sector has spawned an equally diverse number of independently initiated, funded,

and implemented E-agriculture undertakings. This situation marks both the biggest challenge and opportunity for E-agriculture in the Philippines.

In the next chapter, the variety and diversity of such projects within and beyond the Department will be discussed. The biggest challenge is to bring all these initiatives within a coherent and cohesive strategy that addresses the country's agricultural and rural development goals. Furthermore, this strategy should be consistent with the country's information and communications technology development goals as well.

Status of E-agriculture Services in the Philippines

As stated earlier, the variety and diversity of E-Agriculture projects currently being implemented within and beyond the Department of Agriculture is quite extensive. However, these projects were planned, designed and developed independently from one another without the benefit of an umbrella E-Agriculture policy or program. Hence, some of these services are not interoperable; much of the data unmigratable. The biggest challenge is to bring all these initiatives within a coherent and cohesive strategy that addresses the country's agricultural and rural development goals.

As reported by DA ICTS, the following are specific E-Agriculture projects under their portfolio:

Expansion and maintenance of National Information Network (NIN) Data Warehouse. A repository of all agricultural information to ease the regular and ad hoc reportorial requirements of the Bureau of Agricultural Statistics (BAS), Planning Service (PS) and the Field Operations Service (FOS).

Development of DA-Wide Applications for Planning, Field Operations, Administrative and Finance Functions. Refers to the "demand- driven" requests by DA Staff Offices to improve their office productivity using customized information systems.

Enhancement and maintenance of regulatory services portal. Among the portals being maintained are the SPS system for import and export transactions, electronic inward foreign manifest (e-IFM) and other trade-related legal issuances websites.

Maintenance of DA private network in remote sites. This particular project serves as the "backbone" for improving the DA's "seamless interconnectivity" intervention specifically on the provision of internet access. It will be the main jumping-point of the ICTS to directly support the provision of DA web services to the public. The efficient inking of ICT infrastructure and networks will allow clientele to access the vast available information on agriculture and fisheries as well as tap online ICT services. For the fiscal year (FY) 2017, the DA Central Office will have at least 200 Mbps of bandwidth of internet service from a mere average of 80-150 Mbps. This will definitely increase our internet penetration rate for DA employees which will make the delivery of services through online access to our clientele more efficient. The project also includes the maintenance of remote sites and the DA data center.

Expansion and upgrading of DA-wide area network (WAN), bureaus and attached agencies local area networks (LANs) including RIARCs and priority. The project involves the hosting of at least eighty one (81) agency websites and databases, server maintenance, switches, routers and other network equipment. Also includes the maintenance of the Business Continuity and Disaster Recovery (BCDR) System in Puerto Princesa City, Palawan to ensure information system uptime, data integrity and availability, and business continuity.

Development/ Implementation of continuing ICT technical skills development. It involves the conduct of in-house training on electronic office productivity tools such as word processing, spreadsheets, slides presentations, desktop databases, photo editing/publishing and web content management. The project also conducts outsourced capacity-building through reputable ICT training institutions like DICT, TESDA, UP and others.

Monitoring of agency ICT plans and policies. This activity tackles the monitoring of physical and financial accomplishments of ICTS programs and projects as well as the formulation of strategic and operational policies and plans of the Service.

Community Level Information System-Barangay Network Project (CLIN-BNP). A mobile technology-based project that can provide real-time information to evaluate and quantify the accomplishments of DA programs. It enhances the way to link decision-makers, implementers, and beneficiaries towards the achievement of DA goals. The information is shared through internet, SMS and social networking broadcasting capabilities to field-level stakeholders and vice-versa.

Support for Department of Agriculture's Trade Enabling Risk Management System (DA-TERMS), and Expansion and Upgrading of ICT facilities and equipment of Research Stations, Quarantine Stations/Ports (Information and Communications Technology Service). The general objectives of this project are to: (1) enhance the systems and procedures particularly in the SPS import and export clearances and certificates as well as risk management for quarantine and inspection; and (2) reduce the Department's risk exposure in relation to its existing ICT system currently being provided by external value-added service providers (VASPs).

Establishment of Management System for Business Process, M&E Systems and ICT Support Services. Includes the general network structured-cabling for the DA RFO 2 new office, provision of ICX equipment, infrastructure, and business productivity solutions.

International Affairs Coordination and Liaising (International Affairs Division). The project centers on real-time teleconferencing solutions and ICT equipment to international embassies', attaches, and other consulates.

Information and Communications Technology Support for DA Staff. The project includes the establishment of necessary ICT

support logistics and capacitation activities that will support the conduct of efficient and effective operational activities, and implementation of selected DA staff's programs and projects. It addresses the lack, or inadequacy, of logistics and skills to support an efficient implementation of support activities. The project also involves the procurement and installation of ICT equipment including, servers, desktop and laptop computers, printers, switch boards, routers, and scanners.

Market Promotion Portal for Expansion of Agricultural Commodities. The project will assist in accessing international agricultural commodities markets by providing the necessary resources for exporting and importing agricultural commodities. It can play a vital role in helping farmers and fisherfolk in their production and marketing decision.

Information and Communications Technology Support of DA Staff. The project aims to provide hardware and software ICT support for DA BAR.

Development of food safety and agro-fishery machinery standards/ BAFS infrastructure. The project also aims to provide ICT support, particularly infrastructure and equipment, for DA BAFS.

Knowledge Center for agriculture and fisheries towards interactive knowledge sharing. The project aims to provide ICT support, particularly infrastructure and equipment and the construction of the DA Knowledge Center, for DA ATI.

Rehabilitation of FITS Center affected by disasters through the provision of IEC and ICT equipment. The project aims to provide ICT support, particularly the rehabilitation of infrastructure for FITS Center, for DA ATI.

Establishment of Agri-Aksyon Sentral and Bukid Techno Center Hub in the Philippines. This project aims to establish Agri-Aksyon Sentral and Bukid Techno Center hubs equipped with advanced ICT based technologies developed to cater to the growing information needs of the farmers and clientele communities.

Color-coded Commodity-based Agriculture and Fisheries Resources Mapping. This project aims to address the limited and unorganized information on agricultural resources and interventions down to the local level. It also intends to provide substantial details as to spatial location and extent, proximities to objects of interest, and notable attributes of all inventoried agriculture-related features and facilities.

National Farmers/Fisherfolk Database System. This project aims to create a centralized and nationwide farmers and fisherfolk database that would support various levels of planning, decision-making, and delivery of interventions for the Department of Agriculture. The database contains information on farmers, farm laborers, fishermen, and their farm parcel. The database can significantly improve the delivery of programs and services of the Department of Agriculture while making the data available to other agencies that share the same stakeholders as thx DA.

Department of Agriculture Trade System Expansion and Upgrading of ICT Facilities and Equipment of Research Centers/Stations and Quarantine Stations/Ports. The project will enhance the online services of the Department, specifically the regulatory agencies, by creating an agriculture single -window for the stakeholders.

Farm Lot Geo-referencing and integration of Drone in DRRM Strategies. The farm lot geo-referencing addresses the need of accurate field measurement in relation to fertilizer recommendation. The establishment of such an advanced system will help modernize the current system of the Department, and eventually lead to the higher production of the farmers, and more accurate intervention measures will be provided based on the system data.

The DRRM (use of drones) component addresses the existing gaps in pre calamity and post disaster needs assessment. This could be done by the following objectives of the project: (1) to be more efficient in assessing risk, losses, and damages; (2) to have a more efficient and accurate data to assess the necessary interventions for

prevention, mitigation, preparedness, response, and recovery in a shorter time period; and (3) to lessen time in acquiring data and reports from LGUs and assess the necessary interventions needed in a shorter time period.

Enterprise ICT Support for DA Operating Units (OUs) Project. The proposed project includes the establishment of necessary ICT support that will enhance the efficient and effective operational activities and implementation of agency programs and projects. Consistent with the aspirations of the DA and ICTS, the following are the specific objectives of the project: (1) address the lack or the inadequacy of ICT tools to support the enhanced implementation of DA Operating Units (OUs) activities that cuts across agency programs and projects; (2) procure ICT equipment, applications, infrastructure, services, and other resources for respective DX Operating Units (OUs); and (3) Deliver ICT equipment, applications, infrastructure, services, and other resources for respective DA Operating Units (OUs).

Agricultural Marketing System (AMS) - Farm-level Agricultural Marketing Exchange Information System (FLAMES). Consistent with the aspirations of the DA AFMIS and DA trading centers, the following are the specific objectives of the project: (1) increase the availability and accessibility of quality agricultural commodities, at affordable prices, and the community level with help from innovative information technologies (ITs); (2) reduce, if not eliminate, the trading intermediaries or middle-men, with the help of ICT; (3) develop an alternative virtual market for farmers' produce, and provide opportunities for farmers and fisher folk to be engaged in direct marketing, that is, from producers (farmers or fisher folk) directly to distributors (beneficiaries/recipient) and ultimately to the consumers; and (4) Encourage community empowerment and create livelihood opportunities.

Upscaling of Precision Farming using Agri-bots: Attaining Food Security with the help of Space Technologies. The general objective of this project is to use innovative ICT solutions, particularly precision agriculture, to make agricultural production

more efficient. Specifically, the project aims to: (1) create collaborative project teams and assess existing precision agriculture systems; (2) identify and operationalize precision-farming and agri-bot solutions for agricultural crops; (3) procure ICT resource requirements (SW & HW); (4) Conduct training on the proper use and maintenance of the system; and, (5) Carry-out information and education campaign (IEC) and end of project.

Support to Philippine Rapid Alert System for Food and Feeds. This project will provide and operationalize a system that will facilitate the rapid exchange of information and alert notifications among competent authorities responsible for food and feed safety controls in the Philippines; establish between Phil-RASFF, the ASEAN-RASFF, the EU-RASFF, and other equivalent systems of other international trading partners; and institutionalize the implementation and operationalization of the national rapid alert system.

Halal Food and Feeds Supply Chain Traceability Project. Consistent with the aspirations of the DA Halal Program, the following are the specific objectives of the project: to develop ICT traceability solutions that can be applied in Halal products, to track and trace products or raw materials from point-to-point across the supply chain; and to achieve transparency, efficiency as well as enhanced security and safety in the monitoring of Halal products; and, implement an alert and information notification system to provide the DA regulatory authorities with an effective medium for exchange of information on measures taken to ensure Halal agri-fishery product safety and quality.

Blaster for Farmers (BfF) Project. The general objective of this project is to ensure that the advocacies of the DA are disseminated down to the grassroots level. Specifically, the pilot project aims to: (1) increase the reach of the Department in the marginalizes areas; (2) strengthen the link between the DA and its clientele; and, (3) directly inform and educate the farmers and fisherfolk about issues in the agriculture and fisher sectors, and during emergencies.

AgriHackathon. The project will hold contests on ICT technologies and solutions involving students and other interested stakeholders

around the country. The winners will have the opportunity for their innovations to be incubated by the DA ICTS for possible upscaling.

ICT Support to the Agri-Fisheries Mechanization Engineering Resource Network. The major objectives of this project are: (1) serve as the national resource base facility on agro-fishery mechanization and engineering information systems; (2) generate the needed data for general information and reference – resource analysis, planning and allocation and for policy analysis, decisions and advocacy; (3) serve as web-based facility for monitoring of agri-fishery mechanization and infrastructure projects and, (4) facilitate the online registration of agri-fishery machineries and equipment.

However, there are other e-agriculture technologies, services and solutions that have been or are currently being implemented:

Agricultural Stress Index System (ASIS). ASIS is an index that helps show how 'stressed' agricultural crop areas are and detects the areas with a high likelihood of agricultural drought, by combining vegetation and condition and temperature variables.

AgriDOC App. AgriDOC is a mobile application designed as a virtual farming assistant where users can access information about rice farming, as well as manage their farming through various tools like farm journal, scheduler, and diagnostic tools.

AgriNet. AgriNET computer-based data bank that serves as a repository of knowledge/information about organic agriculture including best organic farming practices.

BSWM AgroMet. A tool for Climate change adaptation and in the development of local early warning system through the use of agro-meteorological stations in highly vulnerable agricultural areas

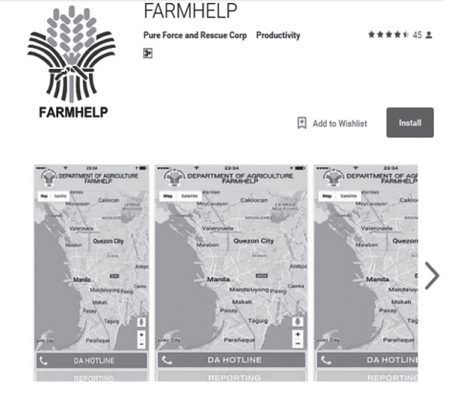
CountrySTAT. CountrySTAT Philippines is a web-based system that integrates national food and agricultural statistical information to ensure harmonization of national data and metadata collections for analysis and policy making.

CRM4AQUA. Climate Resilience Management for Aquaculture is a platform that provides valuable information using applications of information and communications technology (ICT) tools to deliver timely, scientific and updated advisory services for adaptive aquaculture farming operations in response to challenges brought by dynamic changes in weather and climate.

Cropital. Cropital is a crowdfunding online startup that that seeks to generate funds from both domestic and international sources for lending to Filipino farmers.

E-Extension - E-learning. An ICT-based extension delivery system that aims to maximize the use of information and technology in enhancing the productivity, profitability, and global competitiveness of agriculture, fisheries, and natural resource sectors in the Philippines. E-learning includes farming courses, forums, and technokits.

FarmHelp. Through this app, farmers can identify the problem affecting his farm, such as plant diseases, by taking a photo and sending it to the FarmHelp desk. DA experts will then examine the problem based on the photo and will respond to the farmer within 24 hours upon receipt.



FSIS. Food Security Information System or FSIS is a web-based information system that retrieves, analyzes, and presents statistical data, indicators, and other information pertinent to food security in the Philippines at the national and sub-national level.

MOET App. MOET computes the appropriate field fertilizer requirements of a particular Philippine irrigated lowland rice cultivar and predict the rice yield if another fertilization plan is followed.

Philippine Rice Information System (PRISM). PRISM gathers and organizes information on rice area, yield, yield gaps and the causes of these yield gaps, and to provide this information to key stakeholders for policy support. PRISM relies on data from remote sensing, crop models, in-field crop surveys, and other fieldwork to deliver actionable information on rice crop seasonality; area; yield; damage from flood, wind, or drought; and yield-reducing factors, such as diseases, animal pests, and weeds

PhilRice Text Center. An SMS-based helpdesk and customer support service that caters to farmers or anyone interested in rice farming, who have queries on matters related to rice crop management (e.g. rice varieties, pest management)

Pinoy Rice Knowledge Bank. PinoyRKB is an online repository of productive rice farming information in the Philippines and a rich source of information to help you improve and localize your rice farming practices.

Rice Crop Manager. RCM provides a farmer with a personalized crop management recommendation after the farmer answers a series of questions. It is only for use with irrigated and rainfed rice grown in farm lots surrounded by bunds.

SARAI. Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines is a knowledge based portal where stakeholders can easily access science based farming technologies, interactive maps, decision, support systems, forecasts, and innovational farming materials.

Soils Information System. Soils Information System is an online knowledge bank for the types of soils suitable for rice farming. It also contains characteristics of the soils by depth and the provinces where these soils are distributed.

E-agriculture Vision for the Philippines

***Assumptions*.** The E-agriculture visioning presented in this chapter is founded on the findings discussed in the preceding chapters:

1. ***Food security and food safety are continuing problems***. The population of the Philippines is steadily rising while the number of Filipinos engaged in agriculture is decreasing. Sixty percent of the poor come from rural areas. The incidence of malnutrition is high and risks related to food safety are also high.

2. ***Climate change is impacting negatively on food security***. Climate change will reduce food production. The country's high vulnerability is exacerbated by natural disasters and man-made environmental problems.

3. ***The Philippines is now an information society***. The country has leapfrogged from an agricultural based economy to an information-based economy. Filipino ICT user rates are among the highest in the world.

4. ***E-Agriculture is actively but uncoordinatedly practiced***. Within a thriving information society, information, communication and knowledge resources can be brought to bear successfully on rural development and agricultural problems. Within and beyond the Department of Agriculture, innovative services and solutions are being designed and developed. However, these have occurred without the benefit of a coherent strategy, an umbrella policy, or a program.

5. ***The DA's Ten-Point Agenda accommodates E-agriculture***. We should note that each of the items in the DA's ten-point agenda can very well be supported by information and communication technologies and services.

6. ***The time is ripe for an E-agriculture Strategy***. The policy environment for an e-agriculture strategy in the Philippines is conducive from the point-of-view of both the agriculture and information and communications technology sectors.

***Vision Statement*.** The DA Vision reads: "A competitive, sustainable, and technology-based agriculture and fishery sector, driven by productive and progressive farmers and fisherfolk, supported

by efficient value chains and well integrated in the domestic and international markets contributing to inclusive growth and poverty reduction."

This vision may be rearticulated into the following E-agriculture Vision Statement for the Philippines:

We envision a competitive, sustainable, and technology-based agriculture and fishery sector, driven by productive, progressive and climate smart farmers and fisherfolk, supported by information and communication technologies, services and solutions and efficient value chains well integrated in the domestic and international markets contributing to inclusive growth and poverty reduction.

Mission Statement. Currently, the DA Mission is: "To help and empower the farming and fishing communities and the private sector to produce enough, accessible and affordable food for every Filipino and a decent income for all."

This mission may be rearticulated into the following E-Agriculture Mission Statement for the Philippines:

Our Mission is to assist, capacitate and empower the farming and fishing communities and the private sector with information and communication technologies, services and solutions to produce enough, accessible and affordable food for every Filipino and a decent income for all.

Goal Statement. Chapter 4 of the Philippine Development Plan 2011-2016 targets three rural development goals: food security improved and incomes increased; sector resilience to climate change risks increased; and policy environment and governance enhanced. The E-Agriculture Goal Statement would read:

The goals of the e-agriculture strategy for the Philippines are: improved food security and increased farm incomes; increased sector resilience to climate change resilience; and enhanced rural development policy environment and governance through the design, development, administration, coordination and monitoring of information and communication technology services, solutions and programs by the Year 2022.

***E-agriculture Expected Outcomes*.** Adopting the E-agriculture Strategy is expected to lead to sixteen outcomes:

1. Increased accuracy and timeliness of monitoring & evaluation data.
2. More effective planning and monitoring of agricultural law enforcement.
3. Sounder management decisions influenced by timely/ accurate data and actionable information.
4. Increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management.
5. Increased effectiveness in agriculture decision making among DA officials, farmers and other stakeholders.
6. Improved capacities to collect, analyze, store and share agriculture information for daily decision making purposes.
7. Decreased transaction costs in agricultural marketing.
8. Decreased information asymmetries in agriculture marketing.
9. Improving coordination and transparency in rural markets.
10. Strengthened networks for agricultural information sharing within and among farmers' associations/ cooperatives or producers and processors.
11. Improved access to ICT services among rural farmers, extension workers and other stakeholders.
12. Improved access to agriculture and fisheries production and post-production technologies.
13. Increased knowledge, better attitudes and improved agricultural and fisheries practices.
14. Reduced climate uncertainties.
15. Enhanced preparedness and response to disasters and other risks.
16. Increased resilience due to climate change adaptation information.

Priorities and Strategic Thrusts. The Duterte Administration has identified three agricultural sector priorities: staple food commodities; high value crops to generate foreign earnings; and food sufficiency. Dovetailing these, the E-agriculture Strategy should implement three programs:

1. ICT services and solutions for staple food production.
2. ICT services and solutions for high value crops intensification, post-harvest and marketing.
3. ICT services and solutions for the availability and affordability of food.

Furthermore, the E-agriculture Strategy for the Philippines will adopt four strategic thrusts:

1. Sector-wide Data Collection and Analysis;
2. Research and Innovation Data Management.
3. Production and Value Chain Support Services; and
4. Agricultural Knowledge Management.

Strategic Framework. Situating these elements within a matrix results in this Strategic Framework:

VISION STATEMENT	We envision a competitive, sustainable, and technology-based agriculture and fishery sector, driven by productive, progressive and climate smart farmers and fisherfolk, supported by information and communication technologies, services and solutions and efficient value chains well integrated in the domestic and international markets contributing to inclusive growth and poverty reduction.
MISSION STATEMENT	Our Mission is to assist, capacitate and empower the farming and fishing communities and the private sector with information and communication technologies, services and solutions to produce enough, accessible and affordable food for every Filipino and a decent income for all.
GOAL STATEMENT	The goals of the E-Agriculture Strategy for the Philippines are: improved food security and increased farm incomes; increased sector resilience to climate change; and enhanced rural development policy environment and governance through the development, administration, coordination and monitoring of ICT services, solutions and programs by Year 2022.

	STRATEGIC THRUSTS			
PROGRAMS	**Sector-wide Data Collection & Analysis**	**Research and Innovation Data Management**	**Production and Value Chain Support Services**	**Agricultural Knowledge Management**
ICT4 Staple Food Production **ICT4 High Value Crops** **ICT4 Food Availability and Affordability**	• Increased accuracy and timeliness of monitoring & evaluation data • More effective planning and monitoring of agriculture and fisheries law enforcement • Sounder management decisions influenced by timely/ accurate data and actionable information	• Increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management • Increased effectiveness in agriculture and forestry decision making among DA officials, farmers and other stakeholders • Improved capacities to collect, analyze, store and share agriculture information for daily decision making purposes	• Decreased transaction costs in agricultural marketing • Decreased information asymmetries in agriculture and forestry marketing • Improving coordination and transparency in rural markets • Strengthened networks for agricultural and forestry information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors	• Improved access to ICT services among rural farmers, extension workers and other stakeholders • Improved access to agriculture and fisheries production and post-production technologies • Increased knowledge, better attitudes and improved agricultural and fisheries practices • Reduced climate uncertainties • Enhanced preparedness and response to disasters and other risks • Increased resilience due to climate change adaptation information

National E-Agriculture Strategic Plan

Entry Points in the Ten-Point Agenda

AGENDA 1: A National Color-Coded Agricultural Guide Map

The Adaptation and Mitigation Initiative in Agriculture or AMIA supported the development of new planning tools that consider the challenges of climate change, to assist Filipino farmers and fisherfolk, and all other stakeholders, including the private sector, towards climate-ready crop management systems, while ensuring science-based interventions by the government. This supports the President's vision to remove the guesswork in Philippine farming, first by providing color-coded guide maps that identify the areas where crops could be ideally grown based on soil types, climatic conditions, and bio-physical requirements. This initiative is also intended to ensure food security and reduce poverty incidence in the agriculture & fisheries sector.

E-Agriculture Entry Point. The first of the planning tools developed under the program is the AMIA National Color-Coded Agricultural Guide (NCCAG) Map. The color-coded map identifies the crops that are most suitable in agricultural parcels, and overlays soil properties, elevation, rainfall pattern, temperature and more importantly, the projected climate-induced multi-hazards. The maps will guide the government in determining forward-looking policies and site-specific food production projects and infrastructure investments. As a decision support tool, the color-coded map can be used for investment planning, climate-resilient research and development, innovative credit and insurance packages, climate-resilient agriculture and fisheries extension, infrastructure and disaster management. It will be useful for LGUs in preparing their CLUPs, planning disaster risk reduction measures and climate change adaptation technologies and practices.

Strategic Thrusts: Sector-wide Data Collection and Analysis; Research and Innovation Data Management; Agricultural Knowledge Management

Related E-agriculture Projects: Development of Big Data Platform for real time monitoring systems; Color coded crop mapping monitoring system; Precision farming using agri-bots; Farmer's and fisher folk's database.

AGENDA 2: A National Food Consumption Quantification Study

A nationwide survey will be conducted to determine the most consumed and in-demand foodstuff and agricultural commodities for all Filipinos. This initiative will also establish the food consumption rate in relation to population growth of the country, allowing the government to think ahead and pursue programs and projects that address food concerns proactively.

E-Agriculture Entry Point. Big data platform for real time consumption quantification

Strategic Thrust: Sector-wide Data Collection and Analysis; Research and Innovation Data Management

Related E-agriculture Projects: Community Level Information System-Barangay Network Project (CLIN-BNP); and the National Farmers/ Fisherfolk Database System.

AGENDA 3: An institutional restructuring and paradigm resetting for the Department of Agriculture and its officials and employees

Nationwide orientation and mind setting for all officials and employees of the DA to ensure that they are guided on the priorities of the Duterte Presidency in agriculture and fisheries and the road map for the mission to provide Available and Affordable Food for the Filipinos is clearly explained.

E-agriculture Entry Point. Online certificate course on the Duterte agricultural doctrine via the DICT Gabay Aral learning management system. The certificate earned will be credited for employment or promotion.

Strategic Thrust: Agricultural Knowledge Management

Related E-agriculture Project: Information and Communications Technology Support for DA Staff.

AGENDA 4: An intensive technology updating and sharing, modernization and mechanization program

The Department is braving the challenges of the new world by embarking in various technological advancements aimed at increasing and improving productivity in the agriculture sector.

For one, DA is looking into the utilization of solar panels for various agricultural activities, including small water systems to irrigate the farmlands. With the aid of the solar panels, water will be sourced underground which may be used for irrigation, water for fish tanks/ pens and even hydroelectric power.

E-agriculture Entry Point. The DA is considering innovations in information technology that would give farmers access to needed information about plant and animal diseases and weather forecasts. A similar technology developed into an application for smart phones can also guide an individual where to sell or buy farm supplies.

Strategic Thrust: Research and Innovation Data Management; Production and Value Chain Support Services; Agricultural Knowledge Management

Related E-agriculture Projects: The following initiatives lend support to this agenda: Community Level Information System-Barangay Network Project (CLIN-BNP); Knowledge Center for agriculture and fisheries towards interactive knowledge sharing; Upscaling of Precision Farming using Agri-bots: Attaining Food Security with the help of Space Technologies; AgriHackathon; and ICT Support to the Agri-Fisheries Mechanization Engineering Resource Network.

AGENDA 5: An easy access financing program for farmers, fishermen and agriculture and fisheries stakeholders

Adhering to the directives of the DA Secretary, the Agricultural Credit Policy Council will set up a lending package providing crop insurance loan for high-risk areas. In addition, the LandBank of the Philippines, under a partnership with DA will come up with a sizable funding for the inland fisheries, fishponds and fish cage industries to prevent an acute shortage of fish supply in the country.

E-agriculture Entry Point. Weather index based crop insurance supported by a smart phone or tablet apps for in situ actuarial computations of crop insurance premiums and benefits.

Strategic Thrust: Sector-wide Data Collection and Analysis

Related E-agriculture Project: Community Level Information System-Barangay Network Project (CLIN-BNP); Support for Department of Agriculture's Trade Enabling Risk Management System; Department of Agriculture Trade System Expansion and Upgrading of ICT Facilities and Equipment of Research Centers/ Stations and Quarantine Stations/Ports; Agricultural Marketing System; Farm-level Agricultural Marketing Exchange Information System (FLAMES).

AGENDA 6: A strategic and effective post-harvest, storage and processing facility

Part of Secretary Piñol's priority agenda is the full-operation of the Benguet Trading Center, which will later be turned-over to the farmers of the Cordillera. CAR, which a major producer of highland veggies and dubbed as the Salad Bowl of the Philippines was chosen to house the largest trading center of agricultural produce to assist the vegetable growers of the highlands. Benguet produces 90% of the total production in the region.

E-agriculture Entry Point. Monitoring system for the compliance of good agricultural practices standards in organic farming and food safety.

Strategic Thrust: Production and Value Chain Support Services

Related E-agriculture Project: Support for Department of Agriculture's Trade Enabling Risk Management System; Market Promotion Portal for Expansion of Agricultural Commodities; Development of food safety and agro-fishery machinery standards/ BAFS infrastructure; Agricultural Marketing System (AMS) - Farm-level Agricultural Marketing Exchange Information System (FLAMES); and ICT Support to the Agri-Fisheries Mechanization Engineering Resource Network.

AGENDA 7: A government-initiated and supported aggressive marketing campaign especially for high-value crops in foreign markets

Under the new DA management, high-value crops like rubber, oil palm, banana, abaca, coconut, and marine products will be given full support. For instance, a Coconut Productivity and Rehabilitation Agenda, which aims to develop almost 600,000 hectares of coconut crops, was designed.

In line with the target of boosting farmers' market access and income, the DA chief has vowed to personally lead the promotions and marketing for the local agriculture, fisheries, and organic food in international markets including the heirloom rice of the Cordillera highlands.

E-agriculture Entry Point. Design and development of an integrated market information, post-harvest monitoring and inventory tracking system or high value crops.

Strategic Thrust: Production and Value Chain Support Services; Agricultural Knowledge Management

Related E-agriculture Project: Support for Department of Agriculture's Trade Enabling Risk Management System; Market Promotion Portal for Expansion of Agricultural Commodities. Development; Agricultural Marketing System (AMS); and Farm-level Agricultural Marketing Exchange Information System (FLAMES).

AGENDA 8: A coordinated program with other agencies of government to ensure the protection and preservation of water sources, especially watershed

DA, alongside the Bureau of Fisheries and Aquatic Resources and the Department of Environment and Natural Resources, is directed to bring back the polluted Laguna de Bay to the pristine state it was in some hundred years ago. As such, various measures towards a cleaner water resource and bigger source of fish catch for the small fishers will be undertaken. DA will also carry out an Agro-Forestry Program, which will delegate a family to protect and take care of a designated area planted to fruit-bearing tree species, providing them a stable income and source of food.

E-agriculture Entry Point. Use of GIS technology to monitor and analyze protection and preservation of water bodies and watersheds.

Strategic Thrust: Agricultural Knowledge Management

Related E-agriculture Projects: Support for Department of Agriculture's Trade Enabling Risk Management System; Rehabilitation of FITS Center affected by disasters through the provision of IEC and ICT equipment (ATI); Farm Lot Geo-referencing and integration of Drone in DRRM Strategies; Upscaling of Precision Farming using Agri-bots: and Attaining Food Security with the help of Space Technologies.

AGENDA 9: A relentless campaign for the enforcement of agricultural and fisheries laws, especially on land conversion and illegal fishing

Following the success of the closed-season policy of DA-BFAR, resulting to the lifting of the yellow card slapped to the country by the European Union, the Agriculture Department will carry on with the implementation of the initiative, to give ample time for marine resources to replenish and restore.

E-agriculture Entry Point. The use of drone technology and satellite imagery to monitor violations and enforcement of agricultural and fisheries laws.

Strategic Thrust: Sector-wide Data Collection and Analysis; Agricultural Knowledge Management

Related E-agriculture Projects: Community Level Information System-Barangay Network Project (CLIN-BNP); Establishment of Management System for Business Process, M&E Systems and ICT Support Services; Knowledge Center for agriculture and fisheries towards interactive knowledge sharing; Establishment of Agri-Aksyon Sentral and Bukid Techno Center Hub in the Philippines; Farm Lot Geo-referencing and integration of Drone in DRRM Strategies.

AGENDA 10: Re-introduction of basic agriculture in the primary and elementary grades of the Philippine school system

Tapping the Department of Education, DA will revive basic gardening as a special activity for elementary school children in both public and private schools all over the country. The initiative seeks to encourage the youngsters to get acquainted with agriculture and eventually develop a liking for the sector. DA will provide technicians, gardening tools, seeds, organic fertilizers and even irrigation equipment for the program.

E-agriculture Entry Point. Provision of online learning modules on basic agricultural knowledge and skills using the Gabay Aral learning management system of DICT.

Strategic Thrust: Agricultural Knowledge Management

Related E-agriculture Project: Agriculture Hackathon 2017, and Information and Communications Technology Support for DA Staff.

e-Agriculture Theory Of Change

Programs. Since the E-Agriculture theory of change for the Philippines is based on a five-year strategic plan instead of an annual operational or action plan, its components are limited to the following: programs; intermediate outcomes; and final/ultimate outcomes.

The E-Agriculture Strategy for the Philippines will have three priority programs:

- Program 1. ICT for Staple Food Production (ICT4SF)
- Program 2. ICT for High Value Crops (ICT4HVC)
- Program 3. ICT for Food Availability and Affordability (ICT4FAA)

***Intermediate Outcomes*.** To review, the E-Agriculture Strategy will have sixteen (16) outcomes. We will classify these outcomes under the strategy's four strategic thrusts to generate the following list:

1. Sector-wide Data Collection and Analysis

    1.1. Increased accuracy and timeliness of monitoring & evaluation data;
    1.2. More effective planning and monitoring of agricultural law enforcement; and
    1.3. Sounder management decisions influenced by timely/ accurate data and actionable information.

2. Research and Innovation Data Management

    2.1. Increased efficiencies in information flow, data gathering and analysis, traceability, transactions and supply chain management;
    2.2. Increased effectiveness in agriculture and forestry decision making among DA officials, farmers and other stakeholders; and
    2.3. Improved capacities to collect, analyze, store and share agriculture information for daily decision making purposes.

3. Production and Value Chain Support Services

    3.1. Decreased transaction costs in agricultural marketing;
    3.2. Decreased information asymmetries in agriculture and forestry marketing;

3.3. Improving coordination and transparency in rural markets; and
3.4. Strengthened networks for agricultural and forestry information sharing within and among farmers' organizations and associations/ cooperatives or producers and processors.

4. Agricultural Knowledge Management

4.1. Improved access to ICT services among rural farmers, extension workers and other stakeholders;
4.2. Improved access to agriculture and fisheries production and post-production technologies;
4.3. Increased knowledge, better attitudes and improved agricultural and fisheries practices;
4.4. Reduced climate uncertainties;
4.5. Enhanced preparedness and response to disasters and other risks; and
4.6. Increased resilience due to climate change adaptation information.

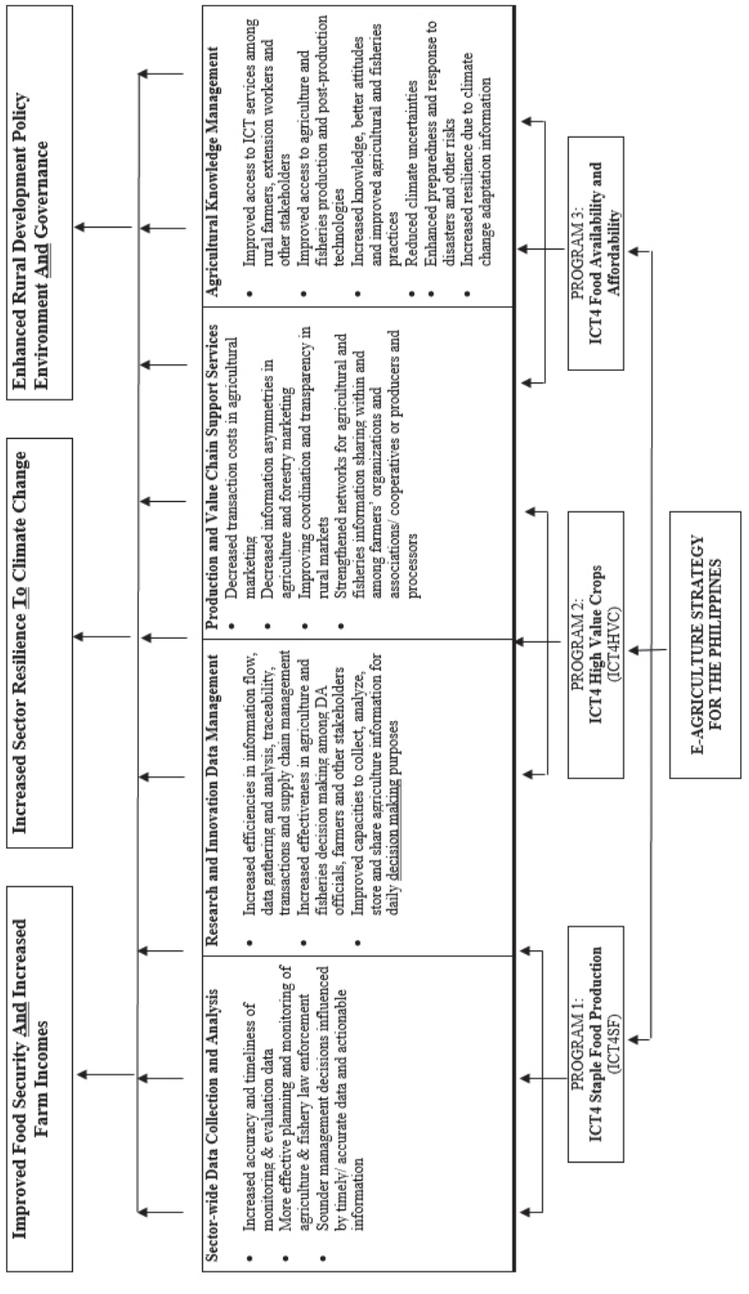
***Final Outcomes*.** Guided by the Philippine Development Plan's goals on rural development, the ultimate outcomes of the strategy are:

1. Improved food security and increased farm incomes.
2. Increased sector resilience to climate change.
3. Enhanced rural development policy environment and governance.

***Results Chain*.** Linking the programs to the intermediate outcomes and the ultimate outcomes will produce the results chain found aat the next page.

Five-Year Strategic Plan

***Programmatizing E-Agriculture in the Philippines*.** The very first page of this document argues that a comprehensive national strategy prevents E-agriculture projects from being implemented in



isolation and develops efficiency gains from intra and inter sector synergy. One unique element in the Philippine E-Agriculture scene is the preponderance of ICT for agriculture initiatives from almost all of the bureaus, attached agencies and partners of the Department of Agriculture. Offices under the Department of Science and Technology, the Department of Environment and Natural Resources, and the Department of Education not to mention international organizations (IRRI, ADB, USAID, etc.) private corporations, nongovernment organizations and state colleges and universities also have E-Agriculture related projects some of which predates the 2000 Okinawa Summit of G7 Nations that initiated the World Summit for the Information Society. APPENDIX B is a partial inventory of such projects some of which were already described in Chapter IV.

As already stated in a couple of instances, the variety and diversity of E-Agriculture projects currently being implemented within and beyond the Department of Agriculture is quite extensive. However, these projects were planned, designed and developed independently from one another without the benefit of an umbrella E-Agriculture policy or program. Hence, most of these services are not interoperable. Much of the data are unmigratable. For so long, attempts have been made to standardize even the most basic and critical of platforms, geographic/geospatial information systems. However, Philippine E-Agriculture actors still do not employ a standard base map, database, or software for their projects.

***E-Agriculture Policy*.** The biggest challenge is to bring all these initiatives within a coherent and cohesive strategy that addresses the country's agricultural and rural development goals, situate them within component programs, and adopt an inclusive set of output and outcome indicators for monitoring purposes. Thus the very first task in the strategic plan is to draft and adopt a policy that establishes E-Agriculture under one umbrella that reflects the goals of the Philippine Development Plan and the Duterte Administration. This policy will take the form of a department administrative order (DAO) the main executing agency of which would be the DA Information and Communications Technology Service. The policy should have the following provisions:

- Establishing a National E-Agriculture Program (NEAP)
- Conduct of Annual National Congresses of E-Agriculture
- NEAP will have three priority programs: Program 1. ICT4 Staple Food Production; Program 2. ICT4 High Value Crops; and Program 3. ICT4 Food Availability Affordability
- Specific E-Agriculture projects, solutions and services under these programs may be independently planned by agencies within and without the Department of Agriculture, the only prerequisite being coordination with the DA
- All existing, planned and future projects, solutions and services will be situated under these programs for purposes of registration, standards, coordination, and monitoring and evaluation. Incentives for registration include partial financial support (if applicable), national promotion, networking, sharing and reuse of resources and products
- Identifying DA ICTS as the clearinghouse of E-Agriculture programs, projects, solutions and services

Tasks and Milestones

TASKS	MILESTONES
1. Programmatize E-Agriculture 1.1. Prepare Department Administrative Order 1.2. Establish E-Agriculture Clearinghouse at DA-ICTS 1.3. Register current and planned services/solutions 2. Implement Program 1. ICT4SF 2.1. Situate ICT4SF projects/services/solutions 2.2. Coordinate ICT4SF projects/services/solutions 2.3. Monitor ICT4SF projects/service/solutions 3. Implement Program 2. ICT4HVC 3.1. Situate ICT4HVC projects/services/solutions 3.2. Coordinate ICT4HVC projects/services/solutions 3.3. Monitor ICT4HVC projects/service/solutions 4. Implement Program 3. ICT4FAA 4.1. Situate ICT4FAA projects/services/solutions 4.2. Coordinate ICT4FAA projects/services/solutions 4.3. Monitor ICT4FAA projects/service/solutions 5. Evaluate NEAP	1. NEAP DAO Signed 2. First E-Agriculture Congress 3. Second E-Agriculture Congress 4. Third E-Agriculture Congress 5. Fourth E-Agriculture Congress 6. Submission of Evaluation Report

ICT FOR MODERNIZATION: AGRICULTURAL EXTENSION FOR MYANMAR

Introduction

Background. After more than fifty years characterized by economic downturns, Myanmar is now on the verge of becoming a new Asian 'tiger.' The country's gross domestic product increased by over 8% per year from 2010 to 2016. Over the same period agricultural GDP has expanded at an average rate of 3.2%.

While some of its ASEAN neighbors have already transitioned to an information-based economy, Myanmar is still an agricultural country with about 28% of GDP and over two thirds of employment accounted for by agricultural transactions and agriculture labor, respectively. The sector is a key source of foreign exchange earnings, over $3.1 billion in 2015/2016 through exports of products such as pulses, rice, shrimp, livestock, and rubber. There is still a growing interest in the development potential of this sector.

In Myanmar, agricultural sector development is marshalled by the Ministry of Agriculture, Livestock and Irrigation. MOALI resulted from the merging of three Ministries (Agriculture and Irrigation; Livestock Fisheries and Rural Development; and Cooperatives). Consequently, MOALI is in urgent need of restructuring.

An Agricultural Development Strategy (ADS) based on Myanmar's Agricultural Policy was crafted as an integrated and shared strategy for the newly merged ministry. Crafted by a diverse group of stakeholders, the policy determines the development strategies for adoption which in turn will guide agricultural programs, projects and activities. ADS aims to identify clear priorities in the short, medium and long terms, its development being consistent with existing strategic documents of the government.

Rationale. Extension is one of the critical functions of the Ministry. Currently, Myanmar has a large network of extension institutions and physical facilities strategically located in all agro-ecological regions of the country. There are considerable land areas made available

as research, seed or extension farms. Since the merging of the three Ministries, the Extension Division under the Department of Agriculture has taken responsibility for the spread of agriculture and rural development innovations across the country. However, there are subsectors other than agriculture, such as livestock and irrigation that are directly linked to the development pathway. This has raised the need for the adoption of integrated extension approaches that would promote appropriate technical recommendations that guarantee farmers' livelihood and food security.

The extension service is yet to prove its mettle in increasing agricultural productivity for high value crops, livestock, and aquaculture. Moreover, most extension plans and projects have not fully addressed farmers' needs, constraints and ensured sustainability of programs. Specialized training based on farmers' needs and constraints, agro-ecological and socio-economic conditions, are virtually lacking in Myanmar. An extension support system involving E-Agriculture, farmers' networks, coordination mechanisms and linkages with other relevant agencies is perceived as an important contributing factor for a modernized agricultural extension service.

To achieve the goals of the Agricultural Development Strategy, a robust modernized agricultural extension system needs to be established. This document proposes an Agricultural Extension Modernization Strategy to reform and restructure Myanmar's extension service consistent with ADS. It gives a strategic framework and outlines a program of projects and activities for this purpose.

Situation Analysis

The modernization of agricultural extension in Myanmar is faced with both challenges and opportunities.

Sub-sectoral Concentration. The primary challenge to the extension service is the current manpower and resources concentration on the agriculture sub-sector. To begin with, the extension service is severely lacking in manpower. Myanmar currently has a population of 54.9 million. Seventy percent live in the rural

areas. The Ministry has only 8000 extension workers nationwide. There is roughly only one extension worker for every 80,000 farmers. An extension worker covers an average of 70,000 acres of farmland.

These 8,000 extension workers belong to the Department of Agriculture and are focused on crops. However, the livestock, fisheries and rural development sub-sectors, equally need agricultural extension services. These sub-sectors may require catching-up and thus may entail more capacity development efforts.

Recruitment of New Sub sectoral Extension Workers. There is definitely a need to recruit more extension workers. Recruitment should provide adequate provisions for the strengthening of extension services for the Department of Fisheries and the Livestock Breeding and Veterinary Department not to mention the irrigation and rural development sub-sectors.

Strengthening capacities of State Colleges and Universities of Agriculture. It must be pointed out that even if the Ministry can invest more in extension manpower, there might not be enough supply of extension graduates from the state agricultural colleges or universities. The proposed strategy should also cover the supply side of agricultural extension, namely improving agricultural extension higher educational institutions (HEI's).

The ADS proposes the consolidation of the university system to include colleges of agriculture, livestock and aquaculture. The consolidated universities will include different disciplines including agricultural extension and communications. Furthermore, the existing 3-year diploma curricula of State Agricultural Institutes will cover all states and regions to provide training on all key sectoral disciplines including extension.

***Adoption of Innovative Extension Modalities*.** There is also a need to explore alternative extension modalities. The mobilization of community extension resources for extension purposes should also be maximized. Additionally, the revitalization of the Farmers' Field Schools and its expansion to the fisheries and livestock sub-sectors should be explored.

Science of Delivery. Consider a situation where the delivery of extension services is assumed by parties other than the government extension worker. FAO Myanmar is currently conducting a project that engages community animal health workers from among the ethnic populations of Myanmar. This participatory approach is the extension model of choice of the Livestock Breeding and Veterinary Department. This participatory approach closely resembles the *science of delivery* or SOD model currently being promoted by the World Bank. SOD believes that demand-driven technologies and services are not enough to bring about a desired result. There must also be effective delivery encompassing the following features: Capture/Share Local Knowledge; Training on Delivery; Applied Research; and Framework.

This strategy may be adopted in other agricultural subsectors and mainstreamed within the agricultural extension service of the entire sector. Community extension workers should be capacitated with training and ICT services and solutions. Other opportunities should be provided for them considering that they are non-salaried community development workers.

Changing Role of Extension Workers. Consistent with SOD is the changing role of government extension workers from actual delivery to facilitation. In fact, with this shift of responsibilities, the lack of extension personnel need not be addressed exclusively by hiring additional staff. Indeed, the ADS is not advocating a massive increase of human resources in the extension service. It is promoting capacity building of existing extension workers and the transformation of their role from delivery agents of extension services to overall facilitators of agricultural extension service providers. This role change will be accompanied by a greater emphasis on the delivery of services at the village level by service providers, which may come from the private sector, nongovernment organizations, or from the ranks of the farmers themselves.

Farmers' Field Schools (FFS). The curricula for the FFS should be revitalized to include adaptive land management techniques. The concept should be expanded to the other sub-sectors. The Department of Fisheries is operating three fisheries schools or

training centers that serve as its main extension platform. They can be transformed into fisherfolk field schools with a revitalized curriculum incorporating coastal resources and inland fisheries ecology concepts. Furthermore, the fisheries officers involved as trainers should be part and parcel of the sectoral agricultural extension system. E-agriculture services and solutions should be designed for them. They should be able to avail themselves of capacity development opportunities that the modernization strategy would result in.

***E-Agriculture*.** Possibly the most important element in the agricultural modernization strategy is the use of new information and communication technologies to expand the reach of extension services.

E-agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. Globally, the challenges facing agriculture have grown in number and in scale. These include: hunger; malnutrition; post-harvest loss and wastage; unsafe food; unsustainable farming practices; loss of biodiversity; and loss of arable land exacerbated by floods, drought, and extreme weather conditions brought about by climate change. These problems may be addressed in whole or in part by an equally global phenomenon, the development and spread of new information and communication technologies (ICTs), service and solutions.

E-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICT in the rural domain, with a primary focus on agriculture. In recent years, opportunities for ICTs in agriculture have grown exponentially from low-end technologies (rural radio, mobile phones and SMS) to high-end solutions (drones and the Internet of Things) encompassing precision agriculture, remote sensing, early warning systems and connected networks.

Agricultural Extension Modernization and E-Agriculture. E-agriculture includes standards, norms, methodologies, tools, development of individual and institutional capacities, and policy support. A national

e-agriculture strategy will help rationalize financial and human resources, harness ICT opportunities and address challenges in the agricultural sector. A comprehensive national strategy prevents E-agriculture projects from being implemented in isolation and develops efficiency gains from intra and inter sector synergy. The Food and Agriculture Organization (FAO) and the International Telecommunications Union (ITU) have developed an E-agriculture Strategy Guide to facilitate decision makers in developing a national E-agriculture vision, action plan and implementation strategy. The proposed Agricultural Extension Modernization Strategy, albeit wider in scope, closely resembles and, in the case of Myanmar, may substitute for a national E-Agriculture strategy.

Alignment with Initiatives eGovernance and the Telecommunications Sector. It is a most opportune time for the Ministry of Agriculture, Livestock and Irrigation to embark on E-Agriculture. The Posts and Telecommunications Department of the Ministry of Posts and Telecommunications is currently implementing the five-year World Bank Telecommunications Sector Reform Project. Ending in 2019, this project has three components: eGovernment; policy reform of the telecommunications sector; transforming the MTC into a government corporation to effectively participate in the telecommunications services market. Through this project, the provision of telecommunications services to far-flung rural and remote areas of Myanmar is being initiated. This is in line with the Last Mile Hypothesis proposed by Michael Calvano in 2002. Calvano, then the Regional Director of the International Telecommunications Union, submitted that, in developing countries, telecommunications infrastructure will advance not because of what are traditionally regarded as impetus for growth such market forces, competition and private sector involvement. It can only spread from the backbone to the periphery with its use by the government in the provision of basic services (such as communications, agricultural extension, or health).

A second phase of this World Bank project is anticipated and will be called Digital Myanmar. The agricultural extension system should participate in this phase as content, service and solutions provider along the lines of the last mile hypothesis, where the

provision of basic government services will lead to the development of telecommunications infrastructure from the backbone to the peripheries.

Alignment with Initiatives from the Private Sector. Currently, a private sector initiative called XYNTEO Rural Growth Coalition is piloting a project in Myanmar employing the following work streams or program approaches:

- Work stream 1: Village outreach model
- Work stream 2: Platform and technology
- Work stream 3: Live testing and refinement

These work streams may easily form part and parcel of E-Agriculture interventions and vice-versa.

XYNTEO's program partners are corporate giants in the food, agribusiness, ICT, academe and finance. They include Unilever, Google, Ericsson, Plan International, Yoma Bank and the Asian Institute of Technology. The pilot phase timeline is from 2017 onwards. It is an opportunity for Myanmar E-Agriculture to gain synergies with the private sector.

Agricultural Extension Modernization Strategy

***Situating the Modernization Strategy within ADS*.** In the pathway to change adopted by this strategy, agricultural extension modernization will lead to Myanmar Agricultural Development Strategy's OUTCOME 2: *Increased Productivity and Farmers' Income*.

Among the activities outlined in the ADS is the "review of the extension system and formulate national extension policy and strategy, encompassing the functional mandate of MOALI (crops, livestock, fisheries, cooperatives, and rural and community development), and paying attention to the priorities of the Agricultural Policy and ADS Vision, including food security and nutrition, socio-economic well-being of farmers and development of the national economy."

This proposed modernization strategy is an actualization of the aforementioned ADS activity and will thus be guided by the Agricultural Policy and ADS Vision. Please refer to the APPENDIX for a detailed enumeration of the provisions on agricultural extension found in the Agricultural Development Strategy.

Within the ADS context, modernization directly contributes to OUTPUT 2.2. Agricultural Extension: *Transformed agricultural extension system delivering improved (crop, livestock, fisheries) products and technology for adoption and adaptation*; and OUTPUT 2.3. Research-Extension Coordination - *Improved research-extension coordination systems with participation of farmers and private sectors.*

The following strategic framework, guided by the Agricultural Policy and ADS, describes how.

***Strategic Framework*.** Agricultural extension modernization in Myanmar will be based on a strategic framework composed of the following elements: Vision Statement; Mission Statement; Goal Statement; and Strategic Thrusts.

Vision Statement. Based on the ADS and upon consultation with MOALI and NGO partners, this Strategy adopts the following vision statement:

"We envision a transformed agricultural extension system delivering, through E-agriculture and other innovative mechanisms, improved crop, livestock and fisheries products and technology for adoption and adaptation by farmers in Myanmar resulting in: food safety and security; competitive and stable markets; increased incomes; poverty alleviation; technology development; and farmers' protection."

Mission Statement. Based on the ADS and upon consultation with MOALI and NGO partners, this Strategy adopts the following mission statement:

"Our mission is to modernize agricultural extension with E-agriculture programs covering the crop, livestock and fisheries subsectors

and to improve research-extension coordination systems with the participation of farmers and the private sector contributing to: sustainable development goals; food security, nutrition and safety; effective networking across value chains; and interministerial collaboration."

Goal Statement. Based on the ADS and upon consultation with MOALI and NGO partners, this Strategy adopts the following vision statement:

"*By the Year 2020, a transformed agricultural extension system and improved research-extension interface shall enable: the adoption of good agricultural practices (GAP); the development of farmer community networks; and increased production of safe agricultural products and market access significantly contributing to increased productivity and farmers' income*."

Strategic Thrusts. As part of the modernization strategy, the thrusts of the agricultural extension community from 2017 to 2020 should revolve around:

Policy Development. Appropriate ministerial decrees on the modernization and revitalization of the extension system should be crafted based in the proposed strategy and consistent with the ADS. Additionally, E-agriculture concerns should be included in initiatives to amend and update the Myanmar Telecommunications Law. Furthermore, guidelines on the piloting of the eVillage Project should be developed.

Institutional Development. The MOALI should be strengthened with adequate provisions for its organizational restructuring and infrastructure development for agricultural extension. The functions and responsibilities of departments and divisions vis a vis agricultural extension should be specified.

Network Development. There is a need to develop electronic, institutional and social networks for agricultural extension at the national, provincial, district, township and community levels. These networks should extend to agricultural stakeholders.

Capacity Development. This strategic thrust involves the provision of long-term and short term training for extension workers, middle level, and higher level officers. These training programs should likewise be extended to farmers.

Programs

Policy Development Program. A Policy Development Program under the Agricultural Extension Modernization Strategy will be pursued consisting of the following policy initiatives:

Ministerial Decree on Agricultural Extension. A comprehensive national policy on agricultural extension should be crafted and implemented through a ministerial decree. A policy task force should be created to look into policy options and consequently to formulate the ministerial decree.

The decree should contain specific provisions on the restructuring of the current Extension Division of the Department of Agriculture. The mandate and coverage of the office must be studied. Should it be elevated as a Department of Extension covering all subsectors? Or should it remain under the Department of Agriculture? In whatever case, provisions on the institutional development of the office should be given. Furthermore, the ministerial decree must address strengthening the Research-Extension interface. It should also lead to the engagement of the Myanmar extension service in ASEAN agricultural extension initiatives.

Ministerial Decree on E-Agriculture. A ministerial decree on E-agriculture should likewise be crafted by the same policy task force. It will thus be called the Policy Task Force for Agricultural Extension and E-Agriculture. The decree will identify and prioritize E-agriculture applications to assist the extension process, i.e., market information systems, weather information, social media platforms, etc.

For instance, the ADS states that an information and knowledge system should be established to provide advisory services to farmers that: address their and other stakeholders' demand for

information and knowledge through facilitating direct contact with subject matter specialists; prepare and disseminate simple farmer-friendly technical documents, including manuals on crop, livestock, apiculture, fisheries and agri-business enterprises and activities and other tools; and promote and use ICT to interactively link extension workers and farmers with demonstrations, updated crop/animal/ fisheries husbandry manuals, and advisory services provided by research centers, call centers and knowledge centers. This system may be prioritized among all others. Alternatively, the packaging, promotion and dissemination of knowledge on improved production technologies for adoption by farmers with Commodity Manuals may be prioritized.

The ministerial decree must also contain guidelines on capacity building on E-agriculture and knowledge sharing protocols within the Ministry. Finally, the ministerial decree should promulgate the implementing rules and regulations in the piloting and mainstreaming of the eVillage Project.

Amendment of the Telecommunications Law. The Myanmar Telecommunications Law (Pyidaungsu Hluttaw Law No. 31, Series of 2013) must now be amended to incorporate E-agriculture concerns. The proposed amendment would include the participation of the agricultural extension service as content, service and solutions provider along the lines of the *last mile hypothesis*, where the provision of basic government services will lead to the development of telecommunications infrastructure from the backbone to the peripheries.

Institutional Development Program. An Institutional Development Program under the Agricultural Extension Modernization Strategy should be put in place with the following components:

Institutional Strengthening of the Extension Division. Informed by the proposed Ministerial Decree on Agricultural Extension, an institutional development program for the Extension Division (or Department of Extension) should be implemented. The program involves capability building for updated mandates, roles and Terms of Reference at the national, regional, provincial, district and township levels. Capability

building will also cover establishing specialized units such as farmers' training and adaptive research centers to jointly demonstrate research results and extension recommendations on modernized farming Institutional strengthening will also involve provision of ICT equipment including broadcasting facilities for rural radio and the corresponding budget support from the government and other funding agencies.

Additionally, the ADS suggests that National Agricultural Research and Extension System (NARES) be established to facilitate coordination between R&E.

Lastly, there is a need to upgrade and rationalize the current Yezin Agriculture Universities into one consolidated university with colleges for agriculture, livestock and aquaculture with both undergraduate and graduate degrees with upgraded agricultural extension and communications programs.

Network Development Program. One of the most important components of the Myanmar Agricultural Extension Modernization Strategy is E-Agriculture. Along this line, a network development program should be put into place. This program will have the following components:

Network Infrastructure Development. Broadband assets for the agricultural extension service should be made available in the entire country by year 2020. Mobile infrastructure and support should be made accessible to extension workers. MOALI's participation in Phase 2 of World Bank Telecommunications Sector Reform project would make this possible.

Delivery Systems Development. Along with network infrastructure delivery systems should also be designed, developed and tested. These include indigenous media, conventional media and new media as well as their interfaces. Mobile and connectivity amenities should be provided to extension workers.

Institutional Networking. It will form part of a stakeholder network of research centers, call centers and knowledge centers.

Stakeholder Networking. Under the Agricultural Extension Modernization Strategy an information and knowledge system to provide advisory services to farmers and other stakeholders should be established. This system will address farmers' and other stakeholders' demand for information and knowledge through facilitating direct contact with subject matter specialists. It will prepare and disseminate simple farmer-friendly technical documents, including manuals on crop, livestock, apiculture, fisheries and agri-business enterprises and activities and other tools. Furthermore, it will promote and use ICT to interactively link extension workers and farmers with demonstrations, updated crop/ animal/ fisheries manuals, and advisory services.

Capacity Development Program. Lastly, a capacity development program on E-agriculture and other relevant areas for agricultural extension workers, middle level officers and high level officers should be initiated. Farmers and other stakeholders should also partake of these training programs. ADS provides for training to build and strengthen capacities of agricultural, livestock, and fisheries extension services institutions and staff in participatory methods, social mobilization of farmer organizations, Farmer Field Schools (FFS), and Farmer Marketing Schools (FMS), including specialized training to field personnel to be sensitized to Gender Equality and Social Inclusion and nutrition.

Long-Term Training. These involve graduate scholarships locally and abroad. Areas of specialization include GIS, IT, extension and development communication.

Short-Term Training. These involve regular short courses for extension workers, community volunteers on E-agriculture applications.

eLearning and Blended Learning. These modes of instruction should be tapped by Yezin Agriculture University in collaboration with other institutions for offering basic and advanced extension programs. The Department of Extension should initiate eLearning program for farmers and private sector.

The Way Forward

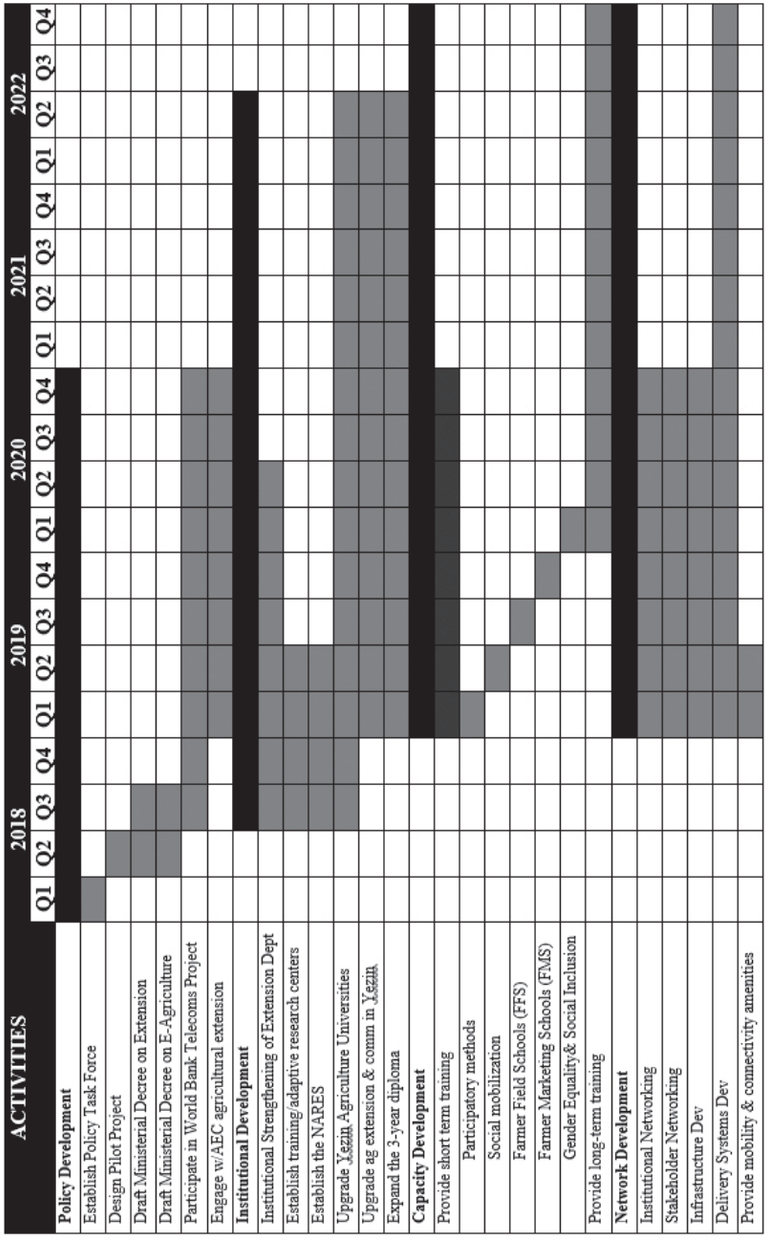
Next Steps. Assuming that the Agricultural Extension Modernization Strategy would be accepted in principle by the Ministry of Agriculture, Livestock and irrigation, the following next steps may be taken based on the programs proposed and the provisions of the ADS:

- Establish Policy Task Force to draft policy and advocacy agenda.
- Draft and process ministerial decrees on agricultural extension and E-agriculture.
- Design Pilot Project.
- Link up with XYNTEO Rural Growth Coalition Myanmar Pilot Project.
- Position Agricultural Extension in Phase 2 of World Bank Telecommunications Sector Reform Project.
- Engagement with ASEAN Economic Community agricultural extension initiatives.
- Provide training (long-term and in-service, with competency testing) and mobility and connectivity amenities to build and strengthen capacity of agricultural, livestock, and fisheries extension services institutions and staff.
- Strengthen capacity of field extension staff in participatory methods, social mobilization of farmer organizations, Farmer Field Schools (FFS), and Farmer marketing Schools (FMS), including specialized training to field personnel to be sensitized to Gender Equality and Social Inclusion and nutrition.
- Establish information and knowledge system to provide advisory services to farmers:
    - Address farmers' and other stakeholders' demand for information and knowledge through facilitating direct contact with subject matter specialists.
    - Prepare and disseminate simple farmer-friendly technical documents, including manuals on crop, livestock, apiculture, fisheries and agri-business enterprises and activities and other tools.
    - Promote and use ICT to interactively link SBS, extension workers and farmers with Knowledge

System, demonstrations, updated crop/animal/ fisheries husbandry manuals, and advisory services – include research centers, call centers and knowledge centers.

- Build and strengthen capacity of agricultural, livestock, and fisheries extension services institutions and staff through adequate training (long-term and in-service with competency testing), mobility, connectivity.
- Conduct in-depth study of agricultural, livestock, and fisheries extension and research systems with view to improve coordination.
- Establish the National Agricultural Research and Extension System (NARES) to facilitate coordination between research and extension.
- Implement Annual Research - Extension Liaison Meetings for sharing of experience and information and decisions on approaches to crop, livestock, and fisheries development.
- Establish farmers' training and adaptive research centers to jointly demonstrate research results and extension recommendations on modernized farming.
- Jointly package, promote and disseminate knowledge on improved production technologies for adoption by farmers, including preparation of Commodity Manuals.
- Upgrade and rationalize the current Yezin Agriculture Universities into one consolidated university with colleges for agriculture, livestock and aquaculture with both undergraduate and graduate degrees.
- Upgrade key sectoral disciplines in Yezin and other universities, including agricultural economics, agricultural business and marketing, agriculture engineering, water management, food technology, and agricultural extension and communications.
- Expand the 3-year diploma curriculums of State Agricultural Institutes (SAI) in all states and regions to provide training on all key sectoral disciplines, including agriculture, livestock, fisheries, machinery, food technology, farm management, agribusiness and marketing. Expand these institutes' offerings to include short-term certificate training as well.

Table 4-12. Indicative Gantt Chart



SELF ASSESSMENT QUESTIONS

1. Why is agriculture the most vital sector for ICT intervention?
2. How did devolution affect agricultural extension in many Asian countries? What role can ICT assume given the situation?
3. Give the modalities of ICT for agricultural extension.
4. Who are the users of agricultural information?
5. What are the elements of a logical framework?
6. Who are the stakeholders of agricultural information?
7. Describe the workflows of SAIMS.
8. Name the eight factors that spell the success or failure of information systems employed to bridge the rural digital divide.

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SPFS WEBSITE. http://www.fao.org/spfs/

CHAPTER 5.
ICT for Basic Education

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Describe the optimum approach for ICT4E;
2. Discuss current initiatives on ICT for pedagogy, teacher training and educational governance;
3. Enumerate technical, content, utilization, program, structural and political issues associated with ICT4E;
4. Enumerate the elements of the BESRA ICT4E Strategic Framework; and
5. Enumerate the policy recommendations for ICT4E.

KEY CONCEPTS

ICT4E
ICT for Pedagogy
ICT for Teacher Training
ICT for Governance
Service-Oriented Architecture

INTRODUCTION

The inclusion of information and communications technology for education as one of the thrusts of the global education reform agenda has found a most opportune time in the current policy environment.

Background

When ICTs first hit the limelight in the development arena during the 90s, one of its most logical areas of application was education. Historically, educational communication in general, and instructional systems technology in particular, has benefited immensely from the arrival of new information and communications technologies, compared with other development sub sectors. These benefits

came as soon as the first PCs, laptops, and digital presentation media were developed in the early 80s. Furthermore, with the advent of the World Wide Web, the marriage of computers and telecommunications offered an entire new range of possibilities to enhance the teaching-learning situation. Simultaneously, the realization that the world is turning into a global information society wherein information becomes the source of wealth and the most critical economic resource, has prompted development planners to support investments in ICTs.

The international development assistance community has since been actively endorsing ICT as a thematic area that cuts across all sectoral concerns such as agriculture, health, the environment, and most especially, education. Thus, almost every development project proposed, funded, and implemented contains an ICT component or element in the form of the design and development of information systems, or the provision for public awareness employing digital tools.

Government policy and programs have also been quite supportive. To the Arroyo Administration's credit, a cabinet-level Commission on Information and Communications Technology has been established. ICT programs in every line agency have been supported by the GAA and financial injections from international funding agencies and the private sector.

The education sector, particularly basic education, is no exception. Since 1999, almost every project designed and implemented, be it funded by multilateral financial institutions as a loan or by bilateral agencies as a grant, contains an ICT component. Civil society has also been quite active in promoting ICT for education projects.

This supportive policy and program environment resulted in a situation that featured both advantages and disadvantages. Firstly, there are now several ongoing ICT4E initiatives coming from the international development assistance, government and private sectors. Secondly, this has spawned a wide array of stakeholders including industry, civil society, and even politicians. Attendant to this is the diversity of agendas, which may conflict at times in prioritization. Thirdly, an ICT framework has already evolved

organically within the education sector. Lastly, there may be a need to harmonize these initiatives and agendas to fit into the ICT framework.

The situation is such that a common encompassing ICT4E framework within the reform parameters set by BESRA may be adopted by the different stakeholders. At this point, perhaps a most appropriate contribution of BESRA for the ICT4E movement is the provision of focus and coherence, validation, and confirmation to existing initiatives and plans within the reform platform.

Philippine Situationer

Current ICT for Pedagogy Initiatives. Presently, the Philippine education sector has a variety of ICT for Pedagogy initiatives.

1. *DepED Computerization Program.* Beginning 1996, the Department of Education has embarked upon an undertaking that would provide computers to all public secondary schools in the country. Supported by the DepED's line budget (110 million pesos annually) as well as infusions from the Governments of Japan and the Republic of Korea, the DepED Computerization Program not only includes computerization and connectivity but also teacher professional development, technical training, content development, and strategic planning. FIT-ED (2005) states that the program has succeeded by dramatically increasing computer penetration in public secondary schools. Last year's estimate was 60 to 75 percent. However, the average computer to student ratio is still quite low. For 2007 onwards, the Department will jumpstart this initiative among public elementary schools.

2. *DTI PCs for Public Schools Project.* Senator Mar Roxas initiated this project while serving as Secretary of the Department of Trade and Industry. Funded by the Government of Japan, public secondary schools will be supplied with ten to twenty PC units to equip their Computer Laboratories including the teachers' training component. This initiative started in 2002 and is still continuing.

3. *Commission on ICT.* The Commission on Information and Communications Technology *(CICT)* has been an active player in the ICT4E movement since its inception. It has launched several

initiatives in collaboration with DepED such as: the Broadband Deployment Program, which intends to provide broadband access to public secondary schools and Community eCenters (CeC); the iSchools Program, which among other things will provide computers, connectivity, and content for basic education to Community eCenters; and the eSkwela Program, the nonformal or alternative learning system counterpart of iSchools.

4. *BALS.* As stated, the ICT4E movement logically covers the nonformal subsector. The Bureau of Alternative Learning Systems has developed more than 500 modules, some in two languages (English and Filipino), distributed to ALS service providers in print and CD-ROM formats. Some modules are supplemented by audio and video materials that are made available in selected learning centers. Furthermore, pilot projects on radio-based instruction in support of the Accreditation and Equivalency (A&E) program are being conducted.

5. *Regional Initiatives.* Other ongoing programs have taken on a regional or subregional scale. These are the ASEAN SchoolNet Program and the APEC ICT Model School Network Project sponsored by the Association of Southeast Asian Nations and the Asia Pacific Economic Council, respectively. Both undertakings involve equipment provision, teachers' training, telecollaboration, and exchange visits from the countries involved. DepED has actively participated in both.

a) Current ICT Initiatives for Teacher Development. The following initiatives for ICT teacher development are currently being implemented:

1. *CHED Standards for Undergraduate Teacher Education.* Policy support for ICT4E has also come from the Commission on Higher Education with its Revised Policies and Standards for Undergraduate Teacher Education Curriculum. These standards provide for the inclusion of six units (two 3-unit courses) of education technology (mainly ICT) in the teacher education curriculum.

2. *Commission on ICT.* The iSchools- eSkwela - Community eCenter Projects previously mentioned in the preceding section provides for the training of computer laboratory managers and selected teachers on a Web-based learning management system (LMS), the Web Board.

3. *Intel Teach to the Future Program.* Intel Technology Philippines Incorporated (ITPI) is contributing to ICT for teacher development through its Intel Teach to the Future Program (consisting of 10 modules on the use of ICT in teaching and learning). This undertaking is made up of three components: an Enhancement Workshop for Selected Regional and Master Trainers; Training for Master Trainers of Selected Schools; and an Administrators Strategic Planning Workshop of Selected Schools (i.e., effective and efficient management of technology environment in the school). The 80,000 public secondary school teacher-recipients of the Program were mainly from the DepED Computerization Program (Batches CY 1996 – 2002) and DTI PCs for Public Schools Project Batches 1 (CY 2002) & 2 (CY 2004), where the said teachers teach 20 other teachers (school-based training) after completion of their trainers training course. The said Program was coordinated at the national level by the former DepED national ICT coordinator Jesus L. Huenda from CY 2002 - 2004, while from CY 2005 onwards it is being coordinated by FIT-ED in 9 selected focused schools divisions.

4. *World Links – FIT-ED Instructional Design Workshop.* World Links (Philippines) and the Foundation for Information Technology for Education and Development *(FIT-ED)* is also implementing two training programs: Instructional Design Workshop on Web-enhanced Learning; and Teacher Training on Telecollaborative Learning.

Partners in Learning – PBSP. On the other hand, the Partners in Learning (PiL) and the Philippine Business for Social Progress (PBSP) have initiated the SMART Schools Program. Under SMART Schools, two teacher training courses are being conducted: the Teacher Resource Center Laboratory Technician Training; and the 21st Century Leadership Training on ICT for Education (ICT4E).

Incentives for outstanding teachers who have demonstrated best practices in using ICT in teaching and learning were in the form of Innovative Teachers Leadership Awards that included a PC unit for each national winner, participation in a team building course, and the top five national winners vying for top awards among ASEAN and APEC counterpart countries held in Singapore and in Seoul, Korea. Moreover, the "Potensyal", which is a national search for outstanding schools divisions, schools, and teachers who have exhibited leadership, innovation, openness to technology, and the drive to further school/community empowerment, is an annual initiative by PiL through PBSP in support of the DepED's Schools First Initiative. Thus, the thirty finalist schools divisions (i.e., 10 each from Luzon, Visayas, and Mindanao) received P2M each; while the top 3 schools divisions (i.e., 1 each from the said island groupings) similarly received P10M each in terms of teachers' training and technology support. "Potensyal" then continues by building strong public - private partnerships and contributing to the 21st century education system through the realization of schools divisions'/ schools'/teachers' potentials (The "Potensyal" 2006 winners were the schools divisions of Muntinlupa City, Cebu Province, and Digos City). Other PiL – PBSP initiatives include the Partners in Learning regional cluster roadshows nationwide, the school – local college/ university tandem on the Microsoft Office Specialist (MOS) teachers training; the "Fresh Start" Program wherein a school may avail of free MS Office license for each donated PC unit; the "empowerICT" Program through Learn.ph Foundation for selected science-oriented high schools in Metro Manila; the hosting of the learning community website through Softrigger : www.pil.ph with close to 4,000 teacher/ school head/parent - members; the "Teachers PC" Program's pilot implementation in NCR, Regions III and IV=CALABARZON whereby any public and private elementary and secondary school teacher and non-teaching personnel may avail of an affordable discounted PC via payroll deduction through any local Asia United Bank; and the ICT-readiness survey of schools in the Philippines through Learn.ph Foundation in cooperation with the Philippine Normal University, and Cebu Normal University; the DepED – PiL IT Academy Center with 20 units of networked PCs at the 4th Floor, Bonifacio Bldg., DepED Complex, Meralco Ave., Pasig City; the IT college student-volunteer mentors through People Ignite; and the F2F/online 1-on-1/many-to-1

ICT-fusion techmentoring through the Learn.ph Foundation; among others. The PiL through PBSP initiatives were coordinated by the former DepED national ICT coordinator Jesus L. Huenda and former DepED-Technical Service Director Orlando O. Oxales.

5. *DepED – Oracle Database Technology Program*. Recently, Oracle Philippines extended assistance to DepED in terms of public-private linkage partnership in an 8-week online training of 60 teachers from 30 pilot secondary schools nationwide who are spending an average of 2 hours per week on teleconferencing with 24/7 on-call USA trainers, and an hour per weekday on user-friendly interactive web-based lessons/quizzes on topics such as database structure, design, modeling, programming, etc which the teachers later on can integrate in designing prototype lessons in TLE (Entrepreneurship) III & IV and Computer Science I & II for regular and science-oriented high schools, respectively. This Database Technology Program culminates in a 5-day face-to-face (F2F) in Makati High School where instructional design on web-enabled tryout database lessons will be the focus of sharing good practices and minds-on and hands-on learning experience. This Program will be scaled-up to 150 other public secondary schools per pilot school.

b) Current ICT Initiatives for Governance and Administration. The Department of Education is currently maintaining the Basic Education Information System (BEIS). In the design and development pipeline are the Management Information Resources System (MIRS); the Human Resources Information System (HRIS); and the Financial Information System (FIS). The BEIS, in particular, runs on a Microsoft Excel platform using a Visual Basic front-end. Data is provided by the national, regional, divisional, and district DepED offices. The HRIS is currently being designed by a team of computer science students from the Asia-Pacific College, Makati City.

DepED maintains a website www.deped.gov.ph, which addresses the information needs of internal users from the Department and external users from the public. Another service called the DEText is an interface of texting services with Web services.

Both systems are supplemented by the DepED Monitoring Network or MONET which was developed and uploaded by the Partners in Learning and Microsoft Philippines. MONET provides a forum for organizational communication, horizontally, across offices and bureaus and vertically, across national, regional, divisional, and district levels. Announcements, memoranda and updates are regular features of MONET. The Educational Information Division is the main client of the system.

Additionally, almost every project executed and implemented by the DepED and funded by the World Bank, the Asian Development Bank, USAID and AusAID has an ICT component. More often than not, the ICT component includes an MIS element that provides information service support to the specific project. To satisfy sustainability requirements, the project designs almost always specify an MIS which may eventually be adopted by the Department. The Third Elementary Education Project (TEEP), for instance, has developed a sophisticated Web-based system powered by MSSQL that integrates learning management with administrative systems. The adoption of such a system by the Department, however, poses structural and policy issues that the design has failed to take into consideration. The fact remains, however, that many such "integrated" or centralized packages have been and are being developed for DepED and may, in fact, be used as modules should a service-oriented architecture (SOA) be adopted systemically.

ICT4E STRATEGIC FRAMEWORK

Chronology for a Strategic Framework

With assistance from the NGO sector and the CICT, DepED has embarked on strategic planning for ICT4E. It may be said that this strategic plan has evolved organically within the Department, since its people provided the substance of the Plan.

NSPI. In 2004, a National Strategic Planning Initiative (NSPI) for ICTs in Basic Education was spearheaded by the Foundation for Information Technology for Education and Development (FITED), the Commission on ICT, and DepED. A series of consultative

meetings involving the Bureau of Elementary Education, the Bureau of Secondary Education, and the Bureau of Alternative Learning Systems was conducted with resource persons coming from CICT and the ICT industry. The NSPI resulted in the National Framework Plan for ICTs in Basic Education (FIT-ED, 2005). The Plan was supposed to be submitted to then Secretary Butch Abad for endorsement. However, Secretary Abad's untimely resignation from the Department delayed immediate action on the Plan. Eventually, the Plan was formally transmitted in July 2005 to then OIC Secretary Ramon Bacani by: Dr. Fe Hidalgo, then Undersecretary for Programs and Projects; Dr. Emmanuel C. Lallana, CICT; and Ms. Victoria Tinio, Executive Director of FIT-ED.

Continuing Initiatives. Work on a strategic plan on ICTs for basic education did not stop with the official transmittal of the National Framework Plan. In October 2005, a Framework for an ICT Strategic Plan was drafted by the DepED ICT Consultant based in the Technical Services Division and circulated among the staff of OPS.

The National Framework Plan itself went through a couple of transformations. It has been rehashed as the ICTs in Basic Education Framework Plan (2005-2010) then as the Master Plan for ICT in Basic Education (2006-2010).

BESRA. In 2006, the World Bank funded Basic Education Sector Reform Agenda or BESRA built on the earlier initiatives and, based on a series of nationwide consultative workshops, produced an ICT4E Strategic Framework. Compared to earlier frameworks, this was based on a number of issues and concerns that surfaced in key informant interviews and focus group discussions that included DepED staff and public school teachers.

Issues and Concerns

A number of issues and concerns surfaced in the key informant interviews that were conducted to supplement the focus group discussions. The ICT4E strategic framework should be sensitized to these issues.

Technical Issues. Concerns that related to the technical aspects of ICT4E included: readiness; cost-effectiveness; and standardization.

Was the public school system ready for computerization? Perhaps this can be answered in the affirmative among the network of national high schools and science high schools in the country. But for the majority of public schools, particularly elementary schools in far-flung areas, readiness is still an issue. The inadequacy of the infrastructure is evident in the poor condition of classrooms, not to mention the lack of classrooms. The lack of utilities is evident in the lack of electricity in many areas, not to mention landlines for dial-up services. As of last count, 69 to 72% of public secondary schools now have computer facilities. But are these actively operational computer laboratories or merely glorified word processors used by teachers, or worse, office decorations kept under lock and key only to be gazed at and not used by learners?

Related to readiness is cost-effectiveness. Although hardware and bandwidth is getting cheaper by the day, software is getting more expensive. The combined costs of hardware, software, bandwidth, and services is still relatively high vis a vis other educational products and services. The current per capita investment on basic education may have to be doubled to achieve widespread computer/ information literacy/fluency, something that cannot be possibly done in the foreseeable future given the current state of affairs. This is further complicated by the fact that the return on investment on ICT4E is neither tangible nor immediate.

A related issue is the bandwidth costs incurred by the DepED. Should DepED be utilizing commercial Internet service providers for its bandwidth when the larger portion of the spectrum for the Internet is non-commercial? Within this non-commercial spectrum is a backbone reserved for education and research. In the Philippines, this backbone is used by the Philippine Research and Education for Government Institutions Network administered by the Advanced Science and Technology Institute of the Department of Science and Technology. The backbone has been made available to the PREGINET through APAN.

The Asia Pacific Advanced Network or APAN is a non-profit international consortium established in 1997 designed to be a high-performance network for research and development on next generation applications and services. APAN provides an advanced networking environment for the research and education community in the Asia-Pacific region, and promotes global collaboration.
Its objectives are: to coordinate and promote R&D activities on networking including technology, applications, and services; and to provide an advanced networking environment for research and education communities in the Asia-Pacific region.
On the other hand, the Asian Internet Interconnection Initiatives or AI^3 is a regional research consortium among research institutes in the Asian region that aims to develop leading edge technologies for the Internet, such as IPv6, WWW caching and replication mechanisms, multimedia communication mechanisms, and applications for the advanced usage of the Internet.

Both consortia have access to the research and education Internet backbone allotted by the World Wide Web Consortium (W3C) for R&D, education, and distance learning use.

Lastly, under technical considerations, there is the issue of standards. The choice for the more common information technology applications such as office suites, databases, and Web tools are ruled by de facto standards. With the clampdown on software piracy, these de facto standards are costing fortunes for licensing and hardware key fees. However, running a giant of a bureaucracy such as DepED, which has a mandate over one of the most critical sectors in society, would require standards both for governance/ administration and for instruction. Should DepED adopt open source software versus proprietary software under its department-wide ICT4E standards? There are clearly advantages and disadvantages to each option. Proprietary software are perceived to be more stable, more user friendly, more readily available, more accessible to technical support, and more compatible with other systems. They are also more expensive. Open source software is cheaper, but are perceived to be less stable, less user-friendly, incompatible with most systems, and inaccessible to technical support. Clearly, a combination of open source and proprietary software may be considered as a viable option.

Content Issues. A more debatable issue is the need for content. A decade of ICT4D experience underscores such a need. Past investments on technology (i.e., hardware, software, connectivity) without content have many times led to systems unpopulated by data. Flor (2003) notes:

> *At the turn of the century (or the millennium, rather), there transpired a concerted effort among many forward-looking development agencies to build up their ICT infrastructure. Today, many of these agencies have their infrastructure in place, some employing multiple networks. However these networks run the risk of becoming electronic white elephants because there is not enough substantive content within them.*
>
> *During the First National Partners Meeting of the Philippine Research and Education Government Infrastructure Network (PREGINET), this concern was whispered among many of the participants who now had access to broadband and wireless technology but had comparatively little appropriate content to feed into their networks. Note that the Internet (the infrastructure) would not have flourished as much without the World Wide Web (the content).*

Networks thrive on content. Without it, systems are useless. After the first decade of ICT4D, a major lesson learned by the development assistance sector, particularly the UN agencies and the World Bank, is that investments on content and capability building should be significantly larger than investments on infrastructure (Walsh, 2006). According to some estimates, for every dollar invested on ICT4D, ten cents should go to infrastructure. Another ten cents should go to software. Still another ten cents should go to training. But the remaining 70 cents should be spent on content development.

On the other hand, there is a school-of-thought that submits that all the content that one would ever need is found in the World Wide Web. As discussed in the previous section, some of the participants

suggested that DepED need not invest in curriculum and content development but more on instructional design.

Indeed, the Web is potentially the only source one would ever need for general information. For instance, one search engine alone, Google, has access to sixteen billion Web pages as of December 2005. The challenge facing the learner is to navigate through this maze of information. It was argued that the chore of facilitating and guiding this navigation should be assumed by the instructional designer.

Nevertheless, instructional design is part and parcel of curriculum development. In the same vein, identifying and collating Web pages or compiling metadata, is part and parcel of content development. Hence, one cannot do away entirely with curriculum and content development in spite of the World Wide Web. In the same manner that one cannot do away with teaching guides in spite of the presence of textbooks in basic education.

Furthermore, there is the question of appropriateness of content. Does information contained in the Web conform to the standards and specifications of the approved Basic Education Curriculum? Is it suitable for the Filipino grade school or high school user? Is it packaged for learning purposes? These questions lead us to the next category of concerns.

Utilization Issues. Appropriateness is not only a content issue but a technology issue as well. A common inaccuracy among practitioners is to consider ICT as exclusively digital. And yet, historically, ICT ranges from low end to high end, from the analog to the digital.

The first educational communication technology project in the Philippines funded by the World Bank was the Communication Technology for Rural Education (CTRE). The project made use of AM radio. Traditionally, communication technology referred to overhead, opaque and slide projection hardware, demonstration media, two-way radios, closed circuit television, small format video, and open broadcast radio and TV. Nowadays, it encompasses personal computers, cellular telephony, imaging technology, cable television,

digital photography and videography. However, ICTs still encompass the older, more traditional media.

Given our existing realities and imperatives, which ICTs are more appropriate in the Philippine rural setting? Shouldn't there be an acceptable use or appropriate use policy for ICT that situates a specific educational application within the low-end, high-end spectrum?

Program Issues. Then there are concerns related to current ICT4E program rationale and design. What are the determinants of the elements of a program design? Are these based on assessed needs or are these donor-driven? Are these determined by a social agenda or are they technology driven?

Many of the bilateral ICT4E projects currently being undertaken may indeed be described as technology driven or donor driven. There is nothing wrong with such projects particularly if they are funded by grant money. However, the relevance and sustainability of the undertaking would be immensely enhanced if the impetus for the project came from a real and felt need.

Structural Issues. The Department of Education, being one of the largest line departments in the government bureaucracy, is made up of several well-entrenched bureaus and offices. The three bureaus – the Bureau of Elementary Education, the Bureau of Secondary Education, and the Bureau of Alternative Learning Systems – make up the largest complement in the Department, extending their line of authority from the national, to the regional, then to divisional and down to the district offices. Some describe the bureaus as fiefdoms, whose operations follow a tradition-bound protocol having been least affected by decentralization and devolutionary initiatives of the GOP. Bureaucracies have their merits. Unfortunately, however, they tend to undermine networking processes and principles.

Networks are the natural structures of living systems. And living systems perform three critical functions in order to survive: the exchange of materials; the exchange of energy; and the exchange of information (Talisayon, 1983). Organizations are considered as living

systems and thus need uncluttered communication flows in order to survive. Information and communication networks provide such communication flows within the organization. But ideally, these information and communication networks should also be organic within DepED and should be parallel to the host organization's structure. Considering DepED's bureaucratic organizational structure, however, it may be expected that information and communication flows would become stymied as a consequence, instead of flowing freely horizontally, vertically and radially. Casual observation of communication flows within and among DepED bureaus support this argument. Information, be it in electronic form or otherwise, may flow freely from top to bottom, but the flow is hampered laterally as well as upwardly.

One of the three prerequisites of knowledge management is an organizational culture conducive to information sharing and reuse. Does the DepED possess the organization readiness for information sharing and reuse? Without a change in its organizational culture supplemented by supportive policies, the answer would be a "No."

Political Issues. Related to structural issues are political issues. At present, ICT is mostly regarded as operational elements of individual offices instead of as a cross-cutting concern. Information units are lodged in several offices, independently functioning from one another. The Technical Services Division of the Office of the Secretary used to act as the lead unit but most of its staff has now been transferred to other offices. The DepED Rationalization Plan has not fully addressed this issue. Its pending implementation offers little prospects of improving the situation.

DepED is yet to establish an integrative platform or a coordinating office that is responsible for an overall ICT program. Given the situation, the tendency for key units and key players to compete for prominence and the furtherance of their respective agendas is but expected, considering the current ICT4E portfolio and the resources that are being infused into it particularly by external sources.

An immediate alternative would be to form a Departmental ICT4E working group that cuts across bureaus and offices. Such a body

has been formed very recently. On 28 July 2006 OIC Secretary Fe Hidalgo signed an Office Order constituting an ICT Technical Committee chaired by Maria Victoria Abcede of the Bureau of Secondary Education. The ICT-TC is under the direct supervision of the Undersecretary for Programs and Projects with the following responsibilities:

1. Recommend policies, standards and guidelines on the use of ICT in basic education;
2. Conceptualize, implement, coordinate and monitor ICT programs and projects;
3. Establish a database on ICT programs and projects;
4. Conduct research and development studies on ICT in education;
5. Evaluate ICT programs and projects proposed by other government organizations and non-government organizations, and recommend actions to be taken thereon; and
6. Network with government and nongovernment organizations on the implementation of ICT programs and projects in basic education.

Eventually, the ICT Technical Committee should be constituted a regular office within the DepED. An additional function of this proposed office will be to serve as a Clearinghouse for future ICT4E undertakings, As such, it may screen ICT4E projects to assess their priority and to see how and where they fit in the overall strategic framework. The clearinghouse may offer suggestions on how these projects may be redirected to ensure their relevance and sustainability and to ascertain that their impetus are not merely technology or donor driven. The office may be headed by DepED's "Information Czar," a position that requires at least an assistant secretary post. The proposal for this post was initially lodged by TEEP in 2002. The office will thus follow a model adopted by leading corporations and organizations, which employ a Chief Knowledge Officer or, as in the case of the Asian Development Bank, a Vice-President for Knowledge Management.

Based on the preceding analysis, this paper concludes that the current thinking, decision-making and institutional actions on ICT for basic education has not been based on specific and explicit policies nor are these guided by a coherent framework or plan.

In spite of dynamic and fast-paced developments in ICT4E, it is a relatively new concern. Thus, the Department of Education has not had the opportunity to adopt an explicit policy or strategy on ICT4E nor has it established an office to coordinate activities within its scope. Except for those initiated by the Commission of Information and Communications Technology for DepED, much of the prevailing initiatives on ICT4E is either technology-driven or donor driven.

Understandably, there is a distinct sense of urgency among ICT4E champions for DepED to chart a definite direction and to adopt a strategic framework. There are now several ongoing ICT4E initiatives coming from the international development assistance, government and private sectors spawning a wide array of stakeholders including industry, civil society, and even politicians. The situation is such that a common encompassing ICT4E framework within the reform parameters set by BESRA may be adopted by these different stakeholders. At this point, perhaps a most appropriate contribution of BESRA for the ICT4E movement is the provision of focus and coherence, validation and confirmation to existing initiatives and plans within the reform platform.

Optimum Approach for ICT. The National Framework Plan for ICT in Basic Education states that the transformative power of ICT is more likely to be realized when it is introduced in the context of radical system-wide reform. In the same manner, the optimum approach for using ICT as a delivery mode is through learning management systems (LMS) instead of using it on a piecemeal basis. ICT components bundled up in a system, profit from the synergy produced by operating from one digital platform. For instance, the whole Microsoft Office Suite is greater than the sum of its parts primarily because each application's output can be used/ imported/ embedded by the other applications within the Suite.

As to approaches in content development and utilization, the selection criteria are relevance and contextualization. Furthermore, the development of ICT systems has always followed an evolutionary prototyping approach, not experimentation and trials.

So far, much of DepED's expenditures on ICT have been allotted to equipment procurement. A more strategic approach for DepED is to

allocate and use its available resources for institutional strengthening or capacity building on managing ICT4E.

***Institutional Strengthening of the DepED*.** Institutional strengthening for ICT4E at DepED should follow a two-pronged approach: programmatic and structural. Programmatic refers to the charting of directions and adopting specific policies and plans leading to strategic goals.

The BESRA ICT4E Framework

The major elements of a strategic framework are: the vision statement; the mission statement; the goals, the strategic thrusts; and program priorities. As gleaned from the preceding situation analysis, a strategic plan for ICT in basic education has already evolved organically within the Department of Education. Since the development of strategic frameworks form the initial stage in the design of strategic plans, it may be said that the BESRA ICT4E strategic framework has already found grounding in the National Initiative for Strategic Planning for ICTs in Basic Education.

Hence, some of the critical elements of the BESRA ICT4E strategic framework have already been endorsed in past consultative meetings organized under NISP: These include: the vision and mission statements (National Framework Plan, 2005), the goal (Master Plan for ICT in Basic Education, 2006); and the strategic thrusts (Master Plan, 2006). With regard to the latter, it is recognized that the thrusts should closely correspond with the overall strategic thrusts of the DepED.

Mission and Vision Statements. The mission and vision statements came from the National Framework Plan for ICT in Basic Education (2005). It was slightly refined during the validation process to read as follows:

> *The Department of Education envisions an ICT-supported system of quality basic education for all. It is committed to the appropriate, effective, and sustainable use of ICTs to achieve nationwide information fluency and broaden equal access to and improve the quality, equity and efficiency of basic education service delivery for all.*

It should be noted that the mission and vision statements focus on the provision of quality as well as to appropriate, effective and sustainable utilization of ICT. It is consistent with the language used in Education for All as well.

Goal Statement. The goal statement initially lifted from the Master Plan for ICT in Basic Education (2006) was changed to the following:

> *The overriding goal of ICT4E in the Philippines is to transform the teaching-learning landscape through: computerization of all DepED workflows at the national, regional, divisional, district, and school levels; seventy percent connectivity among all public schools by 2010; seventy percent information fluency among basic education graduates; and one hundred percent information fluency and ICT literacy among school teachers all of which will be achieved by 2010.*

It should be noted that the new goal statement has concrete and time-bound targets as suggested by the participants in the validation workshops.

Strategic Thrusts. The strategic thrusts closely correspond to the overall thrusts of DepED: broaden access; improve quality of learning; improve quality of teaching; and improve planning and management. Thus:

Strategic Thrusts 1. Use ICTs to broaden access to basic education. This thrust employs the following specific strategies reordered as per suggestion of key stakeholders:

A. Deploy appropriate ICT equipment, hardware, peripherals & connectivity for basic education including ALS.
B. Harness ICT resources of community to support basic education curriculum delivery.

C. Strengthen the use of ICTs to improve basic education.
D. Conduct research & special studies on ICT-supported basic education delivery systems.

Strategic Thrusts 2. Use ICTs to enhance the quality of learning. Under this thrust are six strategies:

- Promote good practice in ICT-supported learning in basic education, in both the formal and the alternative learning settings.
- Integrate ICTs into basic education programs and projects, as appropriate.
- Provide ICT-enhanced learning resources for elementary and secondary schools and for alternative learning programs, when appropriate.
- Deploy appropriate ICT equipment, hardware, peripherals, and connectivity based on national guidelines for ICT integration and in support of ICT integration pilots.
- Develop national standards for ICT-supported learning.
- Conduct research and special studies on ICT-supported learning at the elementary and secondary school levels, as well as in alternative learning environments.

Strategic Thrusts 3. Use ICTs to enhance the quality of teaching. This thrust involves the following strategies, likewise reordered as per suggestion:

1. Provide systematic support for ICT-enhanced teaching at all levels.
2. Improve in-service training in ICT-curriculum integration.
3. Develop ICT-supported professional development programs & ICT-based resources to enhance the subject area knowledge, pedagogical content knowledge, & learning management skills of teachers and learning managers.
4. Use ICTs to enhance the quality of teaching.
5. Include ICT competencies in formulation of National Competency Standards.

Strategic Thrusts 4. Use ICTs to improve educational planning and management. Lastly, this thrust involves the following specific strategies, logically reordered by the validation workshop participants:

1. Design & implement overall ICT architecture to guide ICT systems selection & development.
2. Identify, develop, & deploy software applications that promote quality educational planning and management at the national, regional, division, district, and school levels.
3. Harness various forms of ICTs to improve communication w/in DepED & stakeholders.
4. Use ICTs to improve educational planning and management.
5. Augment ICT facilities for educational planning & management at all levels.
6. Develop and implement professional development programs on the appropriate and effective use of ICTs for educational administrators, non-teaching and support staff.

Revised StratFrame. Found below as Table 5-1 is the revised ICT4E StratFrame Matrix: incorporating the proposed changes in the elements of the framework as well as an additional columns for proposed policy instruments and strategic focus for the National Program Support for Basic Education. Hopefully, the BESRA Strategic Framework for ICT4E would serve as the platform for the New Master Plan for ICT in Basic Education and would guide future planning undertakings. It may also serve as a frame of reference from whence future ICT4E projects may be situated.

Establish Mechanisms. Institutional strengthening of DepED on ICT4E does not involve merely programmatic interventions but structural interventions as well. The mechanisms for ICT4E should be well-established within DepED. We learned in the preceding analysis that at present, a Technical Committee takes charge of the ICT for basic education. There is no one office, center or unit directly responsible and mandated for this. At the regional and provincial levels, ICT Coordinators have been designated as additional assignments.

This strategy paper recommends that the ICT Technical Committee and the designated ICT Coordinators be formalized into an ICT Center or Clearinghouse that would initially perform the functions outlined for the ICT-TC, i.e.: to recommend policies, standards and guidelines on the use of ICT in basic education; to conceptualize, implement, coordinate, and monitor ICT programs and projects; to establish a database on ICT programs and projects; to conduct research and development studies on ICT in education; to evaluate ICT programs and projects proposed by other government organizations and non-government organizations, and recommend actions to be taken thereon; and to network with government and nongovernment organizations on the implementation of ICT programs and projects in basic education.

Table 5.1. ICT4E Strategic Framework

VISION/ MISSION STATEMENT	The Department of Education envisions an ICT-supported system of quality basic education for all. It is committed to the appropriate, effective, and sustainable use of ICTs to achieve nationwide information fluency and broaden equal access to and improve the quality, equity and efficiency of basic education service delivery for all.		
GOAL STATEMENT	The overriding goal of ICT4E in the Philippines is to transform the teaching-learning landscape through: computerization of all DepED workflows at the national, regional and district levels by 2015; seventy percent connectivity among all public schools by 2015; seventy percent computer literacy among basic education graduates by 2015; and ninety percent information fluency and computer literacy among school teachers all of which will be achieved by 2015.		
BESRA PARAMETERS/ STRATEGIC THRUSTS	**STRATEGIES**	**POLICIY INSTRUMENTS**	**STRATEGIC FOCUS of NPSBE**
1. ICT for Pedagogy. Use ICTs to broaden access to basic education	Deploy appropriate ICT equipment, hardware, peripherals & connectivity for basic education including ALS Harness ICT resources of community to support basic education curriculum delivery. Strengthen the use of ICTs to improve basic education. Conduct research & special studies on ICT-supported basic education delivery systems	Defining ICT4E scope Appropriate use Public-private sector financing	Strategic targeting Upscale CICT pilots Expand ASEAN/ APEC participation eLearning viability

2. ICT for Pedagogy Use ICTs to improve the quality of learning	Promote good practice in ICT-supported learning in basic education, in both the formal and alternative learning settings. Integrate ICTs into basic education programs & projects, as appropriate. Provide ICT-enhanced learning resources for elementary & secondary schools & for alternative learning programs, when appropriate. Deploy appropriate ICT equipment, hardware, peripherals, & connectivity based on national guidelines for ICT integration & in support of ICT integration pilots. Develop national standards for ICT-supported learning. Conduct research and special studies on ICT-supported learning at the elementary and secondary school levels, as well as in alternative learning environments.	Defining ICT4E scope Appropriate use Public-private sector financing	Strategic targeting Upscale CICT pilots Expand ASEAN/ APEC participation eLearning viability
3. ICT for Teacher Development. Use ICTs to enhance the quality of teaching	Provide systematic support for ICT-enhanced teaching at all levels. Improve in-service training in ICT-curriculum integration. Develop ICT-supported professional development programs & ICT-based resources to enhance the subject area knowledge, pedagogical content knowledge, & learning management skills of teachers and instructional managers. Use ICTs to enhance the quality of teaching Include ICT competencies in formulation of National Competency Standards	Appropriate use Public-private sector financing	Develop standards Strategic targeting Upscale CICT pilots

4. **ICT for Governance and Management.** Use ICTs to improve educational planning and management	Design & implement overall ICT architecture to guide ICT systems selection & dev't. Identify, develop, & deploy software applications that promote quality educational planning and management at the national, regional, division, and school levels. Harness various forms of ICTs to improve communication w/ in DepED & stakeholders. Use ICTs to improve educational planning and management Augment ICT facilities for educational planning & management at all levels. Develop and implement professional development programs on the appropriate and effective use of ICTs for educational administrators, non-teaching and support staff.	Appropriate Use Public-private sector financing Donor coordination	Develop/ Upscale databases Explore use of TEEP modules Invest in M&C Invest in KM feasibility study

Policy Instruments

The preceding chapter ended with a discussion of issues and stakeholder perceptions related to ICT4E. This section presents a set of policy and program responses to address the foregoing issues and concerns.

To review, technical issues revolve around concerns of readiness, cost-effectiveness, and standardization. These concerns will be addressed by: formulating an Appropriate Use Policy for ICT based on relevance and sustainability; adopting a networking approach that enables the Department to tap networking synergies and avail of free bandwidth; and establishing systems standards on ICTs for instruction, governance and administration. Content issues involve the choice between investments in content and investments in instructional design. A content development program should be implemented that enables the bureaus to make full use of available content without prejudice to the development of new content appropriate for the BEC.

Utilization issues concern the appropriate use of information and communication technology on a situation to situation or case to case basis. Again this will be addressed by adopting an Appropriate Use Policy based on an expanded definition of ICTs. Program issues involve donor driven or technology driven projects, which may be remedied by the adoption of an ICT4E Strategic Framework and by formulating a Donor Coordination and Harmonization Policy.

Structural issues pertain to the organizational readiness of DepED for information sharing and reuse. The appropriate response to this concern is the adoption of a knowledge management approach. Finally, political issues revolve around the interfacing of agendas and overall coordination. This requires the establishment of an ICT4E Clearinghouse and the appointment of an Information Czar.

Found below is a matrix of policy and program responses to the issues raised:

Table 5-2. Policy and Program Response to Issues

MAJOR ISSUES	SPECIFIC CONCERNS	POLICY AND PROGRAM RESPONSE
1. Technical Issues	Readiness Cost-effectiveness Standardization	Formulate an Appropriate Use Policy Adopt a Service Oriented Approach Establish Systems Standards
2. Content Issues	Content Development and Instructional Design	Adopt a Content Development Program
3. Utilization Issues	Coverage of ICT Appropriate use	Adopt an Expanded Coverage of ICT4E Formulate an Appropriate Use Policy
4. Program Issues	Donor driven projects Technology driven projects	Adopt an ICT4E Strategic Framework Formulate Donor Coordination Policy
5. Structural Issues	Organizational readiness	Adoption of Knowledge Management
6. Political Issues	Interfacing and coordination	Establish an ICT4E Clearinghouse Appoint an ICT Czar

Policy Recommendation 1. Defining the Coverage of ICT4E. ICT refers to digital technologies (hardware, software, etc.) that have resulted from the convergence of computers and telecommunications. By definition, the coverage of ICT does not include the array of conventional information or communication technologies that have been, are being, or may still be used. Although we cannot change the scope of ICT, we can take liberties with the acronym ICT4E to include conventional media.

Taking a cue from UN agencies, the ICT4E movement in the Philippines should define the coverage of ICT4E in the Philippines as inclusive of both low-end and high-end technologies, digital and analog devices. Thus, ICT4E will have elements of both the old and the new; the conventional and the sophisticated; the analog and the digital. Conventional media include analog AM and FM radio, VHF and UHF television, the print media, video, cinema, and indigenous communication media. Digital media cover mobile phones, personal computers, the Internet, email, imaging technology, digital audio-video, and digital broadcasts, even cable television (Flor, 2002).

Hence, for DepED's purposes the coverage of ICT4E would include as any tool or procedure - traditional or electronic, analog or digital, conventional or non-conventional - that contributes to pedagogy, teacher development, and the provision of educational services.

Policy Recommendation 2. Appropriate Use Policy. With the adoption of the above definition, what logically follows is an Appropriate Use Policy that sets efficient and effective utilization guidelines for ICT4E with due consideration given to technological, ethical, proprietary and humanistic issues. The Policy should be considerate of the primary, secondary and higher order impact of specific technologies to be employed on individual stakeholder groups as well as communities. The use of technology should be guided by practicality, cost-effectiveness and sustainability. Other criteria that may be used in deciding which types of ICT solutions to use include: accessibility; replicability; dependence on electricity; durability; planned obsolescence.

Policy Recommendation 3. Donor Coordination and Harmonization. ICT4E is a subset of ICT4D or information and communication technology for development. ICT is drastically changing the development assistance environment in terms of donor thrusts and implementation guidelines. Basic education should exploit this environment by coordinating and harmonizing donor's initiatives and situating these within a coherent framework that best serves the education sector.

With the variety and diversity of ICT4E initiatives and donors, with their attendant interests, a donor coordination and harmonization policy should be implemented by DepED to make it more adept in exploiting opportunities for cost-effective use of ICT. This policy begins with the tacit agreement that one unified framework should be adopted and that ICT initiatives in the education sector should be guided and situated accordingly by and within this framework. A DepED ICT Clearinghouse should be established to enforce the coordination and harmonization policy. The Clearinghouse may be staffed by the members of the current DepED ICT TWG and will be chaired by a DepED Information Czar who may occupy an Assistant Secretary's position in the Department's organizational hierarchy.

Policy Recommendation 4. Public Private Sector Financing. A policy on public-private sector financing for the ICT4E movement should be enforced. The private sector should be sensitized to the fact that supporting ICT4E would pump prime the ICT industry. This is based on the assumption that an information literate workforce will stimulate the demand for ICT products and services.

SUMMARY

ICT for Pedagogy

The key features of ICT that make this class of technologies important to basic education in the Philippines are: its ability to transcend geographical barriers; its novelty, particularly in remote and rural areas; its versatility; its ability to replicate materials at almost no cost; and its programming languages. The lack of classrooms in remote and rural areas may be remedied by ICT delivery modes, i.e.,

distance learning. The cost of reproduction of audio-visual aids will be drastically lowered with the use of ICT-generated and projected materials.

Computer Literacy. Computer literacy is the ability to communicate with computers. It is the capacity to operate computer hardware and run computer software. Information literacy, on the other hand, is the ability to use the wide range of information tools as well as primary sources in modeling information solutions to problems encountered (Zurkowski, 1974). People trained in the application of information resources to their work are information literates. Information literacy is a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." Information literacy competency focuses on five broad abilities: to recognize the need for information; to know how to access information; to understand how to evaluate information; to know how to synthesize information; and to be able to communicate information (Isbell and Hammond 1993). Once a moderate degree of information literacy is attained, an individual is said to be information fluent.

Significance and Relation to Other Basic Skills. Computer literacy is an aid to both functional literacy and numeracy and thus leads to the fulfillment of other learning objectives. In other words, it has become a basic competency that an individual is supposed to acquire in order to progress up the ladder of formal education and to the world of work. Given the new learning environment and the global workplace, computer literacy is an essential skill.

Current Approaches. The current approaches to acquiring computer literacy are: self-study; enrollment in formal and nonformal courses on the most common computer applications (i.e., word processing, spreadsheets, databases and presentations); and the integration of courses on computer applications into the basic education curriculum.

Cost Effectiveness within the Philippine Setting. With access to the appropriate hardware/ software and with the adequate

incentives to learn, the most cost-effective approach to computer literacy is self-study. Without these pre-conditions, however, integrating computer applications into the basic education curriculum is inescapable, especially if the Philippines intends to make its workforce globally competitive.

Specific Recommendations. Given the preceding analyses, the following specific recommendations on ICT for Pedagogy are forwarded:

Firstly, the DepED Computerization Program inclusive of the DTI PCs for Public Schools Project, should shift to strategic targeting. Beneficiaries of these programs should be prioritized in the following order: regional science and science-oriented high schools; special education schools; voc-tech schools; national high schools; and, finally, public elementary schools. Regional DepED offices should prioritize beneficiary provinces.

Secondly, Commission on ICT pilot projects on ICT for basic education should be upscaled. These initiatives include iSchools, eSkwela, and Community eCenters. CICT has recently prepared a Consolidated Proposal for the 2006 ICT4BE Program. DepED need not invest into the activities enumerated under this proposal since funding will be made available under the eGovernment Fund Request. However, it should coordinate closely with CICT and invest in the upscaling of the aforementioned projects on a strategic targeting basis nationwide.

Thirdly, participation in the ASEAN SchoolNet and APEC ICT Model School Network Project should be expanded. This is deemed strategic since costs are minimal and impact is significant in terms of attracting foreign assistance.

Lastly, DepED should invest on a feasibility study of eLearning for basic education. A Project Concept Profile is included in the next chapter for funding consideration of NPSBE.

ICT for Teacher Development

A computer literate workforce can only be produced by an information and computer literate teaching complement. Currently, we may situate the Intel Teach to the Future Project, World Links and FIT-ED's teacher training courses, the PiL-PBSP SMART Schools initiative and the CICT Web Board under ICT for Teacher Development. A unified curriculum participated in by these stakeholders should be compiled.

ICT and the Teaching Profession. Teachers should adopt ICT not only as a tool for teaching and as a subject matter area to teach but as a means for professional development as well. As the CHED minimum standards for teacher education provides, computer literacy is a must in the teaching profession. The minimum level and scope of computer proficiency appropriate for teachers would be limited to the following applications: word processing; desktop publishing; spreadsheets; presentations; messaging and collaboration; and Web browsing. Intermediate skills should include: database applications; online teaching and facilitation; and multimedia skills. Advanced skills involve: programming; and hardware maintenance.

Teacher Training. Teachers should acquire this proficiency by: self-learning; short-term training; and enrolling in formal and nonformal computer courses, including courses offered in the distance mode. A targeted approach to teacher development on ICT involving all three methods should be implemented first involving teachers from regional science and science-oriented high schools and special education schools; followed by voc-tech high schools, national high schools, and then public elementary schools.

Teacher Training Needs. During the regional validation workshops, the following teacher training needs surfaced: basic computer applications; Web browsing; and the design, development and utilization of ICT-enhanced instructional materials. It was likewise apparent that much of the ICT teacher training currently being undertaken does not consider the entire basic educational teaching complement as a system with strategic nodes. Teachers who may generate the most multiplier effect are not targeted.

ICT for Pedagogy and Teacher Training. In this case, it should also be underscored that the transformative power of ICT is more likely to be realized when it is introduced in the context of radical system-wide reform. ICT for teacher development should be linked with ICT for pedagogy so that one will draw synergy from the other. Thus a systems approach to ICT4E is more strategic and cost-effective in the long run.

Specific Recommendations. Given the preceding analyses, the following specific recommendations on ICT for Teacher Development are forwarded:

Firstly, the CHED standards for pre-service teacher education should be fully enforced. Furthermore, DepED should invest in the development and implementation of National ICT Competency Standards for Teachers. DepED should dovetail CICT efforts along this line.

Secondly, DepED should shift to *targeted* participation in: Intel Teach to the Future Program; World Links – FIT-ED Instructional Design Workshop; Partners in Learning – PBSP TRCL Technician Training/ Leadership Training on ICT4E; and CICT Web board Training.

ICT for Governance and Management

ICT for Governance and Management brings together all past, present and future initiatives dealing with the improvement of management and the provision of educational support services. Situated under this program *are* the BEIS, MRIS, the FIS, and the HRIS. As mentioned in the earlier part of this document, information and communications technology will provide major benefits to DepED as an organization, in particular, and the education sector, in general, by contributing to: efficiency of operations; transparency of transactions; speed of service provision; effectiveness of evaluation; and accuracy of advocacy thrusts.

Integrating ICT in DepED's Institutional Development. ICT cuts across all horizontal and vertical dimensions of operations and it should be integrated in all aspects of the organization. ICT should

support a decentralized decision-making process by providing the communication infrastructure within the organization. From a functional standpoint, DepED should acquire the following capacities: systems maintenance; messaging and collaboration; database applications; Web browsing and publishing; documents management. It may outsource: systems design and development; content development; and multimedia production. More importantly, DepED's capability to manage and coordinate ICT4E should be built and strengthened.

ICT for School-Based Management, Quality Assurance and Budget Reform. School-based management would profit immensely from: database applications; sharing and reuse of instructional materials; template provision and assessment of School Improvement Plans; and messaging and collaboration. Quality assurance may also be enhanced by: database management; messaging and collaboration. Similarly, budget reform may be supported by: computerization of financial records and transactions leading to transparency; and monitoring and evaluation systems.

Prioritizing Applications? Once again, it should be stressed that the transformative power of ICT is more likely to be realized when it is introduced in the context of radical system-wide reform. Information systems should be integrated rather than fragmented. Prioritizing applications may not be advisable since by nature, information systems profit most from the synergy produced by parallel applications and networks. However, a sequencing of system modules may be followed.

Build up Strategy. The "build-up" strategy should not be on a piecemeal, component or modular basis but on a targeting and scale basis.

The first step is to conduct an information resources audit of the entire DepED. This study will reveal the existing information resources, knowledge resources and systems availability. This activity will take from three to six months beginning with the conduct of a survey administered in all DepED bureaus at all levels. The available resources and systems should be analyzed and configured for integration.

Existing systems that are deemed useful such as the Basic Education Information System should be upgraded and upscaled. The Management Resources Information Systems (MRIS), the Human Resources Information System (HRIS), and the Financial Information System (FIS) should be designed, developed and tested. The implementation of these systems should follow an evolutionary prototyping approach beginning with alpha versions and beta release versions. Modules developed by projects such as the Third Elementary Education Project should be reassessed for possible use in the above.

Employing a service oriented architecture, the interfacing or integration of these diverse systems should then be explored without disrupting existing systems operations. Finally the capability of DepED offices for data entry, use and maintenance of both modular and integrated systems should be built beginning with the national down to the provincial, district, divisional and school levels.

Linking ICT for Pedagogy, Teacher Training, Governance and Management. ICT for pedagogy and teacher training should be integrated with ICT for governance and management. We recommend an integrated system employing service-oriented architecture (SOA) that links learning management systems with management information systems.

ICT for Governance and Management should cover not only monitoring and evaluation but the entire gamut of concerns under ICT for governance and administration. The DepED itself is one of the largest bureaucracies in the public sector with the attendant tendencies for paper trails, inefficiencies and corruption. An integrated system may address these problems leading to: a paperless office; transparency of transactions; efficiency of operations; speed of service provision; and effectiveness of evaluation. This brings us to the current debate about the merits and demerits of an integrated system.

Many of the information systems adopted by offices within DepED have developed independently from one another. For instance, the payroll and procurement system has very little to do with the

Basic Education Information System. Obviously, scrapping these systems in favor of a newly designed integrated system would not be an option considering the expense that was put into these so-called legacy systems. Furthermore, they are still being actively utilized. The situation requires a solution that would interface these fragmented systems without disrupting them. In other words, we are proposing a service-oriented architecture (SOA) that makes use of data warehousing. Additionally, this meta-system should go beyond the provision of information but should focus on knowledge management. The knowledge management approach provides material and non-material incentives for information sharing and reuse, thereby transforming the organizational culture of DepED.

ICT and DepED's Institutional Culture, Corporate cultures have indeed changed because of the interplay of quality assurance, knowledge and ICT. This interplay is known as knowledge management or KM. DepED's institutional culture may be changed by KM transforming it into a genuine knowledge organization.

Specific Recommendations. Given the preceding analyses, the following specific recommendations on ICT for Governance and Management are forwarded:

Firstly, DepED should develop, upgrade or upscale its planned or current databases: the Basic Education Information System; the Management Information Resources System; the Human Resources Information System; and the Financial Information System. It should upgrade and upscale DEText, www.deped.gov.ph, and PiL/ Microsoft Monitoring Network (MONET).

Secondly, DepED should explore the utilization of system modules that developed by the Third Elementary Education Project.

Thirdly, DepED should invest in a department-wide Messaging and Collaboration Module to achieve a "paperless bureaucracy."

Lastly, DepED should invest in feasibility of integrated Knowledge Management System. This study would involve the technical

viability and organizational acceptability of such a system. The technical design of such a system should employ a service-oriented architecture (SOA).

SELF ASSESSMENT QUESTIONS

1. What are the current initiatives on ICT for pedagogy?
2. What are the current initiatives on ICT for teacher training?
3. What are the current initiatives on ICT for governance?
4. What technical issues confront the ICT4E in the Philippines?
5. What content issues confront the ICT4E in the Philippines?
6. What program issues confront the ICT4E in the Philippines?
7. What structural issues confront the ICT4E in the Philippines?
8. What political issues confront the ICT4E in the Philippines?
9. Describe the optimum approach for ICT4E.
10. Describe the BESRA ICT4E Strategic Framework.
11. Do you agree or disagree with the policy recommendations on ICT4E? Why or why not?

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CHAPTER 6.
EVALUATION OF ICT4E CASES

LEARNING OBJECTIVES

After studying the chapter, you should be able to:

1. Enumerate the achievements of each of the ICT4E case featured;
2. Describe the challenges faced; and
3. Assess the effectiveness of ICT4E in each case.

KEY CONCEPTS

Monitoring and Evaluation
Performance Evaluation
Indicators

CAPACITY BUILDING PROJECT ON ICT IN EDUCATION (2006-2009)

Performance. The oldest among the six projects evaluated is the Capacity Building Project on ICT in Education. It was initially planned to be a joint project between UNESCO and the Asian Development Bank in 2003 but the latter's participation did not materialize. It eventually started in 2006 and ended in 2009. The Project had a budget of USD 150,000 of which 97 percent or USD146,034.20 was used resulting in USD 3999.80 savings. It covered the entire Asia-Pacific Region but with the reach of digital technology, impacted other regions as well. It was pioneering in the sense that it was one of the first eLearning projects by the international development assistance community in Asia. Its intended outcome was the improvement of capacities of Ministries of Education throughout the region in planning for and making decisions on the integration of ICT in education.

The project developed two eLearning materials: ICT in Education Essentials; and ICT in Education Decision Making. It also produced an ICT in Education Guidebook.

Achievements. The eLearning modules were distributed widely among education sector stakeholders including Ministry officials, technical officers from UNESCO and other international development agencies, teachers and staff of educational institutions. Module 1 on ICT in Education Essentials provided users with fundamental information about ICT in education and promoted a common understanding on the topic within the education sector. Module 2 on ICT in Education Decision Making, on the other hand, assisted policymakers, planners, teachers, school administrators or educators in considering different factors involved in choosing the appropriate technology to use in a particular education setting. A screenshot of the navigation page of Module 1 is found below.

The modules were packaged in CDROM and were not placed in a platform of a password-protected learning management system, thus allowing open access to anyone with a copy of the CD. In fact, their utilization went beyond the Asia-Pacific Region as evidenced by recipients of auto-generated certificates and the utilization survey conducted (Please see ANNEX C). Upon analyzing the content, however, it is apparent that they require updating.

Furthermore, outcome-wise, it may be difficult to establish attribution for an improvement of capacities of Ministry of Education officials throughout the region in planning for and making decisions on the integration of ICT in education at this point. A majority of the surveyed course completers were teachers and not Ministry officials (ANNEX C). Nevertheless, the expanded reach of the project among its beneficiaries as an unintended positive outcome.

Challenges. The Project documented three challenges: the lack of expertise in developing eLearning packages; unexpected delays; and the non-materialization of ADB funding.

Lessons Learned. Considering its novelty during its planning and implementation, there were several opportunities to learn from the Project, including the process of designing, developing and implementing eLearning materials and courses. These lessons, however, may have been outpaced by the technologies of Massive Open Online Courses (MOOCs), which should be pursued as a potential follow through project considering the spread of beneficiaries experienced in the undertaking.

The Project made an observation that the content would have a long shelf life. Five years after its release, the eLearning materials do require updated content and newer, more innovative platforms such as online learning management systems (LMS). An additional lesson learned would be the need for a sustainability plan for eLearning undertakings to ensure content relevance and delivery innovation.

Good Practices. Open access and open educational resources were this Project's good practices that generated a multiplier effect among its intended beneficiaries. The circulation and utilization of the modules and guidebook were not encumbered by proprietary issues.

Key Factors for Success. The key factors for success were innovation and the use of digital technologies that enabled sharing and reuse. The modules were freely distributed and easily replicated. Thus, potential users may increase linearly if not exponentially, without additional resources from the project. In other words, it will grow and spread on its own.

Project Evaluation. The evaluation of this project may be summarized in Table 6.1.

The Capacity Building Project on ICT in Education is highly relevant being one of the first eLearning projects in this area targeted at policy makers and educators. It has efficiently utilized its inputs and has effectively produced its intended outputs.

Impact-wise, it is difficult to fully attribute the immediate outcome of increased capacities on ICT in education among Ministry of Education officials in the Asia-Pacific region to the ICT in Education modules and guidebook produced by the project. Nevertheless, the multiplier effect of open access and digital technologies have dramatically extended the impact of these knowledge products globally beyond the Asia Pacific region as originally intended.

In terms of sustainability, the effectiveness and impact of these knowledge products are not sustainable since by nature digital technologies are subject to planned obsolescence. Thus content and delivery systems require continuous updating, retooling and upgrading.

Table 6-1. Summary Table for Project Evaluation

Capacity Building Project on ICT in Education (2006-2009)		
GOAL	The improvement of capacities of MoEs in planning for and making decisions in the integration of ICT in Education.	
OUTCOMES	**Intended**	**Fulfilled**
	Outcome level not included in analysis	
OUTPUTS	ICT in Education Leaning Modules developed Users of learning management system who completed the ICT in Education course ICT in Education Guidebook developed	All outputs completed.
CHALLENGES	Lack of expertise in developing eLearning packages Unexpected delays Non-materialization of ADB funding	
THE WAY FORWARD	**Action**	Update content, upgrade delivery systems.
	Gaps to Fill	Further widen scale and impact
	Concrete Example	Development of Open Educational Resources for delivery via Massive Open Online Courses

INNOVATIVE PRACTICE ON ICT IN EDUCATION (2006-2009)

Performance. Innovative Practice on ICT in Education was a JFIT-ICT Project implemented by UNESCO Bangkok's Mobile Training Team under the APEID Program. It had a budget of USD 150,000 of which 92.82 percent or USD139,235.50 was utilized resulting in savings of USD 10,764.50. Its intended outcome was the identification, stimulation, documentation, support and networking of innovative practices in ICT in education throughout the Asia-Pacific region. The Project had three components: UNESCO ICT in Education Innovation Awards; training workshops for teachers, teacher educators, planners and administrators based on selected models from the competition or case studies; and case studies of

innovative practices. Under these components, the Project generated the following outputs: the UNESCO ICT in Education Innovation Awards; three training workshops; two video case studies; six case study booklets; and more than a hundred online references on ICT in education innovative practices.

Achievements. The UNESCO ICT in Education Awards generated much interest and publicity. There were a total of 146 entries from 19 countries that vied for the three award categories. The impact of the awards stretched beyond the Asia Pacific Region with entries from Israel and Palestine. The workshops were likewise well received since these provided an opportunity for the sharing and reuse of best practice within a relatively new and innovative pedagogic area. The Project noted that the three training workshops led to invitations for the trainers to conduct similar workshops in other countries, "an outcome greatly welcomed by the sponsor and UNESCO to sustain the innovative practices beyond the lifespan of the project."

The video and hard copy case studies were well circulated with users once again extending beyond the Asia Pacific region.

Challenges. The Project documented a number of challenges, among them were: technical difficulties in downloading large files for the Awards; funding arrangements for resuming the Awards; and delays in the production of the case studies.

Lessons Learned. The UNESCO ICT in Education Innovation Awards generated much publicity and interest but could not be sustained due to the absence of long-term commitment from private-sector sponsors. A sustainability plan that provided for private sector participation or public private partnerships should have been built-into the project.

Good Practices. The three Project components, namely, the conduct of the UNESCO Awards, the sharing and reuse of innovative practices, and the publication of case studies may all be considered as good practices to be emulated in other projects. The documentation of the case studies by UNESCO under its regular clearinghouse function also serves as one. So is the highlighting

of the role of women in ICT in education, which was an unintended outcome for the project.

Key Factors for Success. The sharing and reuse of good practices is the key factor for the success of the Project. When employed strategically, the sharing and reuse of good practices become mutually reinforcing within a community and may even result in a critical mass of practitioners that would spread the gospel of ICT in education on its own.

Project Evaluation. The evaluation of this project may be summarized in the following table:

Table 6-2. Summary Table for Project Evaluation

Innovative Practice on ICT in Education Project (2006-2009)		
GOAL	The identification, stimulation, documentation, support and networking of innovative practices in ICT in education throughout the Asia-Pacific region.	
OUTCOMES	**Intended**	**Fulfilled**
	Output level not included in analysis.	
OUTPUT	Innovative practices in the utilization of ICT in education across the Asia-Pacific region documented Prizes awarded Training workshops conducted Training participants in national training workshops Active regional network nodes	All outputs completed.
CHALLENGES	Technical difficulties in downloading large files for the Awards Funding arrangements for resuming the Awards Delays in the production of the case studies	
THE WAY FORWARD	**Action**	Assist in mainstreaming ICT in Education Awards
	Gaps to Fill	Sustainability
	Concrete Example	A project to design, develop and initiate a sustainability plan for the Awards.

The Innovative Practice on ICT in Education Project is most relevant since it has promoted the practice at a most opportune time. It has efficiently used its resources as evidenced by its drawdown of funds. It has effectively achieved its targets also.

Impact-wise, the Project generated much support and interest. Its only deficiency is sustainability since it requires active private sector participation in order to become a going concern.

NEXT GENERATION OF TEACHERS PROJECT PHASE 1 (2007-2008) AND PHASE 2 (2009-2011)

Performance. The Next Generation of Teachers Project was implemented in two phases. Phase 1 was conducted from March 2007 to February 2008 in Sri Lanka. Phase 2 expanded the coverage of NextGen to the entire Asia-Pacific Region and was implemented from January 2009 to August 2011. The two projects had a budget of USD258,010 with a total drawdown of USD239,245.31 (92.72%) generating USD18,764.69 savings.

The intended outcomes of the Project were: enhanced leadership among deans and faculty of TEIs in planning and creating an ICT-based teacher training environment, managing ICT-related training programmes and supporting instructors' professional development; catalyzed efforts of TEIs self-led ICT-related curriculum reform for pre-service teachers; and increased capacity of teacher educators in designing, providing and managing teacher training activities on ICT-pedagogy integration, and facilitating their collective professional development on ICT-integration.

During Phase 1, around 150 teacher educators were trained on ICT-pedagogy integration; 30 policy makers and planners were trained on

ICT in Education policy; and 250 teachers and students were trained on computer hardware and maintenance. Approximately 75 teacher educators were trained on ICT pedagogy integration. Ten Deans and Presidents from the National College of Education in Sri Lanka attended Dean's Forum at the international level. Thirty policy makers and planners were trained on using ICT in education policy toolkit.

During Phase 2, an Experts' Meeting that designed the curriculum development framework was held. Two regional Deans' Forum (4th and 5th) and one national for Thailand were organized. A TEI Network with 42 institutions from 15 countries was established. Two ICT in Education Pedagogy Integration Workshop and five ICT in Education Curriculum Development Workshops were held. NextGen Resource Centres with 34 volunteer TEIs from 15 countries were established. Lastly, a publication on the collection of ICT-related courses in teacher education was released.

Achievements. At the outcome level, Phase 1 of the Project succeeded in achieving Improved capabilities of teacher education institutions in preparing pre-service teachers for ICT-enhanced environment; improved capabilities of teacher educators in ICT pedagogy integration and using ICT as a teaching tool; improved leadership skills among Deans and educational training personnel in ICT in Education; and increased awareness of policymakers and planners on the integration of ICT in education. These outcomes were achieved based on results of training and post-activity evaluations conducted by the project, which led to the decision to scale it up from Sri Lanka to cover the entire Asia Pacific Region.

On the other hand, Phase 2 outcomes were: increased interest in TEIs to enhance or develop pre-service education curriculum on ICT-pedagogy integration; increased participation from TEIs in the region towards strengthening institutional capacities in integrating ICT with pedagogical approaches for pre-service teacher training; increased capacity to design/ update and implement ICT-related curriculum in TEIs; increased number and relevance of courses in TEIs incorporating ICT; enhanced capacities among teacher educators to design, provide, and manage teacher training activities; and easier access to UNESCO Bangkok ICT in Education resources for teachers

and students in the region. These outcomes are evidenced by results of post-activity evaluations and project reports supplemented by an email survey, which will be described in another section.

Challenges. During Phase 1, NextGen was plagued with communication problems between institutional stakeholders. There was a lack of effective coordination at the country level, between the departments in the Ministry of Education and within the National Institute of Education. The project team had only 12 months (March 2007 – February 2008) to build the capacities of teacher educators and MoE officials in Sri Lanka. The difficulties in coordination and communication severely affected the timeline.

During Phase II, the Project encountered difficulties in convincing TEIs to update or develop new ICT-related courses in teacher education since curriculum development or revisions was a cumbersome, expensive process. Furthermore, there were scheduling issues due to fully committed school calendars. Lastly, limited time and resources, affected the Project's ability to involve more interested countries and institutions.

Lessons Learned. The following lessons learned were documented by the Project:

1. Successful project implementation depends largely on support of the local counterparts.
2. Education resources produced from other JFIT sponsored ICT in Education projects are very useful for the teacher educators.
3. Selection of the appropriate participants to attend the various workshops, forum and conferences is very crucial to the success of these activities.
4. An approach to ICT integration such as the online Telecollaboration is a useful example in integrating ICT in teaching and learning.
5. By identifying teacher education institutions to participate in the project activities, NextGen made a conscious effort to invest in institutional capacity building.
6. Capacity building of institutions requires focused interventions.
7. Curricular revisions can bring about lasting changes in the ability of teacher education institutions to produce better quality educators.

8. To cover more countries and TEIs, NextGen needs more time, manpower and financial resources.

Good Practices. Specific measures were taken to increase the visibility of the NextGen Project. Internal communication channels such as the UNESCO Website and newsletter featured NextGen events and activities. External channels such as local media and promotional campaigns were also tapped.

The utilization JFIT-ICT knowledge resources produced in other projects provided additional synergy within the ICT in Education initiative, in general, and the Program, in particular.

Key Factors for Success. Involvement of all TEI stakeholders at all levels, from the Ministry to the Deans down to the teachers is a practice that should be maintained in similar undertakings in the future. The use of communication and visibility strategies likewise contributed to the gains achieved by the project.

Project Evaluation. The evaluation of this project may be summarized in the Table 6-3.

In spite of the challenges encountered by the Project, it is the External Evaluator's opinion that the Next Generation of Teachers Project (Phase 1 and Phase 2) had been most successful. Its drawdown of funds was 92.7% indicative of its efficient operations. Among the projects evaluated, it had the most extensive set of outputs.

In terms of impact, the evaluation findings are very encouraging. A survey conducted to determine the utilization of JFIT-ICT knowledge resources, many of which were produced by this project, resulted in positive findings. The respondents were sampled from the UNESCO ICT in Education mailing list. One hundred and forty recipients of ICT in Education materials were sampled from a universe of 720 names. An overwhelming majority of those surveyed were teachers who: found the materials useful; completed the eLearning courses; shared these materials with their colleagues; and, notably, were requesting for more when available. The feedback volunteered on

Table 6-3. Summary Table for Project Evaluation

Next Generation of Teachers Project Phase 1 (2007-2008) and Phase 2 (2009-2011)		
GOAL	Building of institutional capacities of teacher education institutions (TEIs) in the Asia-Pacific region.	
OUTCOMES	**Intended**	**Fulfilled**
	Enhanced leadership in TEIs on ICT in education Increased skills of teacher educators in ICT-pedagogy integration Reformed curricula in pre-service teacher education	Difficulty in attributing enhanced leadership to project. Increased skills and reformed curricula fulfilled.
OUTPUTS	Next Gen Resource Centers established Teachers' Training conducted Deans' Fora conducted Curriculum Development Workshops conducted Experts' Meeting on ICT-related Curriculum Development conducted ICT in Education Pedagogy Integration Workshops conducted	All outputs completed
CHALLENGES	Communication and coordination difficulties. Cumbersome curriculum revision process. Scheduling problems.	
THE WAY FORWARD	**Action**	Policy for regional standards on ICT in Education for compliance of TEIs Implementation of regional courses
	Gaps to Fill	Standards
	Concrete Example	The design and implementation of MOOCs on ICT in Education for teachers that may be accredited in all TEIs

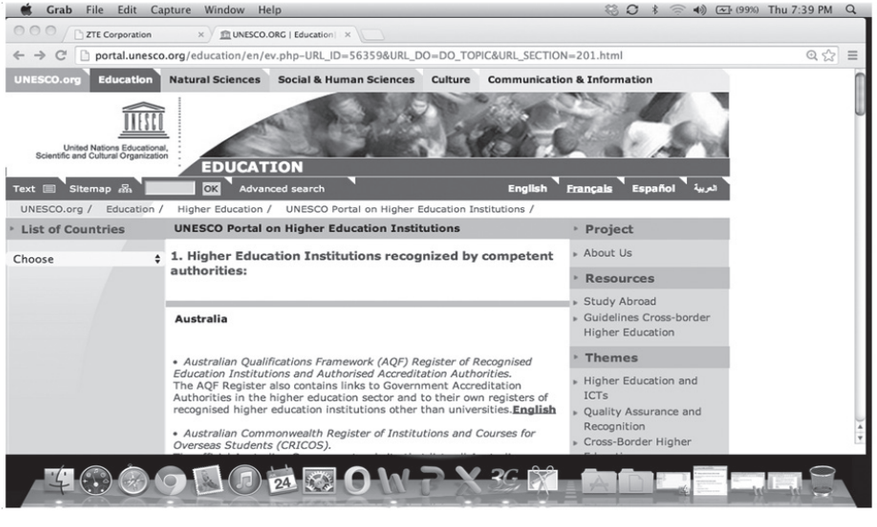
these resources expressed appreciation for their usefulness in their pedagogic responsibilities. Consider that these results were beyond the listed outcome indicators for this project.

ICT FOR ACCESSIBLE, EFFECTIVE, AND EFFICIENT HIGHER EDUCATION (2009-2011)

Performance. The ICT for Accessible, Effective and Efficient Higher Education Project was initiated in March 2009 and ended in February 2011. It had a budget of USD166,110 and an 80.5 percent drawdown (USD133,684.51) resulting in savings of USD32,425.49. The Project's intended outcome is increased effectiveness in policymaking and adaptation of innovative ICT practices in HEIs in the Asia-Pacific region.

Project outputs include: the UNESCO Portal on Higher Education Institutions; seven case studies on the use of ICT in HEIs; five (5) research studies on university graduate employability; and National Information Centre reports.

Achievements. Among the outcomes claimed by the Project are: increased interest in ICT for HEIs among policy makers, administrators and academic staff; increased use of ICT in HEIs for teaching, learning, research and administration; increased training opportunities for staff on using ICT in HEIs; new or updated programs and courses in HEIs incorporating ICT; increased understanding of graduate employability issues; increased capacity to design and update IT/ICT programs in HEIs; an increased number of countries in the region using the UNESCO Portal on Higher Education Institutions.



The outcomes -- increased training opportunities for staff on using ICT in HEIs; new or updated programs and courses in HEIs incorporating ICT; increased understanding of graduate employability issues; increased capacity to design and update IT/ICT programs in HEIs; and increased number of countries in the region using the UNESCO Portal on Higher Education Institutions -- have been verified by documents analysis, key informant interviews and the email survey. However, attribution cannot be established for: increased interest in ICT for HEIs among policy makers, administrators and academic staff; and increased use of ICT in HEIs for teaching, learning, research and administration. The Evaluator cannot source evidence that links the Project directly to these outcomes.

Challenges. The major problems encountered were the inability of three contracted researchers to deliver their outputs satisfactorily.

Lessons Learned. The following lessons learned were documented by the Project:

1. Although implemented independently, project components are complementary and produce synergies.
2. Case studies on the use of ICT for higher education are useful in increasing awareness on how higher education institutions can improve their curricula, courses, management and services through appropriate pedagogy, technology and tools.
3. The research on graduate employability was particularly relevant in view of the financial crisis and the continuing problem of graduate unemployment.

Project Evaluation. The evaluation of this project may be summarized in Table 6-4.

As earlier mentioned, this project was chosen for outcome-level evaluation because the External Evaluator believes that ICT in Higher Education will assume a more prominent role in the near future. Recent trends such as Massive Open Online Courses and Open Educational Resources have shown that much of ICT in education's potential lie in its pedagogical applications in independent and open learning, particularly in higher and continuing education.

Table 6-4. Summary Table for Project Evaluation

ICT for Accessible, Effective and Efficient Higher Education (2009-2011)			
GOAL	The facilitation of effective policymaking and the adaptation of innovative ICT practices in HEIs in the Asia-Pacific region.		
OUTCOMES	**Intended**		**Fulfilled**
	Increased training opportunities for staff on using ICT in HEIs New or updated programs and courses in HEIs incorporating ICT Increased understanding of graduate employability issues Increased capacity to design and update IT/ICT programs in HEIs increased number of countries in the region using the UNESCO Portal on Higher Education Institutions Increased interest in ICT for HEIs among policy makers, administrators and academic staff Increased use of ICT in HEIs for teaching, learning, research and administration		All outcomes fulfilled except increased interest in ICT for HEIs among policy makers, administrators and academic staff; and increased use of ICT in HEIs for teaching, learning, research and administration wherein attribution cannot be established.
OUTPUTS	Number of case studies on the use of ICT in HEIs Research study on the preparation of IT graduates for the labor market conducted UNESCO Portal on Higher Education Institutions and National Information Centers established		All outputs completed.
CHALLENGES	Inability of three contracted researchers to deliver their outputs satisfactorily		
THE WAY FORWARD	**Action**	Build-In results based monitoring and evaluation into program and projects. Implement project that explores open learning in higher education, specifically for teacher training.	
	Gaps to Fill	RBM&E	
	Concrete Example	Initiate a sub-program on results-based M&E for the JFIT-ICT program and its projects	

Unfortunately, the learner-centered open education dimension of ICT in education has not been among this project's main concerns.

Additionally, among the six projects evaluated, the Project had the lowest drawdown at 80 percent. The Evaluator believes that this lack of resource utilization has resulted from the inability of some of the sub-contractors to complete their deliverables. Nevertheless, the Project was not remiss in its outputs. The UNESCO Portal on Higher Education Institutions is now up and running. Seven case studies on the use of ICT in HEIs, five research studies on university graduate employability, and National Information Centre reports are now part of the ICT in Education literature that are frequently cited papers and state-of-play reports on the subject.

The impact of the Project on training opportunities, programs and courses, and understanding of ICT in Education is firmly triangulated in the evaluation. However, the immediate outcome of increased interest and application among HEI policy makers and administrators cannot be directly linked with the Project given the current data.

CENTRAL ASIA REGIONAL SYMPOSIUM ON ICT IN EDUCATION (2012-2013)

Performance. The Central Asia Regional Symposium on ICT in Education (CASIE) is an eight-month undertaking (May to December 2011) that culminated in a three-day Symposium participated in by five Central Asian countries: Kazakhstan; Kyrgyzstan; Uzbekistan; Tajikistan; and Turkmenistan. It had a budget of USD88,136 of which 85 percent or USD75,030.40 were utilized resulting in savings of USD13,105.60. The Project consists of two main components: the Central Asia Regional Symposium on ICT in Education; and the consolidation and dissemination of cross-cutting issues and lessons learned.

The intended outcomes of CASIE are: innovative practices on integrating ICT in education shared and disseminated; a sub-regional roadmap for integrating ICT in education to achieve EFA and enable lifelong learning discussed; and a sub-regional collaboration mechanism for enhancing use of ICT in education established.

The Project organized a Regional Symposium for government officials from countries in the Central Asia region on use of ICT in education and consolidated country reports and disseminated cross-cutting issues and lessons learned.

Achievements. The target outputs for CASIE were achieved. The Regional Symposium for government officials involved six Central Asian countries. In close collaboration with the project partners, the Symposium was held in Almaty with 46 country delegates from the beneficiary countries and international experts from Tokyo Tech, eASEM, IREX, and KIST. The project achieved its objectives by providing a sub-regional platform for national education policy makers, practitioners, and development partners to share issues and challenges that Central Asian countries were facing in integrating ICT into their respective education systems, with particular emphasis on the use of ICT for policy formulation and ICT-supported open and distance learning towards enabling lifelong learning. The Symposium also accomplished its objectives by promoting the collaboration and partnership among the Central Asian countries in the identification of solutions to similar issues and challenges in relation to the effective and efficient use of ICT in Education.

As a follow through, UNESCO Bangkok organized a second CASIE in May 2014 in Uzbekistan albeit without JFIT-ICT funding. CASIE II successfully sustained the subregional platform for the discussion of unique challenges that Central Asian countries are facing in integrating ICT in their educational systems.

Challenges. Because of Central Asia's geographic distance and Russian working language, UNESCO Bangkok had not been as active in the Central Asia as it is in other sub-regions. The Symposium was the first major activity that UNESCO Bangkok carried out in the area of ICT in Education in the Central Asian sub-region. The Project team experienced some difficulties in organizing the Symposium. Firstly, UNESCO IITE was going to organize a conference on a similar topic, called "International Conference on ICT in Education: Pedagogy, Educational Resources and Quality Assurance" on 13-14 November 2012. The Symposium was then rescheduled from 5-7 November 2012 to 28-30 January 2013. Secondly, Mongolia was added as

the sixth target country beneficiary. This change required a budget realignment that was subsequently approved. Thirdly, language became a major challenge. Most of the participating countries write and speak in Russian, while UNESCO Bangkok and resource persons use English as their medium. UNESCO Bangkok collaborated with UNESCO IITE, UNESCO Almaty and Tashkent to ensure smooth communication.

Diversity in the sub-region was also a challenge. Central Asia is quite diverse as well as unique. This uniqueness necessitated the establishment of a sub-regional platform.

Lessons Learned. Promoting the effective use of ICT in Central Asia requires synergizing the efforts among UNESCO Bangkok, UNESCO IITE, UNESCO Almaty and UNESCO Tashkent. The Project noted the following lessons:

1. UNESCO Bangkok will continue to promote and strengthen sustainable partnerships with IITE and UNESCO field offices in the design and implementation of future undertakings entailing the integration of ICT in education in the sub-region.

2. Based on the findings from the analysis and synthesis of the Symposium dialogues, building teachers' capacity in integrating ICT in a solid pedagogical way is one of the key areas that Central Asian countries require support in. Renewed partnership among UNESCO Bangkok, UNESCO Tashkent, and UNESCO IITE will greatly contribute in crafting the appropriate response to such need, especially with UNESCO Bangkok's exemplary programme of teachers' capacity building on effectively using ICT for teaching and learning.

Key Factors for Success. Due to the differences in working languages and organizational cultures, strong local support was a key factor in the successful implementation of a project.

Project Evaluation. The evaluation of this project may be summarized in the following table:

Table 6-5. Summary Table for Project Evaluation

Central Asia Regional Symposium on ICT in Education (2012-2013)		
GOAL	The provision of a platform where government officials and experts can discuss practices in ICT in education, policy options and potential solutions to the common issues and challenges faced by their respective education systems	
OUTCOMES	**Intended**	**Fulfilled**
	Outcome level not included in analysis.	
OUTPUTS	Symposium implemented Symposium Report completed Number of Symposium Reports Disseminated	All outputs completed.
CHALLENGES	Language challenges Coordination with other UNESCO bodies Diversity of the region	
THE WAY FORWARD	**Action**	Mainstream regional symposia
	Gaps to Fill	Policy advocacy
	Concrete Example	Project that conducts annual symposia in Asia and Pacific subregions

CASIE's project design was timely and relevant given the realities in Central Asia. Efficiency was moderate with budgetary resources utilized at 85 percent drawdown. The Project effectively achieved its twin objectives. In terms of impact, the immediate outcomes were realized. With close coordination among relevant UNESCO bodies in the sub-region and continued sponsorship by either UNESCO Bangkok or JFIT ICT, sustainability can be assured.

CHAPTER 7.
ICT for Rural Livelihoods

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Enumerate specific livelihood outcomes of ICT4L;
2. Recall the conditions under which ICT-related projects produce the desired livelihood outcomes;
3. Articulate on the social dimensions of ICT4L;
4. Describe how replicability and scalability of interventions and outcomes can be assured;
5. Discuss DFIDs sustainable livelihood framework; and
6. Describe the proposed logical, M&E and research frameworks for ICT4L.

KEY CONCEPTS

ICT4L
Sustainable Livelihood Framework
Value Chain
Technical Supply Chain
Social Capital
The Network Effect
Reed's Law
Critical Mass Theory

CASES

Do information and communication technologies alleviate poverty? Do ICTs contribute to livelihoods of the rural poor?

There have been a number of projects undertaken by development agencies and civil society that provide an affirmative answer to the preceding questions. The following provides a list of key initiatives available in grey literature found in the World Wide Web. A project profile matrix describing most of these initiatives follows:

Cambodia: Community Access to Computers Providing Basic Services to Cambodian Communes and Villages through ICT

Indonesia: Home workers and ICTs (linked to Malaysia and Thai studies)
Poor Farmers' Income Improvement through Innovation

Lao PDR: ICTs in Support of Tourism Development eCommunity Centers to Improve Local Governance

Malaysia: Integrated Tools Development Home workers and ICTs (linked to Indonesian and Thai studies)

Philippines: Low-Cost IT Center
Village Phone at Work

Thailand: Home workers and ICTs in Southeast Asia (Linked to Malaysia and Indonesia)
The BAAC Agricultural Information Network

VietNam: ICT for poverty alleviation in the VietNam Highlands Development of eCommunity Centers in the Central Region

Pacific Islands: Development of Sustainable Agriculture in the Pacific HELP (Health, Education, Livelihood, Participation) Resources

Table 7-1. Matrix of ICTs for Rural Livelihoods Projects Sampled in the Southeast Asian and Pacific Regions

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
Cambodia	Community Access to Computers Project	National	To achieve universal access to ICTs	Evolution of locally driven cooperative enterprises to manage ICT services for all community sectors	IDRC	1,462,400 (CA$)	Small grants provision Capacity building Networking among Cambodian researchers, and the sharing of experiences with neighboring Laos, Myanmar and Vietnam
Malaysia	Integrated Tools Development Project	Group (women)	To assist disadvantaged women who are confined to their homes due to disabilities and other circumstances. The project explores the possibility of developing an integrated system of ICT tools such as computers, the Internet, telephone, Short Message System (SMS), facsimile and others to free the women from the confines of their homes. Through utilization of tools already available to them, or supplied through this project, the women can provide products and services to the external market.	• Development of technical supply chain and marketing solutions. • Increased capacities of women to offer marketable skills • Income generation	UNDP/ Pan-Asia R&D Grant	USD 29,947	Improving access: Use of an integrated platform to manage supply chain through a not-for-profit entity like eHomemakers, a model for poverty reduction using entrepreneurial principles and ICTs was created. Gender dimension: The ICT platform expanded further to allow women to participate in eHomemakers' gender governance framework where women own and manage the information network for and by them. Social capital formation through networking.

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
Papua New Guinea	HELP Resources (Health, Education, Livelihood, and Participation)		To meet the Information and Communication, Training and Capacity Building and Networking needs of local communities, groups and community-based organizations that are keen to undertake sustainable development initiatives	Increased capacities	Bread for the World, and OXFAM New Zealand	K350,000 per year	HELP Resources currently operates: • a development focused library, with print, video, audio and CD based resources • a desktop publishing service, including translation, editing and graphic design a training unit that can research, conceive, write, design and deliver appropriate training and adult learning curriculum

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
Philippines	Low-Cost IT Center for the Philippines		To bring low cost IT and services to communities throughout the Philippines	Increased capacities	UNDP/ Pan-Asia R&D Grant	USD 9,000	Three principles ensure positive outcomes, sustainability and replication: low initial cost; targeted services for the community based on a pay-what-you-can principle; and building of local skills to maintain and repair the IT center after sponsors has departed.
Philippines	Village Phone At Work		**Village Phone Direct** uses existing mobile communications products and does not require the same level of engagement from the telecommunications company. This model allows virtually any microfinance institution (MFI) to directly develop and implement a Village Phone product for their clients and to select the local telecommunications provider from which to purchase the pre-paid airtime.	Increased incomes for VPOs amounting to US$5-6/ week. Higher sales volume in VPOs primary livelihood (small retail stores, local eateries and the like)	Grameen Foundation	Not indicated	Gender dimension Micro-financing Networking Village Phone Direct was a finalist in the 2008 GSMA Global Mobile Awards for the "Best Use of Mobile for Social and Economic Development"

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
South-East Asia (Thailand, Indonesia, Malaysia)	Home workers and ICTs in South-East Asia		To carry out a participatory study to identify and document the issues surrounding home-based work; To understand how ICTs can address specific social economic challenges and gender barriers facing women home workers in South East Asia.	Increased access to telecoms Increased social capital Increased incomes	IDRC PAN R&D Grant	USD 165,520	Gender dimension: eHomemakers project is a model for all teleworkers and e-entrepreneurs, proving that women can break new grounds with ICT usage, and have the ability to balance home and career Improving access: Creation of trilingual Internet portal catering to women homemakers. Networking: Website enables visitors to improve efficiency of home-based work, embark on entrepreneurship, exchange ideas and experiences, and ask questions of experts in working from home or starting an internet business.
South Pacific (Papua New Guinea, Samoa, Fiji, Tonga, Kiribati.)	DSAP – Development of Sustainable Agriculture in the Pacific		To increase sustainable agricultural production of farm families.	Increased access Increased provision of basic services	NGO (European Union)	-	"Missing Link" Hypothesis: Establishing linkages with basic services providers including local agricultural offices, health offices, schools and NGOs

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
Thailand	Agriculture Information Network Project	National	This project aims to create a model of integrated agricultural information gathered by domestic and international organizations engaged in agricultural research in Thailand. The project developed a model to analyze agricultural areas at risk from floods, droughts, and landslides based on geographical information system (GIS).	Increased sharing of information Increased disaster preparedness	NECTEC, BAAC, MOAC	Not Mentioned	Public-Private Sector Partnership: The agricultural information network benefit farming communities through a data clearing house system that integrates information from public and private organizations. Early Warning Systems: Established an Internet GIS system that shows areas at risk from flooding, drought, and landslides. Precision Agriculture: The GIS can be used to manage areas at the community level. A system of image recording and image information management.

Country	Descriptive Title/Name	Level	Objectives/ Goals	Livelihood Outcomes	Funding	Initial Investment	Key Features
Vietnam	ICT for enhancing people's capacity and poverty alleviation in the highlands		Enhancing capacity of people in doing reports via ICT-Improving technology in Communication, Health care Education , Agricultural production - Handicraft production and communication system of Cooperatives in project areas Objectives: Enhancing capacity of people in the Konplong district, Kon Tum province for using ICT to improve their livelihood.	Increased access to ICTs Increased awareness of health services Increased capacities	Not mentioned	Not mentioned	Missing Link Hypothesis: Provided information links to basic services providers Transferability: Initial trained group can serve as trainers for the following training program to transfer their ICT knowledge to other people at the Cultural Community House - so more people can have access to ICT.

BEST PRACTICE AND LESSONS LEARNED

We may cull a number of observations on ICT4L best practice and lessons learned in the preceding literature review. At this point, preliminary answers to the research questions forwarded by the Scoping Study can be given, based on these observations.

Specific Livelihood Outcomes of ICT4L. On the basis of cases found in Southeast Asia and the Pacific, specific livelihood outcomes linked with ICT are:

1. Increased access to information and communication technologies.

2. Increased capacities of rural groups, particularly rural women, to offer marketable skills.

3. Increased awareness and availing of basic services by communities as well as linkages with government service providers in the agriculture, health, education, micro-finance and disaster preparedness sectors.

4. Increased incomes among families.

5. Higher sales volume in users' primary livelihoods (e.g. small retail stores, local eateries, local transport provision) as in the case of village phone operators or VPOs.

6. Development and evolution of support mechanisms and locally driven enterprises such as technical supply chains, marketing solutions, and other ICT-related services that assist the community and generate additional employment opportunities and incomes as well.

7. Increased social capital generated through information sharing and networking among groups, particularly women.

Conditions Under Which ICT4L Interventions Produce Outcomes. There appears to be a number of conditions for these outcomes.

Firstly, ICT4L projects are more likely to succeed as secondary livelihoods, that is, if it is associated with already pre-existing primary livelihoods in the community, such as small retail stores, marketing cooperatives, food service providers, transport providers, micro-finance establishments, and others. The demand for ICT services increase with the presence of these primary livelihoods.

Secondly, ICT4L projects are more likely to succeed if women groups run these.

Thirdly, ICT4L projects are more likely to succeed if these are linked to basic services providers such as government agencies involve in agriculture, health and education sectors. This observation validates Calvano's "missing link hypothesis" discussed in Part A of Chapter II, wherein the level of telecommunications infrastructure development has been directly correlated with levels of utilization by thematic sectors.

Fourthly, ICT4L projects are more likely to be sustainable with the use of intermediaries and personalized user-friendly technologies such as mobile phones in the VPO Project (Philippines).

Fifthly, ICT4L projects are more likely to be sustainable if it has a capacity building component as in the case of the Home Workers and ICTs Project (Indonesia, Malaysia and Thailand) and the Community Access to Computer Project (Cambodia).

Sixthly, ICT4L projects are more likely to be sustainable with public-private sector partnerships and cost sharing as in the case of the Thai Agricultural Information Network.

Lastly, ICT4L projects are more likely to have better outcomes if they are not technology-driven or donor-driven.

Gender and Social Dimensions. Possible causes of the above seven conditions are explained herein.

Gender. It may be considered sexist to conclude that ICT4L projects run by women are more successful. However, sex may have little

to do with it. A specific gender trait may explain this observation. Casual observation reveals that rural women's groups, particularly in Southeast Asia, tend to be more closely knit than farmers' groups or youth groups. Perhaps this is a function of their circumstances since women have more time to spend with one another during work and leisure times. Furthermore, they can relate and empathize with one another's roles and challenges. It is clear that rural women's groups tend to possess more social capital. Thus, women's networks appear to benefit more from the so-called Network Effect.

Social Capital. The concept of social capital figures out prominently in a discussion of social dimensions. In recent years, economists and sociologists alike have been closely studying a factor, which has been deemed as a necessary element in the development equation. This factor is called social capital as distinguished from financial capital, resource capital and intellectual capital.

Social capital has been defined as the capacity of groups to work together for the common good (Montgomery, 1998) or as the ability to draw on relationships with others especially on the basis of trust and reciprocity (HDR, 1998). The sociological definition of social capital is trust, reciprocity and mutuality that are inherent in social relationships (Cox, 1996). Robinson & Hanson (1995) forwarded an economic definition that describes social capital as the institutional dimension of transactions, markets and contracts.

To the above definitions, we would venture to add another, which may be considered as communicational in nature. Simply put, social capital is the economic value obtained in institutional or individual networking. Note that reciprocity and mutuality, two concepts contained in the sociological definition, are variables central to networks and network analysis. However, social capital must be measured in economic terms.

Networking. Another social dimension of ICT4L is networking. Perhaps the most popular IT adage is found in Moore's Law, which states that, technology-wise, computing power doubles every eighteen months. A lesser-known IT principle is the Network Effect.

Otherwise known as Metcalf's Law, after the head of the Ethernet development team, the Network Effect states that the total value of a network where each node can reach every other node grows with the square of the number of nodes. David Reed, a sociologist and community development expert, applied Metcalf's Law to social networks and arrived at a similar conclusion. Social capital may increase exponentially through Intra and Internet connectivity. How may social capital increase in a networked environment? The following reasons are given:

> Superimposing electronic networks on social networks allow individuals to cross easily between these networks;
> Electronic networks provide pathways, bridges. doors and entry points between and among online community infrastructures; and
> Access to the World Wide Web increases the potential social capital of a community through the augmentation of its knowledge capital.

Due to: the synergy produced in working together as a group; the use of a common platform; and the knowledge resources in the World Wide Web available to them individually and as a group, the *potential* social capital of a group increases exponentially. More so with women's groups, it appears.

Conscientization. A third social dimension is education. How does education contribute to positive ICT4L outcomes? The obvious answer is that it builds up knowledge and skills that capacitates an individual or a group to earn a living. However, there is more to education than capacity building. A higher social goal of education is conscientization.

Conscientization can be made possible through ICTs, particularly video capture and playback, functionalities found in most mobile phone models nowadays. Much has been written about the power of video to act as an electronic mirror that brings a social problem to the fore of a community agenda. An early illustration of conscientization through video and how it addresses poverty may be found in the Fogo Process.

In the late sixties, the island of Fogo was one of the most depressed areas within the Commonwealth of Canada. Situated off Notre Dame Bay, the island is chiefly populated by farm families. In 1967, a film crew from the Canadian Broadcasting Corporation visited Fogo to film a documentary on the islanders' poverty. What resulted was a television feature that presented a superficial and at times erroneous depiction of Fogo life. The film documentary was essentially a subjective interpretation and, hence, a product of the filmmakers' creative process. This generated a lot of resentment from local officials who knew of the genuine situation in Fogo. To present what they felt was a more accurate picture of poverty in Fogo, Colin Low of the Agricultural Extension Service approached a Canadian filmmaker, Don Snowden, known for his documentary work. They collaborated on a film that eventually had a very profound, and yet inadvertent effect on the subjects of the film and their community. This effect was an outcome of the innovative documentary technique that Low and Snowden employed.

This technique may best be described as participatory documentation. Low and Snowden avoided any tendency to impose their opinions and perspectives on their subjects and saw to it that these were not reflected in the film. In other words, they presented the situation from their subjects' eyes, ears and experiences. What was even more innovative was the processing of the documentary in their subjects' minds. The Fogo islanders were shown the film rushes, the rough edits and the final edits. Not only did they participate in the editing. They were actually processing these images and sounds in their minds, eventually, bringing Fogo poverty into their consciousness allowing them an opportunity to collectively validate its causes. This collective validation led to collective action against the conditions that caused poverty.

Participation and Web 2.0. The Fogo Process began with participation initiated social reflection, which resulted in collective action or mobilization. Nowadays, a parallel may be seen in the participatory content provision of Web 2.0.

Insofar as social dimensions are concerned, a final consideration should be the impetus that drives ICT4L undertakings. There are

concerns related to current ICT4L program rationale and design. What are the determinants of the elements of a program design? Are these based on assessed needs or are these donor-driven? Are these determined by a social agenda or are they technology driven?

The Village Phone Direct and the eHomemakers Project are definitely based on assessed needs. However, some of the ICT4L cases given above may indeed be described as technology driven or donor driven. There is nothing wrong with such projects particularly if they are funded by grant money, and not by loan funds. However, the relevance and sustainability of an undertaking would be immensely enhanced if the impetus for the project came from a real and felt need. Furthermore, donor-driven or technology-driven initiatives tend not to foster project ownership within the community.

Replicability of Interventions and Outcomes. Two of the conditions mentioned that influence outcomes of ICT4Lrelate to replicability. These are:

- ICT4L projects are more likely to succeed as secondary livelihoods, that is, if it is associated with already pre-existing primary livelihoods in the community, such as small retail stores, marketing cooperatives, food service providers, transport providers, micro-finance establishments, and others. The demand for ICT services increase with the presence of these primary livelihoods.

- ICT4L projects are more likely to succeed if these are linked to basic services providers such as government agencies involve in agriculture, health and education sectors.

These conditions may be attributed to the fact that technology is merely one of five dimensions in the development process, the others being: economics; values; social structures; and culture (Flor, 2002). Thus, ICT4L cannot exist and be treated separately from other development initiatives within the community. In fact, it has to be closely linked with other initiatives.

Communities of Practice. Unfortunately, many of us involved in ICT4D, in general, and ICT4L, in particular, treat this as exclusive development initiatives. A case in point is our preoccupation on information sharing and reuse, particularly in eAgriculture communities of practice or CoPs.

The eAgriculture community engages CoPs to generate solutions to agricultural problems. Traditionally, communities of practice engage in information exchange, what has been quoted often enough as “the sharing and reuse of information.” This approach is patterned after the corporate KM Model of Davenport et al. (1995). However, in many cases, the initiative ends there. The failure of this approach when applied to development stems from the fact that it stops short from mobilizing sectors and does not go beyond information and knowledge sharing. There are, of course, exceptions within the eAgriculture community such as Solutions Exchange India, but by and large, CoPs should live up to its name by engaging in practice. CoPs should disseminate information to correct unsound policies (e.g., land conversion), uninformed decisions (e.g., biofuel production), unwarranted practices (e.g., using staples as animal feed), and inaccurate predictions and forecasts, all of which are part of the entropy that is causing spiraling food prices and artificial food shortages. In other words, CoPs should engage in advocacy.

We should note that the CoP concept was a progression from the CoIs or communities of interest that characterized the early Internet workgroups that essentially shared notes, information and insights on common areas of interest, beginning with CERN physics and Internet protocols. When CoIs began solving common problems, this brought the workgroup concept to the next level, the CoP. However, many of today’s CoPs offer solutions to problems but stop short of implementing these solutions, preferring to adopt the KM business protocol of sharing and reuse.

The problems that confront eAgriculture nowadays are at a scale that often requires policy interventions, not technological solutions. We have fully dealt out the technological card by engaging into GMO research and precision agriculture. CoPs must now delve into the policy process and progress into *communities of champions* or

CoCs. Thus from CoIs that share information and CoPs that share solutions, eAgriculture must move into CoCs that mobilize sectors through information, knowledge and advocacy. This should hold true with the entire ICT4D community, including ICT4L proponents.

To ensure replicability of ICT4L initiatives, ENRAP3 should ascertain that these go beyond the provision, sharing and reuse of information or knowledge. These initiatives should lead to action and community mobilization. They should be closely linked with other nodes involves with such, particularly agencies that provide basic services to the community.

Critical Mass Theory. Another related consideration is the Critical Mass Theory, which drives home not only the possibility of replication but the desirability and necessity of such to achieve larger impacts.

In physics, a critical mass is that amount of radioactive material necessary to produce nuclear fission. Since the eighties, social scientists have been applying this term to refer to the number of early adopters necessary to steer the rest of the population into collective action. The Critical Mass Theory developed by Oliver, Marwell & Teixeira (1985) attempts to answer: the following questions: What are the conditions for sustained collective action? When does a development intervention assume a life of its own?

The theory was tested through empirical research on, among others, early adopters of rice production technology. In 1987 Markus applied the Critical Mass Theory to interactive media. Generally, these research found that sustained collective action is triggered when a core of members (10 -15 %) within a group or community engages in mutually reinforcing reciprocal behavior. When such conditions are achieved within a given population, a so-called critical mass is formed, ensuring the spread of such behavior throughout the population. A very clear example of this phenomenon is the spread of *texting* or the use of the SMS functionality in cellular phones in the Philippines. When a core of 10 to 15 percent of cellular phone users began reinforcing one another's utilization through the exchange of SMS messages, the rest of the population migrated to GSM and

followed suit making it more popular that telephone calls or voice mail (Flor, 2004). Hence, the above interventions and outcomes must be replicable in order for these to reach the critical mass of users that would produce desired impacts at a societal scale.

Scalability of Interventions and Outcome.These interventions and outcomes must likewise be scalable at the provincial and national levels. In fact, the larger the scale, the bigger the impact these may have on countryside development. Again, the impact and sustainability of ICT4L will only be assured if critical numbers of participant-users are reached.

Validating Observations with Current Frameworks

The preceding section has discussed outcomes and factors as observed in ICT4L best practice in Southeast Asia and the Pacific. However, are these observations general enough to be incorporated in a research framework? How valid are these observations? The following chapter campares the above observations with elements of existing ICT4L frameworks.

RELEVANT ICT4L FRAMEWORKS

The preceding section discussed cases on information and communication technology for rural livelihoods in Southeast Asia and the Pacific, observed livelihood outcomes, as well as explanations on the conditions that lead to these outcomes. This section presents relevant frameworks in the study of ICT4L available in current literature.

Initially, the review provides the *developmental, methodological, analytical and implementation* contexts for ICT4L. Then, it discusses the sustainable livelihoods framework and its research applications, specifically within the Southeast Asian and Pacific environments. The Asian context is quite unique from the African or Latin American contexts. In Asia, particularly in Southeast Asia, one finds the richest and the poorest, the best endowed and the least endowed countries, ICT-wise. Thus, the framework in general, and the basic principles, in particular, may need validation in the Southeast Asian setting, considering the current emphasis on an *evidence-based approach*.

This review has adopted a number of assumptions in its analysis.

Firstly, information and communication technology for rural livelihoods falls within the scope of the Millennium Development Goals.

Secondly, ENRAP3-ICT4L research should not be thought of merely as a theory building exercise but should primarily be considered as part and parcel of the monitoring and evaluation efforts to measure progress and identify adjustments required towards the fulfillment of the MDGs. Thus, theoretical and conceptual frameworks are not elaborated upon in succeeding chapters. The approach adopted is Management for Development Results or MfDR.

Thirdly, the ENRAP-ICT4L research framework should be consistent with the ICT4L project implementation framework.

In short, this paper situates the ENRAP3-ICT4L research framework within the MDGs, employing MfDR techniques, within the ODI-DFID-FAO livelihoods approach.

Developmental Context

The Millennium Development Goals. Goal Number 1 of the MDGs is the eradication of extreme hunger and poverty. Goal Number 8 is to develop a global partnership for development through increased Internet access or penetration and the use of new information and communication technologies.[12] These twin goals pertain specifically to ICT4L.

Management for Development Results Approach. Since, development efforts worldwide are guided by the Millennium Development Goals, the international development assistance community has committed to assist developing countries in achieving these targets by 2015. Each investment made by the international development assistance community is meant to contribute incrementally to annual targets leading to 2015.

[12] *http://www.un.org/millenniumgoals/. Accessed 13 June 2008.*

The monitoring and evaluation of the progress in attaining these incremental targets should guide the management of ICT for rural livelihoods projects. Progress in attaining incremental targets is best assessed with results-based performance indicators.[13] These indicators must be standardized across sectors (e.g., agriculture, education, etc.), programs (e.g., microfinance, community infrastructure, etc.) and projects (e.g., village phones, CoPs, telecenters, etc.).

The yardstick by which ICT4L projects should be gauged is performance. Results or performance-based management is now the M&E approach of choice within the international development assistance community. Marrying the Millennium Development Goals with results based management (RBM) results in what is commonly referred to as MfDR or Management for Development Results.[14] Under this system, the logic behind any development intervention is considered at the very onset. How will the inputs of the undertaking generate outputs? How will these outputs lead to desired outcomes? Will these outcomes contribute to the expected impact?

The MfDR approach likewise takes economic efficiencies into consideration as well as outputs stated in its logframe and their respective indicators. For ENRAP3-ICT4L, the MfDR approach should guide the development of logical frameworks, which will form the basis of the monitoring, evaluation and research efforts.

Methodological Context

Planning Framework. This paper adopts the logical framework approach (LFA) to planning. LFA is an analytical, presentational and management tool which can help planners: analyze the existing situation; establish a logical hierarchy of means by which objectives will be reached; identify the potential risks to achieving the objectives, and to sustainable outcomes; establish how outputs and outcomes might best be monitored and evaluated; present

[13] *Asian Development Bank. 2007.* ***Guidelines for Preparing a Design and Monitoring Framework.*** *Manila*

[14] *Asian Development Bank. 2006.* ***An Introduction to Results Management: Principles, Implications and Applications.*** *Manila*

a summary in a standard format; and monitor and review the implementation of the plan.[15] A distinction should be made between the logical framework approach and the logical framework matrix. LFA involves problem analysis, stakeholder analysis, developing a hierarchy of objectives and selecting a preferred implementation strategy. The result of this approach is the logical framework matrix or simply, the logframe. This matrix summarizes the basis of the plan and its specific activities, as well as the key assumptions, outputs and outcomes**.** Table 7-2 is a tabular description of the Logframe.

Table 7-2. Logical Framework Matrix

Project Description	Performance Indicators	Means of Verification	Assumptions
Goal: The broader development impact to which the project contributes – at a national and sectoral level.	Measures of the extent to which a sustainable contribution to the goal has been made. Used during evaluation.	Sources of information and methods used to collect and report it.	
Purpose: The development outcome expected at the end of the project. All components will contribute to this.	Conditions at the end of the project indicating that the Purpose has been achieved and that benefits are sustainable.. Used for project completion and evaluation.	Sources of information and methods used to collect and report it.	Assumptions concerning the purpose/goal linkage.
Component Objectives: The expected outcome of producing each component's outputs.	Measures of the extent to which component objectives have been achieved and lead to sustainable benefits.. Used during review and evaluation.	Sources of information and methods used to collect and report it.	Assumptions concerning the component objective/purpose linkage.
Outputs: The direct measurable results (goods and services) of the project which are largely under project management's control	Measures of the quantity and quality of outputs and the timing of their delivery. Used during monitoring and review.	Sources of information and methods used to collect and report it.	Assumptions concerning the output/component objective linkage.
Activities: The tasks carried out to implement the project and deliver the identified outputs.	Implementation/work program targets. Used during monitoring.	Sources of information and methods used to collect and report it.	Assumptions concerning the activity/output linkage.

Analytical Context

Sustainable Livelihoods Approach. Perhaps one of the most serious indictments of Information and communication technology for rural livelihoods is its seeming lack of sustainability. This criticism

[15] *AusAID.2003.* ***The Logical Framework Approach****. Commonwealth of Australia, Canberra.*

may have some merit considering the challenges faced: the prohibitive costs of new technologies; the rapid obsolescence of ICTs; the donor-driven nature of most ICT4L undertakings; the lack of media literacy among stakeholders; and the need for intermediaries who cannot commit their time on a sustained basis.

And yet, ICT4L needs to be sustainable in order to move up from the status of a project and assume that of a going concern. In fact, sustainability is a feature of all successful livelihood projects. These would graduate, so to speak, from being projects to long-term undertakings. However, experience has shown that sustainability is a function of a complex cluster of factors.

Much has been written on the sustainable livelihoods approach. However, there is a general agreement that sustainable livelihoods are guided by a set of basic principles. Sustainable livelihoods should:

1. Focus on people not resources;
2. Be developed and implemented through dialogue and participation;
3. Be demand-driven with feedback loops;
4. Build on strengths rather than focus on constraints;
5. Develop or support appropriate policies, institutions and processes;
6. Foster micro-macro linkages; and
7. Focus on outcomes not outputs.[16]

Sustainable Livelihoods Framework. Chapman et al (undated) discussed DFID's Sustainable Livelihoods Framework within the context of ICT4L.[17] The framework is conceived as the interaction of capital assets, transforming structures and processes, and livelihood strategies. The interaction is situated within a vulnerability context (i.e., trends, shocks, culture and environment) that may determine livelihood outcomes. Capital assets are classified into: natural; physical; financial; human; and social capital. Transforming

[16] *http://www.odi.org.uk/RAPID/Projects/R0176. Accessed 15 May 2008*

[17] *Robert Chapman et al. (undated)* ***Livelihoods Approaches to Information and Communication in Support of Rural Poverty Elimination and Food Security****. London: ODI*

structures refer to levels of government (national or local) and private sector structures while institutions refer to laws and policies. Livelihood outcomes are categorized as: increased income; reduced vulnerability; improved food security; and sustainable use of natural resources.

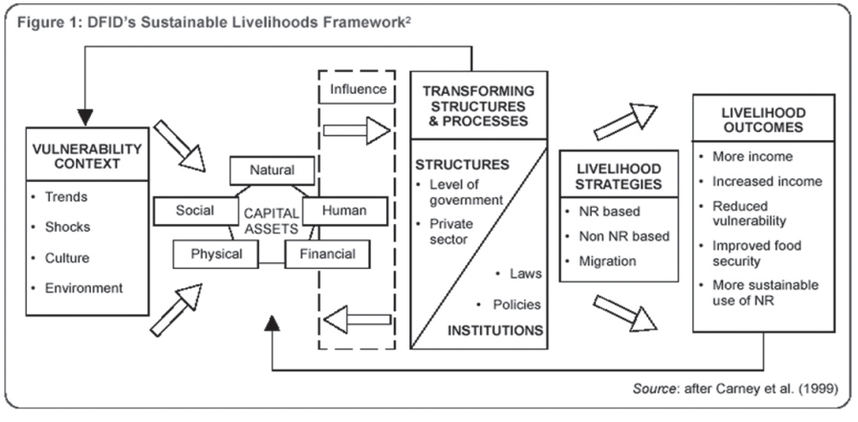


Figure 7-1. DFID's Sustainable Livelihoods Framework (SLF)

DFID's SLF simplifies the outcomes of ICT4L interventions into four: increased income; reduced vulnerability; improved food security; and sustainable use of natural resources. With this Scoping Study, however, we identified specific livelihood outcomes linked with ICT:

1. Increase in access to information and communication technologies.
2. Increase in capacities of rural groups, particularly rural women, to offer marketable skills.
3. Increase in awareness and availing of basic services by communities as well as linkages with government service providers in the agriculture, health, education, micro-finance and disaster preparedness sectors.
4. Higher sales volume in users' primary livelihoods (e.g. small retail stores, local eateries, local transport provision).
5. Development and evolution of support mechanisms and locally driven enterprises such as technical supply chains, marketing solutions, and other ICT-related services that assist the community and generate additional employment opportunities and incomes as well.
6. Increase in social capital generated through information sharing and networking among groups.

For purposes of ENRAP3-ICT4L, we may classify the DFID outcomes as *primary order ICT4L outcomes* and the Scoping Study outcomes as *higher order ICT4L outcomes*.

Livelihoods Wheel. Central to the framework is the concept of capital assets and how information strengthens, solidifies and builds up these assets. The contribution of information to capital assets may be illustrated through the Livelihoods Information Wheel (Figure 7-2).

DFID classifies two types of information required in sustainable livelihoods. Firstly, core information or knowledge (A) gathered through education, training, technical support and assistance. Secondly, context-specific information or knowledge (B) that apply to the livelihoods involved (e.g., production and post-harvest technologies, weather forecasts, or market information). These include information provided by extension workers, NGOs or local knowledge within the community itself.

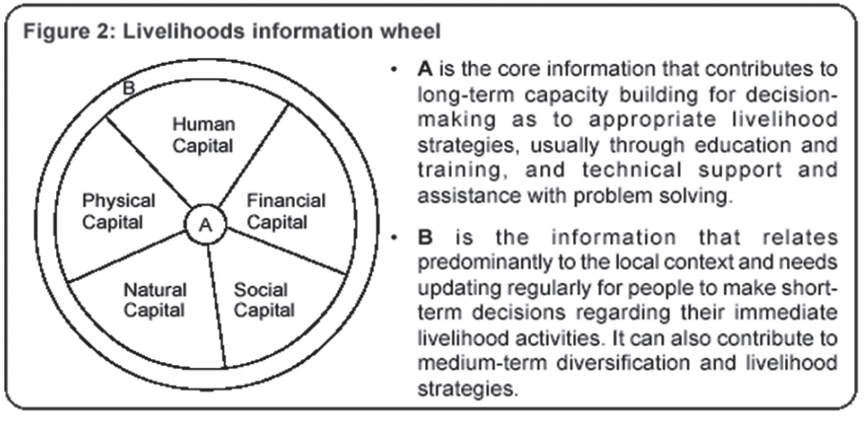


Figure 7-2. DFID's Livelihoods Information Wheel

As presented in Figure 7-2, core information or knowledge is both central and relevant to all types of capital assets. Context-specific information, on the other hand, is applicable to specific types of capital only.

Implementation Context

ICT Knowledge Map. As stated in the Inception Report, the Midterm Report and the introductory part of this chapter, the major sources of documentation, lessons, insights and frameworks on ICT4L is the Overseas Development Institute (ODI) based in the United Kingdom. Beginning 2001 onwards, ODI has partnered with the UK Department of International Development (DFID), the World Bank InfoDev, FAO and IDRC, jointly or separately, to undertake several initiatives on ICT4RL or ICT4L. Their undertakings ranged from regional, country and community program or project reviews capturing experiences and mining knowledge that have been published in several monographs, policy papers and websites, collaboratively maintained with its partners, the latest of which is the RAPID or Research and Policy in Development program website (Chapman et Al, undated; ODI, 2001; ODI, 2003; RAPID, 2007).

The most notable contribution of the ODI initiative is the Enhancing the Livelihoods of the Rural Poor Through ICD Knowledge Map, which among other things, presents a sound framework for the implementation of ICT4L.

Eight Basic Principles. The framework identified eight principles for successful ICD4L planning and implementation:

1. Adapt content to local context;
2. Build on existing systems and work within existing policies;
3. Address diversity;
4. Build capacity;
5. Ensure equitable access and empowerment;
6. Build partnership networks;
7. Adopt realistic approaches to technology; and
8. Share information costs.

These principles have been subsequently incorporated into FAO's Bridging the Rural Digital Divide (BRDD) Program, and their leadership of the e-Agriculture working group established at the World Summit on the Information Society (WSIS) in Tunis, 2005. They are not at all inconsistent with the findings of the Scoping Study that ICT4L outcomes may be influenced by the following conditions:

- ICT4L projects are more likely to succeed as secondary livelihoods, that is, if it is associated with already pre-existing primary livelihoods in the community.
- ICT4L projects are more likely to succeed if women groups run these.
- ICT4L projects are more likely to succeed if these are linked to basic services providers such as government agencies involve in agriculture, health and education sectors.
- ICT4L projects are more likely to be sustainable with the use of intermediaries and personalized user-friendly technologies.
- ICT4L projects are more likely to be sustainable if it has a capacity building component.
- ICT4L projects are more likely to be sustainable with public-private sector partnerships and cost sharing.
- ICT4L projects are more likely to have better outcomes if they are not technology-driven or donor-driven.

Evidenced-Based Approach. As mentioned earlier, another noteworthy contribution of the ODI initiative is the *evidence-based approach* to policy and operational frameworks for knowledge systems in support of rural livelihoods (Rudgard et al, 2003). Inspired by the evidence-based policy (EBP) concept promoted by the UK government since 1997, this approach ensures an empirical basis for policies and programs on ICT4L that would lead to sound investments and investment modalities. In this regard, ODI offers a series of evidence-based, sound recommendations on the conduct of ICT4L. These recommendations are based on several sectoral applications such as agriculture, healthcare, microfinance, education, land adiminstration and management, governance and disaster relief and preparedness. These are based on several country

snapshots and case studies. Asia may not have been adequately represented in the research.[18] However, this Scoping Study provides additional data to cover Southeast Asia and the Pacific.

Summary of Framework Recommendations

Compared with some of the elements of the frameworks reviewed such as the MDGs, these outcomes and conditions are perhaps more relevant to the community and grassroots level. However, these are not inconsistent with the given frameworks. Thus, the review suggests an ENRAP3-ICT4L research framework that:

1. Assesses ICT4L strategies on the basis of the seven basic principles of sustainable livelihoods and the eight basic principles of ICT4L;
2. Evaluates ICT4L projects on the provision of core and context-specific information and the existence of conditions identified in the Scoping Study;
3. Measures results and performance based on livelihood indicators specified in a logical framework, based on the DFID SLF and this Scoping Study; and
4. Reviews the undertaking on the basis of the Millenium Development Goals.

There exists an internal logic to these conclusions: livelihood strategies lead to ICT4L projects; projects lead to results; and results contribute to the MDGs. Similarly, the basic principles lead to provision of core and context specific information; the provision of information leads to livelihood outcomes; and livelihood outcomes contribute to the eradication of hunger and poverty.

[18] *www.ict4l.info/HomePage. Accessed 15 May 2008*

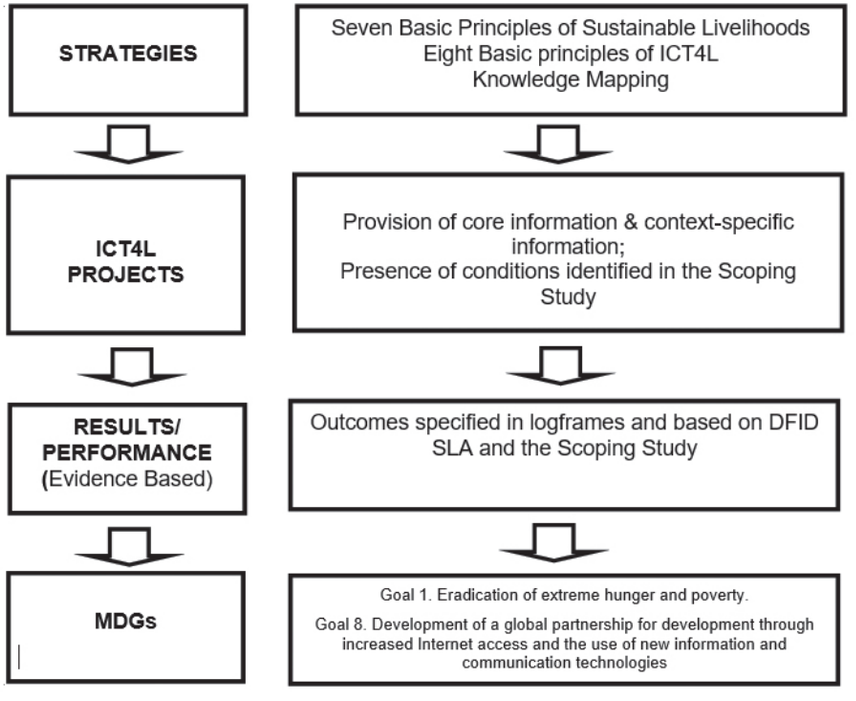


Figure 7-3. Logical Progression from ICT4L TO MDGs

PROPOSED ICT4L FRAMEWORKS

An ideal research framework for ICT4L should: be situated within the MDGs; employ MfDR techniques; be based by the sustainable livelihoods approach; and be guided by the evidence-based approach. More importantly, it should be founded on an explicit strategic framework. Furthermore, its variables should correspond with indicators identified in project designs and logical frameworks.

Based on the preceding review of literature, the following frameworks for ICT4L are proposed: a strategic framework; a logical framework template; a monitoring and evaluation (M&E) framework; and an ENRAP3 action research framework.

Strategic Framework

A strategic framework provides the vision, mission and goal statements of information and communication technology for rural livelihoods in the Southeast Asian and Pacific sub-regions. It enumerates the strategic thrusts and programs that would achieve the goal.

Vision. The vision of ICT4L is freedom from hunger and poverty for rural and peri-urban communities in Southeast Asia and the Pacific.

Mission. The mission of ICT4L is to eradicate hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through information and communication technology programs/ projects that provide core and context-specific information and knowledge for livelihoods.

Goals. The twin goals of ICT4L are:

- To contribute to the eradication of hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through ICT programs that support livelihoods by 2015; and

- To contribute to achieving global partnerships for development through Internet access and new ICTs by 2015.

Strategic Thrusts. There are three strategic thrusts:

- Access and Infrastructure Improvement. The provision of access to ICTs that may be used as channels for core and context-specific information and knowledge.

- Core Information and Knowledge Provision. The provision of core information and knowledge through ICTs, that enhance, enrich and contribute to natural capital, physical capital, financial capital, human capital and social capital through education, training, technical support and assistance.

- Context Specific Information and Knowledge Provision. The provision of context-specific information or knowledge that apply to rural and peri-urban livelihoods and converts natural capital, physical capital, financial capital, human capital and social capital to income and food security.

Programs. Three major ICT4L programs correspond with the aforementioned strategic thrusts:

- Infrastructure Development Program. Corresponding to the access and infrastructure improvement thrust, this program provides access to ICTs that would carry core and context-specific information and knowledge to rural and peri-urban communities in Southeast Asia and the Pacific. Telecenter or Community eCenter development, rural mobile phone services, and last mile infrastructure development projects (VSATs, WiMax, cable modem, etc.) may be classified under this program.

- ICT4L Capacity Building Program. Corresponding to the strategic thrust on core Information and knowledge provision, this program covers education, training, technical support and assistance projects that provide core information and knowledge through ICTs, which enhance, enrich and contribute to natural capital, physical capital, financial capital, human capital and social capital of rural and peri-urban communities in Southeast Asia and the Pacific.

- Content Development for Rural and Peri-Urban Livelihoods Program, This program corresponds with the strategic thrust on context specific information and knowledge provision. It covers projects that develops and disseminates context-specific information or knowledge that apply to rural and peri-urban livelihoods and converts natural capital, physical capital, financial capital, human capital and social capital to income and food security.

Table 7-3 presents the strategic framework in a single-paged matrix.

Table 7-3. Strategic Framework for ICTs for Rural Livelihoods in the Southeast Asian and Pacific Regions

STRATEGIC FRAMEWORK FOR ICT4L	
VISION	The vision of ICT4L is freedom from hunger and poverty for rural and peri-urban communities in Southeast Asia and the Pacific.
MISSION	The mission of ICT4L is to eradicate hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through information and communication technology programs/ projects that provide core and context-specific information and knowledge for livelihoods.
GOALS	The twin goals of ICT4L are: • to contribute to the eradication of hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through ICT programs that support livelihoods by 2015; and • to contribute to achieving global partnerships for development through Internet access and new ICTs by 2015.
STRATEGIC THRUSTS	**PROGRAMS**
1. Access and Infrastructure Improvement	Infrastructure Development Program. Telecenter or Community eCenter development, rural mobile phone services, and last mile infrastructure development projects (VSATs, WiMax, cable modem, etc).
2. Core Information and Knowledge Provision	ICT4L Capacity Building Program. Covers education, training, technical support and assistance projects that provide core information and knowledge through ICTs, which enhance, enrich and contribute to natural capital, physical capital, financial capital, human capital and social capital of rural and peri-urban communities in Southeast Asia and the Pacific.
3. Context Specific Information and Knowledge Provision	Content Development for Rural and Peri-Urban Livelihoods Program, Covers projects that develops and disseminates context-specific information or knowledge that apply to rural and peri-urban livelihoods and converts natural capital, physical capital, financial capital, human capital and social capital to income and food security.

Logical Framework Template

Logical frameworks or logframes are project specific. Thus, a generic logframe for ICT4L is not possible. However, this section will attempt a logframe template.

Narrative Summary. The elements of the logframe matrix are: the goal; the project purpose; project components; inputs; outputs. Juxtaposed on these elements are: verifiable indicators; means of verification; and assumptions or risks.

As stated, the goal statement is to contribute to the eradication of hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through ICT programs that support livelihoods by 2015. Based on the strategic thrusts, the project purpose may be one or a combination of the following: to provide access or infrastructure; to provide core information or knowledge; and to provide context specific information or knowledge. Similarly, the components may be a combination of any of the following: infrastructure development; capacity building; and content development. However, inputs and outputs are project specific.

Indicators. On the other hand, the indicators may be specified according to level. At the level of the Goal, verifiable indicators would be impact on livelihoods and sustainability in the use of natural resources. This may be verified through an external post-evaluation conducted two years after the end of the project.

At the level of purpose, the list of outcome indicators includes: increase in income; reduced vulnerabilities; and improved food security. This is verified through an external terminal evaluation conducted at the end of project. Input indicators and output indicators are project specific.

However, there are a number of assumptions insofar as the project inputs are concerned. Firstly, the project focuses on people not resources. Secondly, the project is designed and implemented through dialogue and participation. Thirdly, the project is demand-driven with feedback loops. Fourthly, it builds on strengths rather

than focus on constraints. Fifthly, it supports appropriate policies, institutions and processes. Sixthly, it fosters micro-macro linkages. Lastly, it focuses on outcomes not outputs.

Assumptions. There are also a number of assumptions taken with regard to project purpose of components. These assumptions correspond with the eight basic principles of ICT4L. Firstly, the project adapts content to local context. Secondly, the project builds on existing systems and work within existing policies. Thirdly, the project addresses diversity. Fourthly, the project builds capacity. Fifthly, it ensures equitable access and empowerment. Sixthly, it builds partnership networks. Next, it adopts realistic approaches to technology. And lastly, information costs are shared.

Template. Table 7-4 gives the ICT4L logframe template.

Monitoring and Evaluation (M&E) Framework

Ex Ante Evaluation. Ex-ante evaluation is the most neglected aspect of monitoring and evaluation process. Usually referred to as baseline studies, many projects miss the opportunity for meaningful benchmarking analysis and design evaluation.

Methods. Baseline data is gathered through secondary data analysis and surveys. Rapid rural appraisals are often employed as the method of choice at community level projects. Benchmark data on incomes, vulnerabilities and food security should be established. The design of the project should be evaluated on the basis of the seven basic principles of the sustainable livelihoods approach.

Research Questions. During the ex-ante phase, the following benchmark research questions should be asked:

- What is the current income of the beneficiaries?
- What are the vulnerabilities of the community and their extent?
- What is the level of food security in the community?

Table 7-4. Logframe Matrix Template for ICT4L

<table>
<tr><th>NARRATIVE SUMMARY</th><th>VERIFIABLE INDICATORS</th><th>MEANS OF VERIFICATION</th><th>RISKS AND ASSUMPTIONS</th></tr>
<tr><td>GOAL: to contribute to the eradication of hunger and poverty in rural and peri-urban communities in Southeast Asia and the Pacific through ICT programs that support livelihoods by 2015.</td><td>Impact
Sustainability</td><td><u>Post Evaluation</u></td><td></td></tr>
<tr><td rowspan="3">PURPOSE:
1. To provide access or infrastructure
2. To provide core information or knowledge

COMPONENTS:
A. Infrastructure Development
B. Capacity Building
C. Content Development

OUTPUTS:
Project Specific</td><td rowspan="3"><u>Primary Order Outcomes</u>

Increase in income
Reduced vulnerability
Improved food security

<u>Higher Order Outcomes</u>

• Increase in access to ICTs
• Increase in capacities
• Increase in awareness and availing of basic services.
• Increase in incomes among families.
• Higher incomes in primary livelihoods
• Development of support mechanisms and technical supply chains
• Increase in social capital</td><td><u>Terminal Evaluation:</u>
Input-Output

<u>Mid-Term Evaluation:</u>
Mid-Term Input-Output Analysis;
Pilot Studies</td><td>The project:
• adapts content to local context;
• builds on existing systems and work within existing policies;
• addresses diversity;
• builds capacity;
• ensures equitable access</td></tr>
<tr><td>INPUTS:

Project Specific</td><td><u>Ex-Ante Evaluation:</u>
Benchmarking
Baseline Study</td><td>The inputs/ implementation strategies:
• focus on people not resources;
• are decided and implemented through dialogue and participation;
• are demand-driven with feedback loops;
• build on strengths rather than focus</td></tr>
</table>

Moreover, the following evaluation questions should be answered:

1. As designed, does the project focus on people not resources?
2. Was the project developed through dialogue and participation?
3. As designed, is the project demand-driven with feedback loops?
4. Does the project build on strengths rather than focus on constraints?
5. Will the project develop or support appropriate policies, institutions and processes?
6. Will the project foster micro-macro linkages?
7. Does it focus on outcomes not outputs?

***Midterm Evaluation*.** As the term suggests, midterm evaluations are conducted mid-way into the project to determine adequacy of inputs, monitor outputs, establish the progress towards targets, and determine adjustments required.

Methods. Midterm evaluation data is gathered through key informant interviews and focus group discussions. A midterm input-output analysis is done to determine progress towards meeting the objectives of the project. Depending on the scale of the project, pilot studies are conducted to test interventions that may be introduced to improve project performance. Oftentimes, process documentation techniques are used to record best practice.

Research Questions. The key research questions for the midterm evaluation are as follows:

- Were the project inputs adequate?
- What are the project outputs to date?
- Have there been discernable increases in income, reductions in vulnerabilities and improvements in food security?

Additionally, the following midterm evaluation questions should be asked:

1. Does the project adapt content to the local context?
2. Does the project build on existing systems and work within existing policies?
3. Does the project address diversity?
4. Does the project build capacities?
5. Does the project ensure equitable access and empowerment?
6. Does the project build partnership networks?
7. Does the project adopt realistic approaches to technology?
8. Does the project share information costs?

Terminal Evaluation. Terminal evaluations are done at the end of the project, to determine whether or not a project has achieved its purpose.

Methods. Terminal evaluations employ a combination of quantitative and qualitative research methods such as one-shot surveys, documents analysis, focus group discussions, key informant interviews and input-output analysis. Benchmark data is compared with end-of-project data.

Research Questions. The following research questions are most relevant in terminal evaluations:

1. Did the project lead to increased incomes?
2. Did the project result in reduced vulnerabilities?
3. Did the project improve food security?

The following set of questions, similar to those asked in the midterm evaluation, should also be studied:

- Did the project adapt content to the local context?
- Did the project build on existing systems and work within existing policies?
- Did the project address diversity?
- Did the project build capacities?
- Did the project ensure equitable access and empowerment?
- Did the project build partnership networks?
- Did the project adopt realistic approaches to technology?
- Did the project share information costs?

Ex-Post Evaluation. Ex-post evaluation is conducted at least two-years after the end of the project. This exercise determines the overall impact and sustainability of the project as well as its contribution towards the overarching goal.

Methods. As in the terminal evaluation, post evaluations make use of a variety of methods including: one-shot surveys; the analysis of secondary data; documents analysis; key informant interviews; and focus group discussions with project stakeholders.

Research Questions. The following research questions are asked by and answered through post evaluations:

1. What is the overall impact of the project on income, vulnerabilities, and food security of the community?
2. Are these impacts sustainable?
3. How did the project contribute to the eradication of hunger and poverty?
4. What are the lessons learned?
5. Were there best practices?

M&E Framework Matrix. Table 7-5 summarizes the proposed M&E framework for the ENRAP3-ICT4L component.

A Research Framework for ENRAP3-ICT4L

Parallel to the non-specific M&E studies recommended above, ENRAP3 should also implement an action research agenda focusing on specific research questions that would validate the observations made and explanations forwarded by this Scoping Report.

Research Questions. The questions asked in action research may differ substantively from M&E research questions. While answers to M&E questions provide information, research questions provide explanations and predictions. Thus action research questions tend to begin with "why" and "how." Among the research questions that may be forwarded are:

Table 7-5. Proposed Monitoring and Evaluation Framework for ENRAP3-ICT4L

M&E PHASE	METHODS	RESEARCH QUESTIONS	
		CRITICAL	KEY
Ex-Ante Evaluation	• Baseline Study • Benchmarking • Rapid Rural Appraisal • Documents Analysis • Secondary Data Analysis	What is the current income of the beneficiaries? What are the vulnerabilities of the community and their extent? What is the level of food security in the community?	As designed, does the project focus on people not resources? Was the project developed through dialogue and participation? As designed, is the project demand-driven with feedback loops? Does the project build on strengths rather than focus on constraints? Will the project develop or support appropriate policies, institutions and processes? Will the project foster micro-macro linkages? Does it focus on outcomes not outputs?
Midterm Evaluation	• Focus group discussion • Key informant interviews • Input-output analysis • Process	Were the project inputs adequate? What are the project outputs to date? Have there been discernable increases in income, reductions	Did the project adapt content to the local context? Did the project build on existing systems and work within existing policies? Did the project address diversity? Did the project build capacities? Did the project ensure equitable access and empowerment? Did the project build partnership networks? Did the project adopt realistic approaches to technology?
Terminal Evaluation	• Documents Analysis • Secondary Data Analysis • One-shot survey • Input-output	Did the project lead to increased incomes? Did the project result in reduced vulnerabilities? Did the project improve food security?	
Ex-Post Evaluation		What is the overall impact of the project on income, vulnerabilities, and food security of the community? Are these impacts sustainable? How did the project contribute to the eradication of hunger and poverty? What are the lessons learned? Were there best practices?	

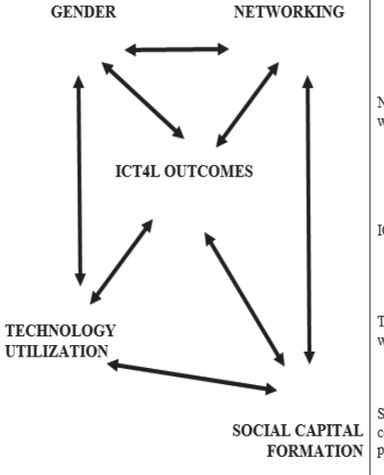
1. How is gender related with technology utilization?
2. How is gender related with ICT4L outcomes?
3. How is gender related with social capital formation?
4. How is gender related with participatory content provision?
5. How is gender related with networking variables (integrity, mutuality and reciprocity)?
6. How are networking variables related with technology utilization?
7. How are networking variables related with ICT4L outcomes?
8. How are networking variables related with social capital formation?
9. How is networking related with participatory content provision?
10. How are ICT4L outcomes related with technology utilization?
11. How are ICT4L outcomes related with social capital formation?
12. How are ICT4L outcomes related with participatory content provision?
13. How does ICT4L develop support mechanisms and value chains within the community?
14. How is a critical mass of ICT4L users formed?

Variables. The action research studies may relate, correlate or test the following variables:

1. Gender
2. Networking variables:
    2.1. Network Integrity
    2.2. Network Mutuality
    2.3. Network Reciprocity
3. Technology utilization
4. Social capital formation
5. Critical Mass formation
6. ICT4L Outcomes
    6.1. Increase in access to ICTs
    6.2. Increase in capacities
    6.3. Increase in awareness and availing of basic services.
    6.4. Increase in incomes among families.

    6.5. Higher incomes in primary livelihoods
    6.6. Development of support mechanisms and value chains
    6.7. Increase in social capital

Table 7-6. Proposed ENRAP3-ICT4L Action Research Conceptual Framework for Southeast Asia and the Pacific

RESEARCH QUESTIONS	VARIABLES	HYPOTHESES
▪ How is gender related with technology utilization? ▪ How is gender related with ICT4L outcomes? ▪ How is gender related with social capital formation? ▪ How is gender related with participatory content provision? ▪ How is gender related with networking variables (integrity, mutuality and reciprocity)? ▪ How are networking variables related with technology utilization? ▪ How are networking variables related with ICT4L outcomes? ▪ How are networking variables related with social capital formation? ▪ How is networking related with participatory content provision? ▪ How are ICT4L outcomes related with technology utilization? ▪ How are ICT4L outcomes related with social capital formation? ▪ How are ICT4L outcomes related with participatory content provision? ▪ How does ICT4L develop support mechanisms and value chains within the community? ▪ How is a critical mass of ICT4L users formed?		Gender is positively correlated with: ▪ technology utilization ▪ ICT4L outcomes ▪ social capital formation ▪ participatory content provision ▪ networking variables Networking variables are positively correlated with: ▪ technology utilization ▪ ICT4L outcomes ▪ social capital formation ▪ participatory content provision ICT4L outcomes positively correlated with: ▪ technology utilization ▪ social capital formation ▪ participatory content provision Technology utilization is positively correlated with: ▪ social capital formation ▪ participatory content provision Social capital formation is positively correlated with participatory content provision.

The foregoing research and M&E frameworks may provide a basis for an ENRAP3-ICT4L Research Agenda for Southeast Asia and the Pacific made up of both action research projects and ex-post evaluations.

Proposed Action Research Pilot Projects

The proposed action research projects will attempt to answer research questions listed in earlier sections and will study the relationships between identified variables, mainly social in nature,

with ICT4L outcomes. The projects will be implemented in grassroots communities on a pilot basis with the end view of replication in other communities across countries within Southeast Asia as well scaling-up at the district, provincial and national levels.

Action Research Number 1. Please refer to Annex E for the Concept Note of this proposed action research pilot project.

Title. Broad-based Networking through ICT for the Promotion of Sustainable Agricultural Livelihoods in the Pacific Islands

Key Concepts: Metcalf's Law or the Network Effect

Abstract. The Mainstreaming of Rural Development Innovations (MORDI) Program seeks to support sustainable livelihood opportunities in remote and rural communities, with a focus on youth and women, in the Pacific Islands. One of its strategic thrusts is the sharing of information and knowledge on best practices and innovations on sustainable livelihoods among communities, NGOs and other agencies. This concept paper proposes the establishment of an electronic (Web-based) cum institutional cum community network under the MORDI Program, initially on a pilot basis, to test the influence of networking variables (such as mutuality, reciprocity and integrity) on sustainable livelihood outcomes.

It will attempt to answer the following questions: How is network integrity related with technology utilization, social capital formation and sustainable agricultural livelihood outcomes? How is network reciprocity related with technology utilization, social capital formation and sustainable agricultural livelihood outcomes? How is network mutuality related with technology utilization, social capital formation and sustainable livelihood outcomes? How is networking related with participatory content provision?

The objectives of the pilot project are: to design, develop and test an online network platform for the sharing and reuse of best practice and lessons learned on sustainable agricultural livelihoods;

to design, develop and test a system protocol that would interface electronic, institutional and community networks; to document the development, testing and primary order as well as higher order outcomes of this network into a case study; to determine the relationship between network integrity, technology utilization, social capital formation and sustainable agricultural livelihood outcomes; to determine the relationship between network reciprocity , technology utilization, social capital formation and sustainable agricultural livelihood outcomes; and to determine the relationship between network mutuality, technology utilization, social capital formation and sustainable livelihood outcomes.

This will be an action pilot research employing the case study design. It will be conducted in three phases: design and development phase; testing and documentation phase; and analysis and write-up phase.

Action Research Number 2. Please refer to Annex E for the Concept Note of this proposed action research pilot project.

Title. Social Capital Formation and Agricultural Livelihood Outcomes Among Women Users in Lao Telecenters

Key Concepts: Gender, Capacity Building, Social Capital

Abstract. Casual observation reveals that rural women's groups, particularly in Southeast Asia, tend to be more closely knit than farmers' groups or youth groups. Active telecenters based in Lao districts with good connectivity are often converging points of women. Is there also a gender dimension in the dynamics of telecenter use, particularly in ICT for agricultural livelihood?

This proposed study would answer the following research questions: How is gender related with social capital formation within the context of a transitional economy such as Lao PDR? How is social capital formation related with ICT4L outcomes? How is gender related with networking variables (integrity, mutuality and reciprocity)? How is gender related with ICT4L outcomes?

Its objectives are: to initiate a capacity building program for rural women users of telecenters; to determine if gender is related with ICT4L outcomes within the context of a transitional economy such as Lao PDR; to observe and document how capacity building contributes to agricultural ICT4L outcomes; to observe and document the gender dynamic in social capital formation; and to assess the relationship between social capital formation and agricultural ICT4L outcomes. This study will contribute to an understanding of gender and social capital within the contest of sustainable livelihood outcomes.

This will be an action pilot research employing the case study design using a variety of data gathering procedures. The main intervention of the project is ICT4L capacity building and assistance to peer-to-peer training among women's groups. Trainors and peer-to-peer trainees will be women users of three Lao telecenters based in the districts. At the beginning of the project, a benchmarking survey will be conducted to determine current utilization levels and incomes. Group representatives will then be trained on the use of information and communication technologies to increase livelihoods. The groups will then be observed, their ICT utilization levels and peer-to-peer training will be documented. FGDs will be conducted on a monthly basis for twelve months. Simultaneously, ICT4L outcomes will be assessed for one year. Data on ICT4L outcomes will be compared with benchmark data,

Action Research Number 3. Please refer to Annex F for the Concept Note of this proposed action research pilot project.

Title: Mobile Phones as a Web 2.0 Platform in the Philippines.

Key Concepts: Critical Mass Theory, Web 2.0, Participatory Content Provision

Abstract. Web 2.0 has revolutionized how people think of the World Wide Web from a collection of individually owned static websites with published content into a body of collectively owned dynamic

websites with user generated content. The 3G mobile phone may provide ICT4D, in general, and eAgriculture, in particular, the much needed platform for Web 2.0. This study will examine possible factors that enable mobile phones to assume this unique role. It will attempt to answer the following research questions: How can mobile phones be used as a Web 2.0 platform among rural online communities? What factors may be associated with mobile phone utilization among rural online communities?

This will be an action pilot research employing the case study design. Three organizations from these three baranggays will be engaged for involvement in the project. A common website utilizing a learning management system (LMS) platform will be established for the three organizations. The website will feature chatrooms/discussion forums and rich media, specifically audio and video. Initial content will be uploaded by the researcher. Henceforth, content will be provided by the members of the three organizations. The project will provide one GPRS enabled mobile phone, with video-audio capture and Internet functionalities, to each organization. Mobile phone service providers will be approached to sponsore more phones for the three organizations. The researcher will train representatives of the three organizations on mobile phone Internet browsing, discussion forum posting, video capture and content uploading. Content development and utilization by the participants will be monitored, quantitatively and qualitatively. Focus group discussions (FGDs) will be organized once a month for five months. During the FGDs, factors contributing to the levels of content provision, utilization and online participation will be elicited from the participants.

SUMMARY

What specific livelihood outcomes, if any, can be directly linked with ICT interventions at the grassroots?

Specific livelihood outcomes that can be directly linked with ICT4L interventions in rural communities are:

- Increased access to information and communication technologies.
- Increased capacities of rural groups, particularly rural women, to offer marketable skills.

Table 7-7. Proposed Action Research Pilot Studies for ENRAP3-ICT4L for Southeast Asia and the Pacific

PROJECT TITLE	RESEARCH QUESTIONS	OBJECTIVES	KEY CONCEPTS
Broad-based Networking through ICT for the Promotion of Sustainable Livelihoods in the Pacific Islands.	How is network integrity related with technology utilization, social capital formation and sustainable livelihood outcomes? How is network reciprocity related with technology utilization, social capital formation and sustainable livelihood outcomes? How is network mutuality related with technology utilization, social capital formation and sustainable livelihood outcomes? How is networking related with participatory content provision?	• to design, develop and test an online network platform for the sharing and reuse; • to design, develop and test a system protocol that would interface electronic, institutional and community networks; • to document the development, testing and primary order as well as higher order outcomes of this network into a case study; • to determine the relationship between network integrity, technology utilization, social capital formation and sustainable livelihood outcomes; • to determine the relationship between network reciprocity , technology utilization, social capital formation and sustainable livelihood outcomes; and • to determine the relationship between network mutuality, technology utilization, social capital formation and sustainable livelihood outcomes.	The Network Effect

Social Capital Formation and Livelihood Outcomes Among Women Users in Lao Telecenters	How is gender related with social capital formation? How is social capital formation related with ICT4L outcomes? How is gender related with networking variables (integrity, mutuality and reciprocity)? How is gender related with ICT4L outcomes?	• to initiate a capacity building program for rural women users of telecenters; • to determine if gender is related with ICT4L outcomes; • to observe and document how capacity building contributes to ICT4L outcomes; • to observe and document the gender dynamic in social capital formation; and • to assess the relationship between social capital formation and ICT4L outcomes	Gender Capacity Building Social Capital
Mobile Phones as a Web 2.0 Platform in the Philippines	How can mobile phones be used as a Web 2.0 platform among rural online communities? What factors may be associated with mobile phone utilization and participatory content provision among rural online communities?	• To test mobile telephony as a Web 2.0 platform for rural farmers, housewives and out-of-school youth. • To develop a protocol for online participation and content provision for rural online communities using mobile Internet and rich media, • To identify and validate factors that are correlated to levels of participation in Web content provision	Critical Mass Theory

- Increased awareness and availing of basic services by communities as well as linkages with government service providers.
- Increased incomes among families.
- Higher sales volume in users' primary livelihoods such as small retail stores, local eateries, local transport provision.

- Development and evolution of support mechanisms and locally driven enterprises such as technical supply chains, marketing solutions, and other ICT-related services that assist the community and generate additional employment opportunities and incomes as well.
- Increased social capital generated through information sharing and networking among groups, particularly women.

Under what conditions are these ICT interventions likely to produce these livelihood outcomes?

The Scoping Study found that ICT4L interventions are likely to produce these livelihood outcomes under the following conditions:

- ICT4L projects are more likely to succeed as secondary livelihoods, that is, if it is associated with already pre-existing primary livelihoods in the community, such as small retail stores, marketing cooperatives, food service providers, transport providers, micro-finance establishments, and others. The demand for ICT services increase with the presence of these primary livelihoods.
- ICT4L projects are more likely to succeed if women groups run these.
- ICT4L projects are more likely to succeed if these are linked to basic services providers such as government agencies involve in agriculture, health and education sectors.
- ICT4L projects are more likely to be sustainable with the use of intermediaries and personalized user-friendly technologies such as mobile phones in the VPO Project (Philippines).
- ICT4L projects are more likely to be sustainable if it has a capacity building component.
- ICT4L projects are more likely to be sustainable with public-private sector partnerships and cost sharing.
- ICT4L projects are more likely to have better outcomes if they are not technology-driven or donor-driven.

How does gender and social dimensions factor into these interventions and outcomes?

Casual observation reveals that rural women's groups, particularly in Southeast Asia, tend to be more closely knit than farmers' groups or youth groups. Perhaps this is a function of their circumstances since women have more time to spend with one another during work and leisure times. Furthermore, they can relate and empathize with one another's roles and challenges. It is clear that rural women's groups tend to possess more social capital.

Social capital has been defined as the capacity of groups to work together for the common good (Montgomery, 1998) or as the ability to draw on relationships with others especially on the basis of trust and reciprocity (HDR, 1998). It has been theorized that social capital may increase exponentially through networking and connectivity. Metcalf's Law (the Network Effect) states that the total value of a network where each node can reach every other node grows with the square of the number of nodes. David Reed, a sociologist and community development expert, applied Metcalf's Law to social networks and arrived at a similar conclusion. Due to: the synergy produced in working together as a group; the use of a common platform; and the knowledge resources in the World Wide Web available to them individually and as a group, the *potential* social capital of a group increases exponentially. Thus, women's networks appear to benefit more from the so-called Network Effect

A third social dimension is education. How does education contribute to positive ICT4L outcomes? The obvious answer is that it builds up knowledge and skills that capacitates an individual or a group to earn a living. However, there is more to education than capacity building. A higher social goal of education is conscientization, made possible through video capture and playback, functionalities found in most mobile phone models nowadays. Participation initiates social reflection, which results in collective action or mobilization. Nowadays, this is made possible in the participatory content provision of Web 2.0

Insofar as social dimensions are concerned, a final consideration should be the impetus that drives ICT4L undertakings. There are concerns related to current ICT4L program rationale and design.

What are the determinants of the elements of a program design? Are these based on assessed needs or are these donor-driven? Are these determined by a social agenda or are they technology driven? The relevance and sustainability of an undertaking would be immensely enhanced if the impetus for the project came from a real and felt need. Donor-driven or technology-driven initiatives tend not to foster project ownership within the community.

Are these interventions and outcomes replicable in other grassroots communities across Southeast Asia and the Pacific?

Technology is merely one of five dimensions in the development process, the others being: economics; values; social structures; and culture (Flor, 2002). Thus, ICT4L cannot exist and be treated separately from other development initiatives within the community. In fact, it has to be closely linked with other initiatives. Unfortunately, many of us involved in ICT4D, in general, and ICT4L, in particular, treat this as exclusive development initiatives. To ensure replicability of ICT4L initiatives, ENRAP3 should ascertain that these go beyond the provision, sharing and reuse of information or knowledge. These initiatives should lead to action and community mobilization. They should be closely linked with other nodes involved with such, particularly agencies that provide basic services to the community.

Another related consideration is the Critical Mass Theory, which drives home not only the possibility of replication but also the desirability and necessity of such to achieve larger impacts. In physics, a critical mass is that amount of radioactive material necessary to produce nuclear fission. Since the eighties, social scientists have been applying this term to refer to the number of early adopters necessary to steer the rest of the population into collective action. Research found that sustained collective action is triggered when a core of members (10 -15%) within a group or community engages in mutually reinforcing reciprocal behavior. When such conditions are achieved within a given population, a so-called critical mass is formed, ensuring the spread of such behavior throughout the population.

Hence, the above interventions and outcomes must be replicable in order for these to reach the critical mass of users that would produce desired impacts at a societal scale.

Are these interventions and outcomes scalable at the local and national levels?

These interventions and outcomes must likewise be scalable at the provincial and national levels. In fact, the larger the scale, the bigger the impact these may have on countryside development. Again, the impact and sustainability of ICT4L will only be assured if critical numbers of participant-users are reached.

SELF ASSESSMENT QUESTIONS

1. What are the specific livelihood outcomes of ICT4L?
2. Under what conditions will ICT-related projects produce the desired livelihood outcomes?
3. What are the social dimensions of ICT4L?
4. How can replicability and scalability of interventions and outcomes be assured?

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UNIT III

STATE OF PLAY

Apart from identifying development sectors and themes, members of the international development assistance community, particularly the multi-lateral financial institutions that fund ICT4D undertakings, have seen it fit to divide the world not only in terms of countries, but likewise in terms of regions and sub-regions.

Let us take the case of the three major regions targeted for development. Africa is considered a region, so is Latin America and Asia. Development financing in Africa is the primary responsibility of the African Development Bank. There is also the Latin American Development Bank and the Asian Development Bank covering the two other regions. The World Bank, as its name suggests, has global scope or worldwide coverage.

Africa consists of the Northern African sub-region, the Central African sub-region, and the Southern African sub-region. Apart from these, there is the Horn of Africa composed of countries such as Ethiopia, Somalia, Sudan, and Eritrea. Latin America has the Central American sub-region and the South American sub-region. The Asia-Pacific Region is made up of the South Asian sub-region, the Central Asian sub-region, the East Asian sub-region, the Southeast Asian sub-region, and the Pacific Islands. It becomes a little bit more complicated when one gets to Southeast Asia because it is also known as a region, the ASEAN region, and is also divided into sub-regions. Under the ASEAN region we have the Greater Mekong sub-region (GMS) composed of Cambodia, China, Laos, Myanmar, Thailand, and Vietnam, countries traversed by the Mekong River. There is also the East Asian Growth Area (EAGA), a sub-region composed of Brunei, Indonesia, Malaysia, and the Philippines (BIMP).

These categorizations are based upon General Systems Theory or GST. The GST perspective submits that systems may be divided into subsystems and in turn, may be clustered together into suprasystems. Consider for instance, Brunei, Indonesia, Malaysia and the Philippines as a subsystem of the BIMP-EAGA, whose suprasystem is the ASEAN region or the Asia-Pacific region.

Unit III of this book likewise adopts this view. It presents an analysis of the so-called state of play of ICT4D in the Asia-Pacific Region, focusing on ASEAN countries.

CHAPTER 8.
ICT4D ENVIRONMENT IN NINE COUNTRIES

LEARNING OBJECTIVES

After studying this chapter, the student should be able to:

1. Compare ICT programs among the nine Asian countries;
2. Differentiate infrastructure development initiatives in the nine Asian countries; and
3. Contrast the ICT policy environments found in the nine Asian countries.

KEY CONCEPTS

Digital Opportunities
Missing link hypothesis

BHUTAN

Bhutan is a small land-locked South Asian country bordered by India in the South, Nepal in the West, and China in the East. It is one of the few remaining kingdoms in the world. It possesses an ancient Buddhist heritage and has gained international distinction for its national yardstick for development, a unique measure known as Gross National Happiness or GNH.

In 2001, the Kingdom of Bhutan's Renewable Natural Resources (RNR) Sector spearheaded by the Ministry of Agriculture (MoA), implemented a systematic, participatory planning process that paved the way for the Sector's Ninth Plan (2002-2007). Among the features of the sector plan was a reorganization of the MoA that introduced "integrative unity at every level of the hierarchy". Three line departments now cover the RNR Sector: the Department of Agricultural Services (DoS); the Department of Livestock Services (DLS); and the Department of Forestry (DoF). The Ministry's Information and Communication Services or ICS provides information and communication support to these three line agencies as

well as other key offices within the MoA, such as the Council of Renewable Natural Resources Research of Bhutan (CORRB). In this restructuring, ICS finds itself in a most strategic position to contribute to the "integrative unity" of the organization considering that system integrity is a function of communication flows within and without. At its level, the ICS drafted its own Master Plan for the Ninth Cycle focusing on strengthening its information and communication technology capabilities.

Parallel to this planning effort, the Division of Information Technology (DIT) of the then Ministry of Communications (MoC) developed Bhutan's Information and Communication Technology (ICT) Master Plan. Among other things, the master plan encouraged individual agencies to draft their respective sectoral ICT master plans compatible with national ICT policies that were forwarded.

In July 2003, the MoC was reconstituted into the Ministry of Information and Communications. The Minister immediately initiated a national ICT policy process, which adopted the five strategic components of the 'development dynamic,' formulated by the Digital Opportunity Initiative (www.opt-init.org), i.e., policy, content and applications, infrastructure, human capacity, and enterprise. The Bhutan Information and Communication Technology Policy and Strategies or BIPS, which set the parameters for the sectoral ICT master plans, was officially released in July 2004.

In line with these developments, ICS transformed its institutional master plan into a *sectoral ICT master plan* that takes into cognizance the RNR sector's specific information and communication technology requirements. The plan itself was patterned after the five strategic components of the Digital Opportunities Task Force and is guided by the BIPS.

Mission and Vision Statements

***Vision Statement*.** In accordance with the Kingdom's Vision 2020, the RNR Sector envisions information and communication technology as an *integrative and enabling, yet socially acceptable and culturally appropriate tool* for the fulfillment of: national food security;

conservation of natural resources; sustainable economic production and enhancement of rural income; and the generation of employment opportunities.

***Mission Statement*.** The RNR Sector shall walk the extra mile in proactively employing and efficiently utilizing information and communication technology in contributing to Gross National Happiness and people-centered development by ensuring food security, natural resources conservation, sustainable production, and poverty alleviation.

Basically, ICT facilitates two elements critical in the RNR sector: *information access* and *networking*. The storage and retrieval of research results facilitates information access while telecommunications facilitates networking. Both elements are found in some of the strategies and goals discussed in this document.

Policy Environment

Because of the country's landlocked, mountainous terrain and geographical barriers, the Royal Government of Bhutan has recognized the potentials of ICT even before the first computers were introduced into the Kingdom in the early eighties. Bhutan Telecom has invested heavily on point-to-point wireless communications ahead of most of the least developed countries (LDCs). With the advent of ICT, the RGoB established the DIT under the then MoC in 2000 with the following mandate: to provide technological guidance to the government; carry out functions to promote ICT; and to coordinate ICT activities. Conscious of the fact that through ICT, Bhutan will be able to overcome communication problems caused by the country's difficult mountainous terrain, the DIT is convinced that ICT is a crosscutting concern affecting all sectors.

Furthermore, the Kingdom is putting in place a regulatory environment for the use and development of ICT. A Telecommunications Act was passed in 1999, a Copyright Act in 2000, and a Draft Information, Communications and Media Act is about to be passed in the National Assembly. Its institutional capacity to regulate and support ICT programs will be lodged in the

Department of Information and Media, the Department of Information Technology, and the Bhutan Communications Authority. As the BIPS states, Bhutan is now in a position to harness the potential of ICT through a greater and more coordinated national effort.

Infrastructure

Improved Connectivity. The Bhutan ICT Policy and Strategies draft document describes the Rural Telecommunications Project that would make available ten telephone lines per geog by 2007. Furthermore, Bhutan Power Corporation is collaborating with an Indian power generation company to lay fiber-optic cables as ground wire along with electric power cables under the nationwide electrification program. When these fiber optic cables are in place, unlimited bandwidth will be available in most parts of the Kingdom with the appropriate Internet backbone.

Broader Bandwidth. Bhutan Telecom has recently established an east-west 155SGH microwave radio backbone, which connects with a 34Mbps optical fiber link from Thimphu to Paro on to Phuentsholing. The satellite earth station in Thimphu connects voice traffic to London, Tokyo, and Singapore. Dzongkhag headquarters are now being connected, either via the microwave backbone or 8Mbps radio links.

Opportunities

Access to a Research and Education Backbone. Currently, there is only one Internet service provider in Bhutan – DrukNet – which offers a maximum bandwidth of 128 kbps to its subscribers. Even with fiber optic cables laid out across the Kingdom, DrukNet's limited bandwidth would severely impair performance.

Much of the World Wide Web is accessed through Internet Service Providers that make use of the commercial Internet backbone. However, there is a non-commercial research and education Internet backbone that may be tapped by the RNR sector. The bandwidth provided by the non-commercial backbone is broad, offering as much as 2 mbps, virtually free, and has hardly any traffic. This

bandwidth is enough to accommodate multi-point videoconferencing over IP. To tap the research and education Internet backbone, the appropriate RGoB agency should become a member of the APAN South Asia Consortium.

Improved Access to Conventional Media. Even conventional media has become more available, more accessible, and cheaper. A comparison of statistics given by the Asian Communication Handbook shows that there are more radio and television stations, more radio and television sets, higher video ownership, more movies, and more publications today.[1] Fifty years ago, radio was acknowledged as the most pervasive medium in rural farming communities. Today, it remains to be the most omnipresent, the only difference being that farmers today have equal access to both shortwave and FM broadcasts. With the spread of television coverage, rural communities have higher access to VHF and UHF (cable TV) transmissions. In Bhutan, cable TV networks now operate in 19 of 20 dzongkhags. Furthermore, the Nationwide FM Expansion Project by the Bhutan Broadcasting Service will cover 15 districts.

Increased incomes and more affordable pricing have also made VHS players almost as available as television sets. The increased availability has resulted in a seemingly contradictory situation wherein the number of cinemagoers has decreased but the popularity of cinema has increased. Moreover, higher literacy rates have also led to better potentials for print media.

Availability of Low Cost Alternatives. It is said that information and communication technology is becoming better and better and cheaper and cheaper by the day. Such may be open for debate. However, ICT4D exponents have developed low-cost hardware and software alternatives. For instance, alternatives to WiFi antennae that would cost a small fortune in the global market have been developed by technicians at the Philippine Rice Research Institute. These antennae that effectively work for wireless LAN can be locally fabricated for the cost of 100 ngultrums only.

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[1] *A, Goonasekara and D. Holiday, eds. (1998 and 2001 Editions).* ***The Asian Communication Handbook*** *Asian Mass Communication Research and Information Center and the Nanyang Technological University (Singapore).*

There are also subsidized alternatives. Bhutan Broadcasting Service is making available cheaper Internet, fax, audio, and video recording services in the districts through Community Multimedia Production Centers (CMMPCs). These telecenters can serve the information and communication requirements of rural and remote districts.

Opportunities for Promoting Bhutanese Heritage and Indigenous Knowledge. ICT has enabled the capture, storage, share, and reuse of knowledge in digital form. These encompasses best practices, indigenous knowledge, and cultural practices in natural resources management. ICT has now made it possible to preserve local and indigenous Bhutanese knowledge that would otherwise be lost through the generations.

Threats

There are likewise several threats that would impede the ability of the RNR sector to realize its ICT vision and fulfill its ICT mission.

Obsolescence. The rate of obsolescence of ICT hardware is highest among current technologies. Moore's Law states that the speed of a microprocessor doubles every eighteen months. The sustainability of continued investments on hardware is uncertain particularly in the context of least developed countries, where returns on ICT investments are not immediate. Hence, equipment procurement should be phased. ICT systems for the RNR sector should adopt a modular and evolutionary design.

Undermining of Culture. When it comes to culture and heritage, ICT may be regarded as a double-edged sword. The same technologies that would allow the RNR sector to capture, store, and preserve indigenous Bhutanese knowledge can also have a negative side. Some content made available by ICT may undermine Bhutanese culture and traditions, particularly those found in some websites and cable TV channels. Although this threat is a natural consequence of increased access to media and has very little to do with the RNR sector, it would only be prudent to consider it and is worthwhile mentioning, since culture and heritage are among the five thematic areas of the RGoB's Vision 2020.

Strengths

The ICT strengths of the RNR sector lie within the Information and Communication Services of the Ministry of Agriculture. ICS is staffed by dedicated practitioners who work as a team. Its management is likewise gifted with a firm vision of the role of ICT in renewable natural resources management. It was among the first government units that operated a local area network (LAN) and established an information portal for a Ministry.

Furthermore, the RNR sector has an extensive agricultural extension network currently in place involving more than 400 extension workers stationed in 201 *geogs* coordinated by 20 *dzongkhag* administrations. Technology packaging officers based in the RNRRCs located in Yusipang (western region), Bajo (west central region), Jakar (east central region), and Khangma (eastern region) provide the content for this network

Weaknesses

However, an FAO project preparatory mission conducted in 2003 found that linkages between research and extension institutions are hampered by several factors: [2]

- The staff at research stations and at district or village level extension units have few opportunities for communicating with one another. Information flow is largely dependent upon face-to-face meetings and infrequent telephone conversations, with a limited supply of extension approaches and research publications, or audio-visual materials reaching extension field workers and decentralized research staff.

- Extension agents do not have sufficient access to other sources of relevant and up-to-date information due to a lack of or limited communication tools (Internet connectivity, computer facilities at the *dzongkhag,* and at the *geog,* telephone, fax machines, etc.).

[2] *TCP Proposal for the Establishment of a Virtual Extension, Research and Communication Network (VERCON) for the Kingdom of Bhutan, FAO Rome.*

- In addition, there is a lack of institutional capability in information management and in the use of effective communication processes and methodologies to reach farmers with locally relevant production information, and in particular, how to effectively create and maintain communication networks with local public and private sector information providers and users.

The situations described in Items 1 and 2 were validated in field visits to the author in Shengana Geog and the Gase Tsho Hom Geog of the Punakha and Wangdue Phodrang dzonkhags, respectively. Item 3 on the other hand, stems from the lack of appropriate training among many of the technical staff members of the ICS. This may be rooted to the value traditionally placed on generalist training rather than specialist training within the Bhutanese educational system.

CAMBODIA

Cambodia is one of the six countries making up the Greater Mekong Sub-region or GMS. In the past nine years, the GMS has kept up with the rest of Asia and the Pacific in terms of telecommunications infrastructure development (ADB, 2004). This was due primarily to the multilateral assistance provided by the Asian Development Bank and bilateral funding coming from Germany, the People's Republic of China, JICA, and KOICA. One distinguishing feature of infrastructure development in the GMS is its sub-regional character. The laying out of a fiber optic backbone in one country is planned with the provision of linking up with fiber optic backbones in neighboring countries the idea being the formation of a sub-regional telecommunications backbone for the entire Greater Mekong Sub-region (Flor, 2005).

For Cambodia, Laos, and Vietnam, it may be stated that the national telecommunications backbones are in varying stages of completion, the most advanced being Vietnam's. Lao PDR's strategic location bordering all GMS countries provides it with a distinct advantage in potentially reaping maximum benefits from a sub-regional infrastructure. Cambodia on the other hand, has the most developed wireless connectivity in the sub-region.

However, there is still the matter of extending this ICT infrastructure and in effect, connectivity and bandwidth to peripheral areas in the countryside, an initiative which is being pursued in all three countries with different degrees of progress and measures of support (Flor, 2005).

Nevertheless, infrastructure development must be linked to thematic sectors such as educational equity, health access, economic policy, and science and technology (S&T) promotion. The link between telecommunications and thematic sectors has been a continuing concern of the International Telecommunications Union since it forwarded its *missing link hypothesis*, wherein the level of telecommunications infrastructure development has not been directly correlated with levels of utilization particularly in developing countries. Calvano (2002) believes that the missing link is the partnering of infrastructure development to thematic sectors represented by institutions such as UNESCAP for the economic sector, UNESCO for the education sector, FAO for the agriculture sector or WHO for the health sector. The extension of ICT infrastructure from the national backbone to peripheral areas is, after all, likened to the growth of a living network. The impetus for infrastructure development to extend or grow radially is provided by these thematic sectors. Further investments into infrastructure should likewise address these concerns (ADB, 2002).

Among the three countries, the Cambodian backbone is the least developed. This may be expected from a country with the lowest electricity availability and the highest generation cost in the region. However, there are two factors that easily redeem this situation. Firstly, Cambodia has a robust wireless network. It is the first country in the world where the number of cellular phone subscribers exceeded the number of landline subscribers. This began in 1996, when the number of cellular subscribers reached the 25 thousand mark. As of 2005, there were 325 thousand cellular phone lines compared to a mere 40 thousand landlines, increasing the country's teledensity to 2.75 (Flor, 2005).

Secondly, Cambodia has received JBIC financing for its segment in the Greater Mekong Sub-regional Backbone network (from Phnom

Penh to Sihanouk Ville to Kampong Chiang Road 6). The design and development phase is now ongoing.

The Ministry of Posts and Telecommunications of Cambodia (MPTC) is the government agency for spearheading ICT development. It is likewise the main telecoms provider, sometimes characterized as a monopoly. Plans are now in the offing to privatize MPTC. There is also a plan to establish at least one exchange via fiber optic cables per province to make services available to the village through private providers. Since fiber optics is cheaper than microwave, the cost of the service will go down, thus increasing demand (Flor, 2005). Its establishment of the National Information and Communication Technology Development Authority or NIDA, evidences national government support for ICT development attached to the Office of the President above the cabinet level. Among NIDA's responsibility is the drafting of a national ICT Master Plan.

Cambodia may easily be categorized as an LDC or least developed country. Its public school teachers have an average monthly salary of US$30. Among the labor force, there is a lack of middle-level capacity or supervisory skills. The demand for eServices in rural areas is quite low primarily because of: low access and availability; the lack of eServices awareness; low information and communication literacy; preoccupation with daily survival needs; and high service cost (Flor, 2005).

However, being a socialist country with a centrally planned economy, Cambodia has a firmly entrenched governance structure that extends from the national to the provincial to the district then to the commune and village levels. The agency tasked for the delivery of basic services is the Ministry of Rural Development (MRD). Services from the national to the village flow through this structure: At the highest level is the Council for Agriculture and Rural Development (CARD) chaired by the Prime Minister. CARD provides policy and program directions to the Ministry of Rural Development. At the provincial level, there is a Provincial Rural Development Council or PRDC. This body coordinates closely with the Provincial Office for Rural Development under the MRD. At the district level is the District Rural Development Council (DRDC), which coordinates closely with the

District Office for Rural Development (DORD) under the PORD. At the commune level is the Commune Rural Development Council (CRDC), which is made up of the heads of the Village Development Councils (VDCs). The VDC acts as the bridge between the rural community and government. The support of the VDCs would be invaluable in ICT4L undertakings in Cambodia.

The government ministry structure reaches down to the district level. Connectivity is likewise down to the district level only (Bestle, 2004). Hence the last mile linkage from the district to the village is missing. Telecenters stationed in the communes may provide such a linkage.

CHINA

China is the world's biggest nation and fastest growing economy. It is Asia's most powerful country with a population of 1.25 billion. However, rural dwellers account for 78% of its population. Agriculture is the main source of livelihood in the rural areas. In fact, this sector accounts for a substantive portion of China's GNP. Chinese agriculture is diverse and technology driven. Yet, it has reached less than half of its potential because of poor education (FAO, 2001).

Because of centralized planning, China has adopted a radial approach in developing its rural ICT infrastructure. In collaboration with the telecommunications and education ministries, the Ministry of Agriculture has taken the lead in establishing eCommunity centers all over China, albeit employing an approach that differs from that of other countries in four respects (Flor, 2004).

Firstly, China is simultaneously developing both satellite and fiber optics technology for its rural ICT infrastructure. It currently operates a robust satellite service actively participated in by commercial service providers. Recently, however, it has entered into an agreement with the Government of Israel for the provision of 500 very small aperture terminals (VSAT) for its rural satellite broadcasts and Internet access. Hand-in-hand, the development of the fiber-optics backbone is well on its completion. The last mile links, however, are concurrently being addressed primarily through eCommunity centers.

Secondly, the eCommunity centers belong to a centralized multi-tiered network at the national, provincial, prefecture, township, and village levels. In other countries, eCommunity centers usually start as independent community initiatives and are thus not networked institutionally.

Thirdly, the Ministry of Agriculture is building upon existing networks of agricultural service providers such as agricultural bureaus, agricultural information centers, local governments, and other distance education institutions. For the past three decades, the Ministry has been establishing an expanded network of farmers' libraries. These libraries are gradually being retooled and transformed into eCommunity centers thus ensuring density and penetration.

Fourthly, the eCommunity centers particularly those under the Ministry of Agriculture form part and parcel of a distance-learning network called the Central Agricultural Broadcasting and Television School (CABTS).

The Central Agricultural Broadcasting and Television School was established in 1980 with a mandate for providing education and training to enhance agricultural production. Its target audiences are farmers, rural youth, rural women, leaders of rural communities, and agricultural extension workers. CABTS, which has been called the "cradle of competent farmers," is now the world's largest educational establishment for agriculture and rural development catering to an average of 900,000 enrollees per year (FAO, 2001).

To say the least, the CABTS Network is huge. It has: one central school in Beijing administering the network; thirty eight provincial schools; three-hundred and thirty prefecture schools; two-thousand four hundred and eight county schools; twenty-three thousand township training centers; sixty virtual classrooms, which will soon increase to five hundred and sixty with Israel's donation of VSAT units; two-thousand seven hundred and fifty administrators; and forty-five thousand one hundred and seven staff.

Since it was established in 1980, CABTS has been employing traditional print, radio and TV-based distance learning delivery.

In 2001, however, it began migrating to online teaching and digital learning environments employing broadband and wireless technologies. It will make full use of the noncommercial Internet backbone and will eventually establish two thousand virtual classrooms all over China. In other words, most of the CABTS network is now linked.

In the past few years, CABTS have begun venturing into learning programs dealing with non-agricultural livelihood. The shift is becoming more pronounced since rural-urban migration has become a dominant trend in most provinces. This shift would definitely be worthwhile monitoring under ICT4L.

INDONESIA

ICT Policy

Presidential Decree Number 3 of 2003 promulgates the application of eGovernance all throughout Indonesia. Yet, two laws have severely impacted on the information and communications capacities of the agricultural extension system in Indonesia although not relating directly to ICT.

Republic Act Number 22 of 1999, otherwise known as the Local Government Code has decentralized the agricultural extension function from the Ministry of Agriculture to the *Dinas Pertanian* of the devolved local governments. It may well be worth mentioning that there are several *Dinas's* responsible for agriculture. Aside from the *Dinas Pertanian*, the major ones are the *Dinas Perikanan* for fisheries, and the *Dinas Perhutanan* for forestry. Prior to the implementation of this Code, the then Agency for Agricultural Extension had a network of 32 Agricultural Training Centers (BLPPs) and 343 Rural Extension Centers (BIPPs) based in the provinces and districts (*kabupatens*), respectively. These centers were equipped with what was then considered as high-end information and communications hardware. When the responsibility for these centers was transferred to the *Dinas*, most of them went exclusively to one *Dinas*, marginalizing the others from utilizing it.

Another law, Republic Act Number 25 of 1999, distributed the budget for agricultural extension to the local governments, which had the liberty to reallocate it for other pressing priorities. Hence, money that was meant for extension activities were channeled elsewhere. This effectively weakened the information and communications capabilities of the agricultural extension force. As of today, the number of productive BIPPs have dwindled from 343 to 28. Of the 32 BLPPs, 7 were retained by the Ministry and are operational.

Realizing the adverse effects on operations, the GOI has since retraced its steps along this line. The Agency for Agricultural Research and Development (AARD) has made a strategic decision not to devolve its Assessment Institutes for Agricultural Technology (AIATS). In other words, Indonesia's agricultural R&D network is still intact in spite of decentralization. Republic Act Number 8 of 2003 has limited the number of *Dinases* in each district to three, unless certain criteria are met for establishing more. Additionally, the Ministry, although unable to exert any direct influence in decisions regarding agricultural extension programs at the local level, has decided to play its financial card. It has set guidelines in the release of budgets meant for extension.

In Indonesia, devolution has emasculated the national agricultural extension system. Among the casualties was the agricultural information and communications system. In a devolved structure, there was no scope for national or regional communications programs. Moreover, the devolved services just did not have the capability to launch their own localized information and communications campaigns. The contribution of information and communications in mainstream extension gradually diminished since these were not supported by the current structure.

Infrastructure

The GOI has invested heavily and early into ICT for the basic delivery of services in the country. Considered to be the world's largest archipelago, it was a strategic decision on the part of the government to do so. Indonesia was the first Southeast Asian country to launch its own satellite for telecommunications purposes. Furthermore,

the country has pioneered in programs that promote rural access. The WARTEL (*warung telepon* or rural telephone service) and the WARNET (*warung Internet* or rural Internet service) have been present in Indonesia long before the Digital Divide became an issue in the developing world. However, Internet penetration is still one of the lowest in Southeast Asia, below that of Singapore, Thailand, and the Philippines. Furthermore, the non-commercial Internet backbone is not adequately tapped for agricultural extension. The MOA Center for Agricultural Database and Information (CADI) for instance, contracts the services of commercial ISPs for its district and sub-district level programs.

The Ministry of Agriculture has adequate hardware, software, and networking facilities up to the provincial level and, in some cases, the district level. In particular, four high-end Sun Microsystems servers power CADI's system. At the sub-district level and below however, hardware is extremely lacking and aging.

Although the potential for ICT infrastructure exits, it is not being adequately tapped for agricultural extension purposes. Indonesia's *Palapa* satellite may be used for wireless technologies. The non-commercial Internet backbone should be developed and utilized accordingly.

Program Planning and Development

The Agency for Agricultural Extension and Training has since been renamed as the Agency for Agricultural Human Resource Development (AAHRD). Given the current devolved structure, AAHRD cannot directly implement ICT programs at the field level for agricultural extension. However, a number of ICT-related programs are in the pipeline that may be linked to an agricultural extension ICT system for Indonesia. These are: the FAO TCP National Program for Food Security (NPFS); the ADB Poor Farmers Income Improvement through Innovation Project (PFI3P); and the World Bank Farmers' Empowerment through Appropriate Technology and Information (FEATI). Furthermore, there are current FAO initiatives that are active in Indonesia such as the SPFS Asia Information Management System (SAIMS).

CADI has likewise initiated the *eForm* program, which makes available an online reporting database system from the Kabupaten level upwards utilizing a MY Sequel backend.

On the other hand, the National Center for Agricultural Extension Development has expressed the need for a program strategy that combines ICT with traditional media most accessible in the rural areas. This again points towards innovative interfaces for last mile linkages.

Although programs on agricultural extension ICT systems are lacking, there are opportunities to link-up with existing and up coming programs that relate directly to this area. Furthermore, an explicit and comprehensive last mile linkage strategy should be developed for Indonesian agricultural extension. This strategy should utilize: high end ICTs such as the Web, cable modem, PDAs, 3G Cellular telephony; low end ICTs such as cable television, SMS or rural radio; and indigenous media.

Content Provision

As mentioned earlier, the AARD has strategically kept its AIATS and retained its nationwide agricultural research network. This network has given AARD the ability to implement field level activities from a national program perspective. Because of the vacuum left by the dismantling of the agricultural extension system, AARD has found itself carrying part of the extension burden in the countryside. Note that the content for innovative agricultural technologies is housed in the AIATs.

Insofar as market information is concerned, it should be likewise noted that CADI is actively developing a market information system currently being piloted in Indramaya and Sukhabumi in collaboration with the Directorate General for Processing and Marketing. This will be further pursued in the ADB PFI3P.

With the participation of the AIATs in the agricultural extension ICT system, content will be made available. Insofar as market information is concerned, CADI can potentially supply the content.

Capability Building

In Indonesia, there are eight thousand researchers compared to 35 thousand extension workers, most of whom are now under the payroll of local governments. It was previously mentioned that innovative agricultural technologies are housed in the AIATs. The AIATs now carry part of the agricultural extension burden. However, the AIATs are staffed by researchers and not by extension workers.

Additionally, most extension workers based in the local governments are beyond 40 years old and awaiting retirement. They belong to the old school of information and communications.

A training course that covers design, development, and utilization of information and communications media by agricultural extension workers is required. Although this course would include sessions on digital multimedia production, it should likewise incorporate interfaces with conventional and traditional media as well as alternative last mile linkage strategies.

LAO PDR

With a population of 5.5 million, the Lao People's Democratic Republic has a total of 442,500 mobile and fixed lines resulting in a teledensity of 8.04. As regards to Internet service, it has a capacity of 5,700 dial up lines and 192 ADSL lines bringing the Internet penetration ratio to 2. Ninety-five out of 140 districts have public telephones. The Ministry of Communications, Transportation, Posts and Construction has been tasked to spearhead the development of the Lao telecommunications backbone. The initiative began with the China-Singapore Optical Fiber and Cable Project financed by a loan from Germany. A succeeding loan from China has resulted in 430 kilometers of fiber optic cables laid down and utilized locally (ADB, 2004).

The development of the national telecommunications infrastructure has been divided into four phases. Phase 1 targeted the initial 430-kilometer backbone that traversed the Thailand and Vietnam borders from west to east of the country. Phase 2 covered 1,250

kilometers extending the backbone northwards and southwards. Phase 3 covered 1,500 kilometers further, extensions to the south and north as well as outlying peripheral areas. Phase 4 covers 1,500 kilometers of mostly peripheral areas in the north, for a total of 4.680 kilometers of fiber optic cables laid out nationwide.

As in the case of Cambodia, the national government has placed much priority on ICT development. The lead agency for this is the Science, Technology and Environment Agency (STEA) of the Prime Minister's Office. In 2004, STEA drafted the National Policy on Information and Communication Technology. Otherwise known as the Lao ePolicy, it contained ample provisions for the development of ICT in rural and remote areas. The ePolicy will pave the way for an ICT Master Plan (Flor, 2005).

Likewise initiated was the eGovernment Project funded by KOICA. The project will produce an eGovernment Plan within the framework of ASEAN integration. STEA has also been charged in drafting the eCommerce Law.

In the past five years, much progress has been made in the development of an eExtension platform for the agriculture sector. In particular, the National Agriculture and Fishery Research Institute (NAFRI) and the National Agriculture and Fishery Extension Service (NAFES) have made gains in the use of ICT for the storage, retrieval, sharing, and reusing of agricultural knowledge and information (Riggs and Flor, 2005). Linkages between research and development institutions in Lao have been electronically established. A one-stop shop for agricultural information has also been launched by both NAFRI and NAFES to serve farmers in rural and remote areas.

In the case of Lao PDR, connectivity can only be assured down to the provincial level. The flow of services generates from the central or national government to the provincial government, down to the prefectures, the districts and on to the villages (Bestle, 2004). As in the case of Cambodia, there is a need to facilitate the flow of basic services down to the village level through the various ICT4R platforms. However, the GOL realizes that fulfilling the demand for eServices in rural and remote areas has to be done in phases. The

provincial level needs to be linked to central government before the district level and the village level.

PHILIPPINES

In the Philippines as in the rest of Asia, the use of the term ICT is hardly a decade old. Before 1996, the term most prevalently in use was IT or information technology. There were three factors that influenced the shift from IT to ICT: firstly, the marriage of telecommunications and information technology in the form of the Internet; the spawning of revolutionary Web-based applications, which required expertise not generally associated with IT; and the increasing recognition that the advent of new IT is transforming social processes that are often classified under the gamut of communication.

ICT was indeed changing the corporate horizon, and its potential for catalyzing upheavals in the development sector as well was seriously considered. However, there were and still are, serious reservations about its applications in the development sector considering its classification as high-end or non-appropriate technology (Flor, 2005). After all, how can one talk about connectivity in rural areas when electricity itself is lacking? How can one assume computer literacy when functional literacy itself is a problem?

Proponents of ICT argued along with leading economists that the portion of the gross national product of the Philippines attributable to information-related activities is getting larger and larger. The number of information workers is also increasing while the number of agricultural and industrial workers is decreasing (Flor, 1986). In other words, the Philippine economy is getting to be more and more information-based. Simultaneously, the realization that the world is turning into a global information society wherein information becomes the source of wealth and the most critical economic resource, has prompted development planners to support investments in ICTs.

The international development assistance community has since been actively endorsing ICT as a thematic area that cuts across all sectoral concerns such as agriculture, health, the environment, and education

(Flor, 2005). Thus, almost every development project proposed, funded, and implemented contains an ICT component or element in the form of the design and development of information systems or the provision for public awareness employing digital tools.

Government policy and programs have also been quite supportive. To the Arroyo Administration's credit, a cabinet-level Commission on Information and Communication Technology has been established. The General Appropriations Act and financial injections from international funding agencies and the private sector have supported ICT programs in every line agency.

Insofar as agricultural livelihoods are concerned, extension workers serve as the frontline support group for farmers, rural women, and out-of-school youth. As in the case of Indonesia, the network of agricultural extension workers in the Philippines began disintegrating in the eighties due to reorganization within the Department of Agriculture and the devolution of basic services to local governments. The alternative deemed most logical under the circumstances, was the use of ICT to re-establish a network of extension workers that would *transcend devolved governmental structures* (Flor and Hazelman, 2004). This response was the Open Academy for Philippine Agriculture or OPAPA, a network of institutions providing education, training, extension, and communication in agriculture to farmers and support service providers. It is an alliance of national, local, and international organizations that utilize and tap the potentials of existing infrastructure from the government and private sectors, their content and information databases, in an open environment. It links policymakers, researchers, service providers, markets, business organizations, and farm communities using ICT and distance learning.

The Philippine Rice Research Institute or PhilRice serves as the lead agency or the official hub for OPAPA because of the institution's advanced network infrastructure, trained ICT specialists, and current initiatives in the promotion of hybrid rice technology, which is the pilot course offering of OPAPA.

OPAPA is not a formal organization but a network of organizations. It is not registered with the Securities and Exchange Commission and has no charter as an organization. Hence, it does not have a mission and vision statement. However, it is an active living network engaged in ODL at the nonformal level backed up by the most prestigious Philippine institutions in this area. Clearly, the OPAPA case merits closer study specifically in its impact on farmers' livelihoods.

SRI LANKA

ICT Policy

The banner program of Prime Minister Wickramasinghe is called *Regaining Sri Lanka*, a comprehensive rural development program aimed at revitalizing the countryside. Among the priority actions of the Regaining Sri Lanka program are to:

- Strengthen technology transfer through print and mass media;
- Utilize ICT in the delivery of advice and marketing information;
- Produce computer-aided and *user driven and controlled* rural knowledge centers; and
- Create biological software production for sustainable agriculture.

These are explicit policy statements on the use of ICT for the delivery of agricultural services. However, the salient feature of this innovative program is its private-sector participation and demand driven approach. Hence, the emphasis on the phrase *user driven and controlled* in item 3 above.

At the level of the Ministry of Agriculture and Livestock, the use of information and communication technology is likewise clearly endorsed in its National Policy for Agriculture and Livestock (2003-2010). The lead agency for this initiative is the Audio Visual Center (AVC) of the Directorate of Agricultural Extension and Training under the Department of Agriculture.

As in the case of Thailand and Indonesia, there is no dearth of government pronouncements on the use of ICT for the delivery of

basic agricultural services. However, the case of Sri Lanka offers another element that may be employed in the proposed TCP. Private sector participation and a demand-driven approach may contribute to the strengthening of agricultural extension systems. Moreover, the private sector generally leads in ICT initiatives. This is not to relegate a lesser role to government extension services. Perhaps the approach that should be carried out for the TCP should be one of *public-private sector partnerships*.

Infrastructure

Japanese and American corporations in partnership with local companies dominate the telecommunications industry in Sri Lanka. Although the telephone service is available all over the island, telephone density is low, particularly in the rural areas. Furthermore, local telephone rates are exorbitantly high and charged on a duration basis. Rural knowledge centers are, thus, hard put to avail themselves of telephone services and, subsequently, Internet services.

The high cost and unavailability of telephone services need to be addressed by the TCP. Alternatives will have to be identified. As in the case of Thailand and Indonesia, tapping the non-commercial Asian Internet backbone for research and education under A3I is a possibility. However, this does not address the requirement for an affordable telecommunications infrastructure, required for first to last mile linkages.

Program Planning and Development

Regaining Sri Lanka includes the piloting of five rural knowledge centers in five villages and five district hubs. These knowledge centers are patterned after the Pondicherry rural knowledge center established by villagers under the auspices of the Swaminathan Foundation in India.

Additionally, the AVC has begun the Cyber Extension initiative, which would eventually tap the 550 *Govijana Kendras* or village level agricultural extension offices all over Sri Lanka as rural knowledge

centers. These village level extension offices are under the auspices of the Department of Agrarian Services, within the purview of the Central Government. It is staffed by an administrator (an employee of the Central Government) and an agricultural instructor (under the payroll of the Provincial Council). The latter supervises between 120 to 150 agricultural research and development officers who report to the village level extension offices three days in a week.

The Cyber Extension project is being piloted by the AVC in ten villages with support from the Council of Agricultural Research Policy or CARP. IRRI will be funding an additional seven rural knowledge centers bringing the total to 17. Phase II of the Cyber Extension project will link the rural extension centers into the National Agricultural Information Network or NAIN, with its hub at the AVC, the National Agricultural Information Center.

The *Regaining Sri Lanka* village hubs and the CARP-funded Cyber Extension project of AVC are both pilot-undertakings. Both will establish rural knowledge centers at the village level. However, it may be noted that there is a fundamental distinction between their respective approaches. The former envisions a private sector, village-level initiative similar to the Pondicherry rural knowledge center, while the latter transforms existing village-level agricultural extension offices into rural knowledge centers with the end view of connecting these into a national network.

There is merit to both two approaches described above and one need not undermine the other. A private sector, demand driven approach generally leads to sustainability. However, the AVC approach of transforming existing facilities and linking them as nodes ensures a cohesive, integrated network built upon a solid institutional structure, something that was dismantled during the devolution of local governments. A public-private sector partnership that brings these two approaches together would provide the TCP with a third, more workable option.

Perhaps, the Thailand experience provides a model of how this may be done. Although a government corporation BAAC operates like a private bank. It collaborates with the DOAE and, although this

collaboration still has some gaps, a synergy is created between the efforts of the two agencies.

Content Provision

Apart from its mainstream research initiatives involving food production, post harvest, and marketing technologies, the Sri Lankan agricultural research system is now engaged in upstream, cutting edge research such as biotechnology and hydro-phonics. There is enough technology to go by. However, the adoption of these technologies is a different matter altogether.

Content wise, there is an adequate supply of raw material in the form of research findings and technology packages, not only from the national agricultural research center but from CGIAR institutions as well. Insofar as packaged content is concerned, the AVC possesses the expertise to design, develop, produce and test interactive multimedia CD-ROMs. Under the Cyber Extension project, the AVC will produce 50 multimedia CDs within the next three years. These CDs will not only contain interactive multimedia presentations but commodity-based digitized research libraries as well.

Content provision is not a problem in Sri Lanka. Furthermore, among the three countries, Sri Lanka has the best expertise in the production of interactive multimedia presentations.

Capability Building

The AVC regularly conducts training courses on multimedia production, media utilization, and basic computer skills for government and private extension workers. It has well-equipped training facilities in its Peradeniya headquarters as well as production facilities for audio, digital video and multimedia authoring. Nevertheless, the Director of the Center expressed the need to update their skills considering the introduction of new versions of Adobe Photoshop, Adobe Premier, Macromedia Director, Flash Animation, and others. Furthermore, village-level agricultural research

and development officers, having been newly appointed this year, have not yet been trained in these ICT technologies.

Although the AVC is quite proficient in the production of interactive multimedia presentations, its staff may need to update their skills in order to maintain their leadership in this area. Its staff will serve as trainors of the estimated 9000 newly appointed village-level agricultural research and development officers as well as village level volunteers who will man the rural knowledge centers established under the Regaining Sri Lanka program.

THAILAND

ICT Policy

The Government of Thailand has prioritized the use of information and communication technology in bringing its services to the countryside through a comprehensive eGovernment policy. The government has sponsored several initiatives along this line.

Thailand has established a National Information Technology Committee made up of four modules covering agriculture, finance, industry and governance. All four clusters are linked to the Prime Minister's Office. Furthermore, Thailand has enacted six ICT Laws, which includes the Digital Opportunity Law designed to provide grants to build rural telecenters.

The general policy of the Thai Government to employ ICT in the delivery of basic services has set the tone for the Ministry of Agriculture and Cooperatives. Most of its line departments, including the Department of Agricultural Extension, have their own ICT programs. What may be lacking is an explicit policy for the integration of and coordination among these programs and systems. Such a policy would ensure that: efforts are not fragmented; no duplication of programs and systems occur; resources are not wasted; standards for ICT services are established; and synergy is created among the line departments.

Infrastructure

Thailand has a National Information Infrastructure Action Plan, which is divided into three components: the SchoolNet; public Internet services by CAT and TOT; and PubNet. Telephone density is pegged at 8 lines per one hundred persons for terrestrial services and more than 9 lines per one hundred persons for cellular services. There are a total of 24 Internet Service Providers: 18 commercial, 4 non-commercial and 2 domestic hubs. The National Electronics Technology and Computer Center (NECTEC), a quasi-governmental think-tank, provides government agencies with ICT solutions. However, bandwidth availability continues to be a pressing concern among field-level extension workers and farmer users.

The Department of Agricultural Extension is well endowed with hardware, software, and networking facilities up to the provincial level. Below this level, hardware is extremely lacking. Attempts have been made, however, to tap the Internet Tambon program for this "last mile linkage."

The Thai ICT infrastructure for agricultural extension can best be strengthened through strategic interventions for the expanded access and use of the non-commercial research and education backbone instead of the commercial Internet backbone. Innovative interfaces between the Internet technologies and other media such as cable television, radio, and cellular telephony should be explored as "last mile linkage" options.

Program Planning and Development

The Ministry of Agriculture and Cooperatives has an IT Master Plan upon which the Department of Agriculture's IT Master Plan is built. The DOA has an Information Service Center (DISC) that serves as the support unit to the Chief Executive Officer and the Chief Information Officer.

The Department of Agricultural Extension, on the other hand, has established an ICT Center exclusively devoted to the agency and extension services. It has likewise embarked upon a five-year Master

Plan dubbed *eExtension* dovetailing the GOT's *eProvince* initiative. The Master Plan, which began implementation in 2000, is now on its second phase.

One of the most prominent stakeholders in the ICT for extension arena is the Bank for Agriculture and Agricultural Cooperatives. BAAC initiated its Agricultural Information Network (AIN) in 2002 offering several innovative products and services. Among these are: an agricultural information gateway that provides unified access to most of the agriculture-related databases of the GOI; eLearning for farmers; and the Pocket PC Project, that makes available a PDA-powered decision support system (DSS) for farming/livelihood options. One of its high-end applications is the Global Mapper geospatial information systems (GIS) using CONUS satellite-generated base maps.

BAAC has gone beyond credit provision services into information, education and communications services to farmers and housewives. Providing technical assistance to specific components of the bank's AIN Program are the Japan Bank for International Cooperation (JBIC), the Canadian International Development Agency (CIDA), the U.S. Trade Development Agency (USTDA), and the European Union (EU).

As in the case of ICT policy, the Thai agricultural sector has adequate programs for the use of ICT in agricultural extension. However, these programs are only coordinated to a certain extent and not at all integrated. A case in point is the need for integration between the ICT programs, products and services of BAAC and the MOAC Department of Agricultural Extension.

Content Provision

For Phase I (2000-2002) of the *eExtension* Master Plan, the ICT Center of the Department of Agricultural Extension has designed, developed and tested 21 data/information bases, all of which have been made available online. Eight of these data/information bases have administrative (MIS) applications accessed by staff over the Intranet while the remaining 13 have technical applications made available to DOAE clients over the Internet. The latter includes: the

Agribusiness Network; the OnlIne Library on Agricultural Knowledge; the Plant Clinic; Agricultural Experts' Directory; Success Stories; and the Web Board, an agricultural online discussion forum for farmers and experts.

For Phase II (2003-2004), DOAE intends to set up the Contact Center for Agricultural Extension or CCExt with field level extension agents and farming communities as users. CCExt is designed as the DOAE's knowledge management platform, an electronic system for the sharing and reusing of best practices and lessons learned among extension workers and farming communities. Initially, these best practices and lessons learned will be mined from the Web Board discussion forum. CCExt will eventually employ a Counter Service Real Time Web-based front-end. With CCExt, the DOAE is migrating from data management and information management to knowledge management.

BAAC, on the other hand, makes their products and services available via satellite through their network of 370 branch-based nodes all over Thailand. It has entered into a Memorandum of Agreement with Kasetsart University for the provision of technical content. Furthermore, it interfaces with the MOAC Department of Agricultural Extension for selected agricultural information and field level activities.

Content provision is the least of the Thai agricultural extension sectors problems. Research institutions and the academe provide technology and innovations. Economic, credit, and financial information is provided by BAAC. There may be a need, however, for up-to-date reliable market information.

Capability Building

Nowadays, it is mandatory for the field extension staff of the DOAE to undergo training on Basic Computer Applications and Web Tools. The DOAE ICT Center conducts both training courses on a regular basis. However, secondary data from the 2001 UNDP Human Development Report reveal that computer literacy in the rural areas is still quite low.

Generally, Thai extension workers are computer literate and proficient in using the World Wide Web. Their role may go beyond plain users but as contributors to and developers of online knowledge products. Thus, training programs on Web technologies (i.e., Web writing, html, and interface design) might be in order.

VIETNAM

Flor (2005) observes that Vietnam has the highest developed ICT infrastructure among the three countries. Its approach to ICT development is also the most sophisticated. The National Institute of Posts and Telematics has put forward a three-way model to illustrate the key components of ICT in Viet Nam. These key components are:

- *Users* - consume products and services; indirectly influence business investments; interact with businesses and government.
- *Government* – provides laws, institutions and policies; conducts regulation, supervision and coordination; conducts training, international cooperation; provides support and facilitation.
- *Businesses* – make investments; deliver products, services and training; promotes and develops markets; works with government.

These three components are said to interact within four areas: infrastructure; applications; human resource; and industry.

Another facet of the Vietnam ICT policy environment is legislation. A US$ 860 thousand grant has been awarded by KOICA to the GOVN to fund the Drafting of the ICT Law. The project is now in the final stage and the draft will soon be submitted to the National Assembly. The ICT Law includes provisions on eGovernance and eCommerce. MPT has also prepared a proposal for the IT Industry Master Planning that would be funded by JICA. The proposal has already been submitted to the Ministry of Planning and Investment for consideration.

Lastly, the Ministry of Posts and Telematics and the National Institute of Post and Telematics is currently implementing a US$ 80 Million ICT loan project funded by the World Bank. Executing agencies other than the MPT and NIPT are the cities of Danang, Hanoi, Ho Chin Minh, and the Government Statistics Office. The project will: review of existing ICT infrastructure; promote ICT standards; establish an eGovernance platform powered by GIS; establish an eCommerce platform; develop an ICT HRP Plan; conduct assessments and strategy development; and develop a roadmap for ICT4D. At the community level, this undertaking may result to solid gains in ICT4L.

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CHAPTER 9.
NICHING

For the past decade, globalization has spawned its champions and detractors within and outside academic circles. Many of our peers consider globalization as a boon to Asian higher education since it opens up our academic programs to Western students. Consider, for instance, the increasing number of North American and European graduate students pursuing their degrees in Thai universities through English language programs. However, an even greater number among us consider globalization as a bane not only to our educational system but also to our Asian societies in general. Localization of resources seems to be the remedy of choice for the perceived ills of globalization. One would assume that this would likewise follow in the area of education and human resource development.

This chapter adopts a slightly different point of view.

From where I stand at the moment and that would be from the vantage point of the Open Campus of the University of the Philippines System, *globalization is a product of technology*. Although as an academic, it is very tempting to analyze globalization from a geopolitical point of view, I see it realistically from the standpoint of technological determinism. From this perspective globalization is seen as the natural consequence of information and communications technologies. New ICTs have resulted in the death of distance and are thus actively undermining national as well as regional boundaries in the economic, financial, communicational, and educational spheres.

To me, it is quite clear that globalization, particularly in education, is not a product of a conspiracy perpetrated by an ideology or an economic bloc. It is merely the natural outcome of a networked world that has shrunk virtually due to advances in telecommunications and transportation.

COMPETITION, COMPETENCE, AND COMPETENCIES

How does the academe situate itself in such a global educational environment? How would universities cope to the challenges of a knowledge society?

ASEAN universities should position themselves according to their relative strengths and strategic advantages. Such is the fundamental ground rule in the globalized playing field, be it in the area of trade or education.

We could very well learn from the example of Indian educational institutions that are now the largest supplier of software developers in the entire world. Indian manpower exports of programmers amount to billions of dollars annually. The Philippines ranks a poor second compared to India, based on foreign exchange earnings attributed to this sub sector. On the other hand, India tails the Philippines as the largest global supplier of call center operators. A strategic advantage that both India and the Philippines have is that their medium of instruction in computer education, as well as in communication, is English.

However, Asia in general and Southeast Asia in particular should not be engaged in cut-throat competition against one another. Each country should focus on their respective niches, be these in computer science, information science or communication science. These niches may actually be found in the list of competencies expected from individuals to lead in a knowledge-based economy. These competencies are clustered under a growing field of study, information and communication technology.

ICT as a Body of Knowledge

Information and communication technology may be regarded as a body of knowledge, built and shaped over time by its practitioners. The building blocks of this body are generated by research, both scientific and anecdotal, involving the documentation of best practice and lessons learned.

Like all bodies positioned within time and space, this body of knowledge possesses three dimensions. In this particular case, however, continua constitute these dimensions: the hard - soft continuum; the front end - back end continuum; and the high end - low end continuum.

The hard-soft continuum refers to the range of systems involved from hardware technologies to software technologies and on to content. Somewhere in this continuum, information and knowledge is situated, the latter being the *softest* of the lot. The front end refers to utilization or user technologies while the back end refers to design and development technologies. High and low ends refer to the level of complexity and sophistication of the technologies.

Situate these dimensions in a matrix and we arrive at the following cells: the hard front high end; the hard front low end; the hard back high end; the hard back low end; the soft front high end; the soft front low end; the soft back high end; and the soft back low end.

Table 9-1. Dimensions of ICT

	FRONT		BACK	
	HIGH	**LOW**	**HIGH**	**LOW**
HARD	Hard front high end technologies	Hard front low end technologies	Hard back high end technologies	Hard back low end technologies
SOFT	Soft front high end technologies	Soft front low end technologies	Soft back high end technologies	Soft back low end technologies

These eight cells likewise represent ICT competency niches that are available in the global educational environment.

ICT Competency Niches

Hard front high-end Competencies. These competencies encompass both the practical and theoretical skills and knowledge involving state-of-the-art industrial and enterprise ICT hardware and infrastructure. Computer engineering competencies involved in the architecture and installation of high-end enterprise or network solutions for corporations and agencies fall under this category. Examples of such skills and knowledge are those required in the provision of systems and services by IBM, Hewitt Packard, Xerox, and Sun Microsystems.

Hard front low-end Competencies. These competencies cover both the practical and theoretical skills and knowledge involving the assembly and mass production of personal ICT gadgets, gizmos and their components. Computer engineering, marketing and financing competencies (including the generation of venture capital) involved in the provision of personal computers, notebooks, personal digital assistants, cellular phones and their parts (processors, chips, motherboards, etc.) fall under this category. Examples of such skills and knowledge are those required in the provision of parts, products and services by Nokia, Sony Eriksson, Palm Pilot, and Dell. The biggest providers in Asia of hard front low-end parts, products, and services are currently found in China.

Hard back high-end Competencies. These competencies involve both the practical and theoretical skills and knowledge involving the design and testing of state-of-the-art industrial and enterprise ICT equipment. Computer engineering competencies involved in the development and fabrication of high-end hardware for corporations and agencies fall under this category. Examples of such skills and knowledge are those required in the development of products by IBM, Fujitsu, Xerox, and Sun Microsystems.

Hard back low-end Competencies. These competencies include practical and theoretical skills and knowledge involving the design and testing of personal ICT gadgets, gizmos, and their components. Computer engineering competencies involved in the development and fabrication of personal computers, notebooks, personal digital assistants, cellular phones and their parts (chips, processors, motherboards, etc.) fall under this category. Examples of such skills and knowledge are those required in the development of products by Nokia, Sony Eriksson, Palm Pilot, and Dell.

Soft front high-end Competencies. These competencies encompass both the practical and theoretical skills and knowledge involving software enterprise solutions. Programming competencies involved in the architecture and installation of high-end enterprise or network solutions for corporations and agencies fall under this category. Examples of such skills and knowledge are those required in the provision of systems and services by IBM, Cisco Systems, Xerox, and Sun Microsystems.

Additionally, these competencies include the provision of knowledge management solutions (i.e., management information systems or MIS in its current form) to organizations, agencies, communities of practice and even sectors. Content provision and its attendant skills (i.e., database management) figure prominently under this category. In the area of ICT4D (information and communication technology for development), soft front high-end competencies include poverty mapping and GIS skills, as well as ICT program planning and development. Hence, government programs and agencies are likely clients of these services.

Soft front low-end Competencies. These competencies cover both the practical and theoretical skills and knowledge involving the development of operating systems, platforms, and software for personal computing. Programming competencies for personal computers, notebooks, personal digital assistants, cellular phones, and all-in-one models fall under this category. Examples of such skills and knowledge are those required in the provision of products and services by Microsoft, Yahoo, and Google. Web maintenance, multimedia utilization and digital documentation all fall under this category.

Additionally, these competencies include the generation of venture capital and the provision of knowledge management solutions

to projects and work groups. Content packaging and provision, specifically for individual users figure prominently under this category. In the area of ICT4D, soft front low-end competencies include service provision for telecenters and last-mile linkages.

Soft back high-end Competencies. These competencies involve both the practical and theoretical skills and knowledge involving the design and testing of software enterprise solutions. Programming competencies involved in the development, beta-testing, and debugging of high-end software for corporations and agencies fall under this category. Examples of such skills and knowledge are those required in software development for IBM, Cisco Systems, Xerox, and Sun Microsystems including Java and XML.

Additionally, these competencies include the design and development of knowledge management solutions for organizations, agencies, communities of practice and even sectors. In the area of ICT4D, soft back high-end competencies include GIS programming, knowledge networking, and ICT policy formulation.

Soft back low-end Competencies. These competencies include practical and theoretical skills, and knowledge involving software development for personal ICT gadgets or gizmos. Programming competencies involved in the development of operating systems for personal computers, notebooks, personal digital assistants, cellular phones, and all-in-one models fall under this category. Examples of such skills and knowledge are those required in the provision of products and services by Microsoft, Yahoo, and Google. Interface design and development, Web writing, multimedia authoring, and database development all fall under this category.

Additionally, these competencies include the design and development of knowledge management solutions to projects and work groups. Content provision and packaging for specialized thematic areas and sectoral concerns figure prominently under this category. In the area of ICT4D, soft back low-end competencies include the planning and design of telecenters and last-mile linkages.

TOWARDS A REGIONAL COOPERATION STRATEGY

Regionalization as a Prelude to Globalization

One common indictment for globalization is that it is just happening too fast and too sudden for developing countries to cope. To allow the globalization phenomenon to grow naturally and organically, some economists suggest regionalization as a prelude. Indeed, regional aggregations such as the EU, NAFTA and APEC have been established to consolidate regional power. Within the ASEAN sub-region, perhaps SEAMEO can take the lead in consolidating the educational resources of the ten ASEAN nations in order to better cope with the challenges posed by globalization. Again, these nations should focus on their individual strengths and strategic advantages and develop their niches.

The ASEAN Educational Fitness Horizon

Nowhere else in the world is the Digital Divide considered more of an enigma than in Southeast Asia. This region boasts of countries that are in the forefront of digital technology. Singapore, Malaysia, and Thailand are producers and exporters of such technology. Also in this region are countries, which may be considered as the most deprived in ICT – Lao PDR, Cambodia, Myanmar, and Vietnam.

To begin with, the differences in the standards of living among countries within the region are quite glaring. Based on the 1999 UNDP Human Development Report, the human development index (HDI), human poverty index (HPI) as well as the HDI ranks of ten ASEAN countries are given in Table 9-2.

Out of 174 countries, Singapore is ranked 22nd in human development, while Lao PDR is ranked 140th. Brunei Darussalam is ranked 25th while Cambodia is ranked 137th. Malaysia is ranked 56th, while Myanmar is ranked 128th. Within the same region, we find countries classified under high, medium and low human development.[3]

[3] ***Human Development Report 1999****, United Nations Development Program and Oxford University Press: New York and Oxford, 1999.*

Singapore and Brunei's poverty indices are negligible while Myanmar and Lao PDR's (32.3 and 38.9, respectively) are quite high. The poverty index of Malaysia, Thailand and the Philippines (14.2, 18.7, and 16.3) are within the same range, while those of Indonesia and Vietnam (27.7, 28.7) are moderate.

The HDR database also offers some interesting insights on the correlation between ICT and poverty. Data on four major ICT indicators, namely, internet hosts per 1000 persons, telephone lines per 1000 persons, personal computer ownership and television ownership were placed side by side with the aforementioned poverty indices. The correlation is unmistakable.

The higher the HDR rank, the higher the ICT indicator values. The higher the human poverty index, the lower the number of ISPs, telephone lines, PCs and TV sets per 1000 persons. The higher the value of ICT indicators (as in the case of Singapore, Brunei, and Malaysia), the lower the poverty index.

Table 9-2. Poverty and ICT indicators

HDI Rank	COUNTRY	Human development index	Human poverty index	ISPs/ 1,000	Telephone Lines/ 1,000	PCs/ 1,000	TV/ 1,000
22	**Singapore**	0.887911	-	15.11	513	216.8	361
25	**Brunei**	0.877795	-	2.41	263	-	417
56	**Malaysia**	0.768328	14.2	2.09	183	42.8	228
67	**Thailand**	0.753147	18.7	0.03	70	16.7	167
77	**Philippines**	0.739973	16.3	0.21	25	9.3	125
105	**Indonesia**	0.680862	27.7	0.11	21	4.8	232
110	**Vietnam**	0.663824	28.7	no data	16	3.3	180
128	**Myanmar**	0.579768	32.3	-	4	-	7
137	**Cambodia**	0.514409	no data	0.01	1	-	9
140	**Lao PDR**	0.491107	38.9	no data	6	1.1	10

The gap between hardware and software capabilities also exists. For instance, as earlier mentioned, the Philippines is considered to be the second largest exporter of ICT professionals and software

developers next to India. Yet, it has hardly caught up with broadband and wireless technologies. The Digital Divide within sectors is likewise formidable. In Thailand and the Philippines, the business sector is fast catching up with its counterparts in Singapore ICT-wise. However, the educational sector is lagging far behind. At the tail end of the ICT utilization spectrum is the agricultural and rural development sector with the least number of ICT users, applications and solutions. In these sectors, we find the preponderance of the information-poor.

Based on these figures, what is the fitness horizon for Southeast Asia to produce globally competitive ICT workers?

The following matrix presents a fitness horizon that situates clusters of the ten ASEAN nations within particular niches. Each cell has a focal point that takes the lead among the countries in the cluster. These focal points occupy the upper-half percentile of Table 9-2 based on the HDI rank. Brunei has not been included in the analysis because of its current economic status, strategies and priorities. On the other hand, the comparative strengths and strategic advantages of Myanmar, Cambodia and Lao PDR in ICT remain undetermined at this point.

Apart from the given indicators, the matrix is also based partially on perceived educational strengths within each country. Thus, at best, it should only be regarded as an indicative scenario for niche-carving.

Table 9-3. Indicative Niches

	FRONT		**BACK**	
	HIGH	**LOW**	**HIGH**	**LOW**
HARD	**Thailand** Malaysia Singapore	*Malaysia* Vietnam Thailand	*Thailand* Malaysia Singapore	*Malaysia* Thailand Vietnam
SOFT	*Singapore* Philippines Malaysia	*Indonesia* Philippines Vietnam	**Singapore** Malaysia Philippines	**Philippines** Vietnam Indonesia

Potentially, each of the remaining six countries in our analysis – Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam - has more than one niche in this scenario. Five of them can be focal points in the eight areas identified.

Thailand is perceived fittest to take the lead in the hard high front end and hard high back end technologies. As a matter of fact, it may have been taking this role on a de facto basis because of the high-end components being manufactured in the country for the past two decades. Thailand could very well supply North American and European hardware companies with the parts and components for their hardware. Thus, its educational institutions should focus on strengthening their computer engineering curricula to provide adequate manpower back stropping for such a role.

Singapore is seen as the fittest in soft front high end and soft back high-end technologies. Excellent technological education coupled by proficiency in English has garnered Singapore these niches for quite some time now. More so, among the ten ASEAN countries, Singapore is the most advanced in content management particularly for corporate clients. Hence it should continue to focus on their computer science and information science offerings.

Malaysia is perceived to dominate hard front low-end and hard back low-end technologies. The country may become the sub-regional hub for the development and provision of consumer ICT products ranging from personal computers to cellular phones. Thus, its colleges and universities should beef up their computer engineering and computer science offerings and revert back to English as the medium of instruction in these programs.

Indonesia is expected to lead in the soft front low-end technologies, i.e. the provision of software packages and content for individual users and consumers. Indonesia has the largest consumer base in Southeast Asia. It has inadvertently focused on strategies that are addressed to these consumers, ranging from marketing to utilization. Furthermore, Indonesia's concern for bringing the Digital Divide has been a tradition that dates back to the launching of the *Palapa* satellite during the late seventies. It has the potential to lead in

ICT4D.

Finally, the Philippines is the potential leader in soft back low-end technologies, involving the design and development of software packages and content delivery systems for individual users and consumers. Is it any wonder that Microsoft's IT manager is a Filipino? Consider the talent that spawned the Love Bug, a computer virus that wrecked havoc around the world, being put to productive use.

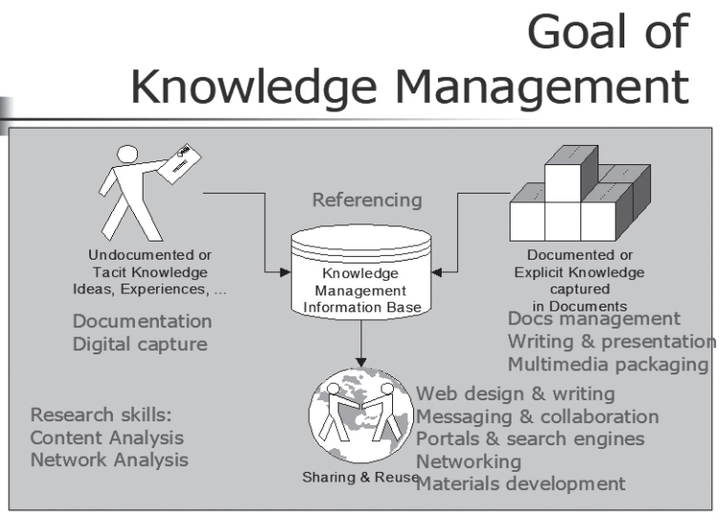
The strength of the Philippines lies in the early convergence, in the academe as well as in the world of work, of the information, computer and communication sciences in proficient English.[4] Additionally, Philippine universities pioneered in programs such as development communication and knowledge management among ASEAN institutions. This background provides the impetus to lead in ICT4D policy and planning.

Knowledge Management Competencies

From the preceding list of ICT niches, the most promising set of competencies can be found in knowledge management. Knowledge Management or KM is a newly emerging discipline that treats intellectual capital as a manageable asset. Its goal is the sharing and reuse of knowledge. KM is now being offered formally as a course in two campuses of the University of the Philippines System, a third one (UPOU) soon to follow. Sets of competencies for the KM student, which can best be illustrated in the following diagram, have been identified particularly in the Los Baños campus.

Assuming that the goal of knowledge management is the sharing and reuse of knowledge, the following competencies are deemed required: referencing skills; documentation skills; proficiency in digital capture; proficiency in document management; writing and presentation skills; multimedia packaging; Web design and Web writing; messaging and collaboration skills; proficiency in content analysis; proficiency in network analysis; proficiency in using portals and search engines; networking skills; and materials development

[4] *After all, the Love Bug would not spread far and wide had it not been packaged enticingly as a love letter written in English.*



skills. Note that this range of skills encompasses information science, computer science, and communication science, and there is a very sound rationale for this.

Although sharing identical roots, the information and communication sciences have developed separately in the past sixty years, the former assuming a mathematical-logical paradigm and the latter adopting a socio-psychological approach. However, the marriage of information and communications technologies (ICT), have prompted the convergence of both information science and communication science. The synergy brought about by this convergence has in turn resulted in new applications, methods, and areas of study such as ICT4D that we in Southeast Asia may excel in considering our unique environment and our tradition in these disciplines.

CONCLUSIONS

To supplement the repositioning of our curricula along the lines earlier described, ASEAN universities may consider redirecting its emphasis to flexible learning systems, specifically distance education and open learning programs, in achieving these competencies. The shift to learner-centered educational paradigms would likewise be attendant to these curricular and delivery system initiatives aimed at achieving localized competencies in a global educational environment.

Such changes may be considered radical by the conservative traditions of the academe. And it is in these traditions that we may find our biggest pitfall.

In December 1996, I delivered a paper in the UNESCO PACE Conference held in Manila. The paper, entitled *Theory of Decreasing Competencies in Communication Education,* described an observed trend wherein conservative academic institutions such as mine could not cope with changes in technology and the attendant competencies required in these changes. Communication curricula at the tertiary and graduate education levels cannot keep up with the new skills and knowledge requirements of equally new information and communications technologies. Why? The answer was simple. Curricular proposals were being bogged down by academic debate. Before a new course, let alone a new curriculum, can pass through the academic councils, the knowledge and skills incorporated in the course would already be obsolete.

Indeed, large prestigious universities may be too encumbered by their own bulk and inertia that they fail to seize the moment. Today, newer, smaller, and "lesser" academic institutions lead in the offering of innovative ICT programs. Although serious questions about the quality of their instruction are raised, they may be getting the bulk of the future crop of leaders in this knowledge society.

One wonders at times, if these academic debates are really prompted by concern for quality and rigor. Or are they really just products of parochial minds? As the 70s IT dictum states, *"Innovate, if not, then stagnate."* We can never be truly globally competitive with a parochial outlook.

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CHAPTER 10.
THE FUTURE OF ICT4D

Planning experts and economists have warned that the world is about to be confronted with a global food crisis unlike anything it has encountered before. Unbridled population increase combined with longer life expectancies, land conversion, biofuel production, and a shrinking agriculture sector exacerbated by rising oil prices and climate change may lead to food shortages and spiraling food prices at a global scale. Within this milieu, agriculture and its emphasis on information and communications technologies and applications in the agricultural sector have been perceived as irrelevant. Not many are aware that the answer to the impending global food crisis may be found in agriculture.

Indeed, one may argue that agriculture has very little to do with the factors that are causing the surge in food prices, i.e.:

- Poor harvests in major producing countries linked to extreme weather events;
- Decline of food stocks at the lowest level since the 1970s;
- High oil and energy prices raising the cost of inputs like fertilizers and irrigation as well as the cost of transport of inputs and produce;
- Lack of investment in the agricultural sector;
- Subsidized production of bio-fuels that substitute food production;
- Speculative transactions that hedge futures markets; and
- Imposition of export restrictions leading to hoarding and panic buying.

And yet if we examine these factors, most of them may be addressed by information and communications. We live in a global information society characterized by information-based economies where information is the primary commodity and the critical resource. It is axiomatic that an impending global food crisis can be solved by information.

This crisis is a product of social entropy or societal breakdown. Cybernetics and general systems theory teaches us that entropy can be negated by information. It is therefore through the process of information exchange that the world may find its salvation. However, these may seem as empty theoretical constructs to the person with an empty stomach.

ADVOCACY

During the Opening Ceremonies, IAALD President Peter Ballantyne quoted the G8 2008 Hokaido Conference in underscoring the importance of access to and dissemination of agricultural technology information in addressing the crisis. We espouse a more proactive response that goes beyond access provision and dissemination for Asia's eAgriculture community to address the global food crisis.

The eAgriculture community engages communities of practice or CoPs to generate solutions to agricultural problems. Traditionally, communities of practice engage in information exchange, what has been quoted often enough as "the sharing and reuse of information." This approach is patterned after the corporate KM Model of Davenport et al. (1995). Unfortunately, it ends there. The failure of this approach when applied to large-scale societal crisis stems from the fact that it stops short from mobilizing sectors and does not go beyond information and knowledge sharing. There are, of course, exceptions within the eAgriculture community such as Solutions Exchange India, but by and large, CoPs should live up to its name by engaging in practice. CoPs should disseminate information to correct unsound policies (e.g., land conversion), uninformed decisions (e.g., biofuel production), unwarranted practices (e.g., using staples as animal feed), and inaccurate predictions and forecasts, all of which are part of the entropy that is causing spiraling food prices and artificial food shortages. In other words, CoPs should engage in advocacy.

Bringing CoPs to the Next Level: CoCs

We should note that the CoP concept was a progression from the CoIs or communities of interest that characterized the early Internet workgroups that essentially shared notes, information and insights on common areas of interest, beginning with CERN physics and Internet protocols. When CoIs began solving common problems, this brought the workgroup concept to the next level, the CoP. However, many of today's CoPs offer solutions to problems but stop short of implementing these solutions, preferring to adopt the KM business protocol of sharing and reuse.

The problems that confront eAgriculture nowadays are to a scale that often requires policy interventions, not technological solutions. We have fully dealt out the technological card by engaging into GMO research and precision agriculture. CoPs must now delve into the policy process and progress into communities of champions or CoCs. Thus from CoIs that share information and CoPs that share solutions, eAgriculture must move into CoCs that mobilize sectors through information, knowledge and advocacy.

The Four Alternative Fs

A potential advocacy theme for eAgriculture CoCs would be the four Alternative Fs: alternative fuels; alternative fertilizers; alternative feeds; and alternative foods. Under alternative fuels, CoCs should push jethropa as a source of biofuels instead of corn, sugarcane, palm oil, and coconut oil. Under alternative fertilizers the organic initiative should be resurrected against petroleum-based fertilizers. Under alternative feeds, CoCs should prod animal nutritionists to consider alternatives to corn and soybean as feed for livestock and poultry considering it takes a hundred kilos of soybeans to produce one kilo of beef. Under alternative foods, upland families in Kalimantan sell 10 kilos of their sweet potato to get enough money to buy one kilo of rice. CoCs should push sweet potato, cassava and soybeans as alternative staples.

Most of all, the advocacies of eAgriculture CoCs must involve the participation of mobile communities at the grassroots level.

MOBILE COMMUNITIES

Fearless Forecasts

This paper makes seven forecasts or bold predictions, if you will, on the future of eAgriculture, all revolving around mobile telephony:

1. Mobile phones will make telecenters or community eCenters redundant and the OLPC initiative irrelevant.
2. Mobile service providers will or are already solving the first mile/ last mile linkage challenge.
3. Mobile phone users in agricultural communities will or have already reached a critical mass.
4. Mobile phone functionalities will lead to collaboration and networking and will render intermediaries unnecessary.
5. Mobile phone content will efficiently address issues such as the language medium, auto-translations, relevance and the lack of local knowledge.
6. Mobile phone handsets will make ICT services affordable to agricultural communities.
7. Mobile phone applications will provide the eAgriculture community with an effective Web 2.0 platform.

Web 2.0 has revolutionized how people think of the World Wide Web from a collection of individually owned static websites with published content into a body of collectively owned dynamic websites with user generated content. The 3G mobile phone, in general, and the iPhone 3G, in particular, a most disruptive tool, has given eAgriculture the much needed platform for Web 2.0.

A lot of these have to do with the mobile phone itself. Mobile phones are no longer phones but are mobile workstations, and more. As early as 2005, Nokia began fining employees in Finland who referred to the Nokia 9300 as a phone, not as a computer.

The Five Cs

For the past decade, we in the eAgriculture sub sector have been confronted by the following challenges, the Five Cs:

- Carriage: There are no first-mile/ last-mile linkages.
- Critical Mass: ICT use in the rural areas has not reached the numbers required to make an impact on agriculture productivity and poverty alleviation.
- Collaboration: Intermediaries only make partnerships and collaboration possible. Generally, farmers, housewives and rural youth do not use ICTs without the intervention of line agencies that provide basic services. This is otherwise known as Calvano's Missing Link hypothesis.
- Content: There is a lack of local content. There cannot be a universally accepted medium.
- Cost: Rural communities cannot afford ICT hardware and services.

Carriage. In one sweep, Apple's iPhone has potentially addressed all of these problems. With the current infrastructure of cellular sites in agricultural countries, the mobile phone has solved the first mile/last mile challenge. Even the need for telecenters, agricultural ATMs or kiosks has vanished. The OLPC has likewise been made redundant.

Consider a household with an iPhone. The husband would regard it as a source of information. The wife would consider it as a medium of communication. The college student would use it as a mobile library. The adolescent sees it as an iPod wherein audio and video podcasts may be downloaded and played back. The youngest in the household would regard it as a PSP or a portable play station.

A professional can use the iPhone as a handheld Mac or a mobile office. A field worker can employ it as a documentation tool capturing images, video and audio. The iPhone can produce user-generated, local content from documents to rich media that may be shared and reused among farming communities. It can certainly do more than what a telecenter can do.

It is not the intention of this paper to promote an Apple product. As a matter of fact, if Apple does not play its cards right and continue to disenfranchise those in the lower economic brackets, then in a few years we might just find ourselves with perfectly operational iPhone clones running on open access/ open code software.

Critical Mass. In the Philippines, cellular phone ownership achieved a critical mass in 1998 with the advent of 2G or GSM technology. The exchange of text messages translated into a mutually reinforcing behavior among social networks. Now, almost everybody owns a mobile phone. The only exceptions are the very young, the very old and the marginally poor.

Ownership transcends/cuts across economic classes (except for the marginally poor), gender, age, and sector. Latest figures reveal that four hundred million SMS messages are sent and received in the Philippines everyday. That translates to ten million dollars a day spent on SMS service alone, excluding voice calls, GPRS, and 3G services.

Collaboration. The mobile phone prompts the farmer, housewife, and rural youth to collaborate, to share and reuse, and to exchange information. Zazueta (2008) observes even residential students prefer online learning if they had a choice. Forty-five percent cost reduction, no significant difference in learning. Apple's MobileMe social networking platform costs US$99 per year.

Content. Given the current mobile phone ownership in rural and remote areas of agricultural countries such as the Philippines, Thailand, Cambodia, Malawi, and Lao PDR, then iPhone has the potential of bringing local content up on the Web, in audio-video. As Metcalf argues, video is the next big thing in the Internet. This makes the issue of a universally accepted medium, moot and academic. Web communities will use their language of choice effectively through video.

With current incentives for developers, we might find a complete suite of eAgriculture applications for the iPhone within the next three years.

Cost. As to cost, the iPhone retails at 200 US dollars and one can purchase a prepaid card for as low as US$1. Technology is getting better and better, cheaper and cheaper, faster and faster, smaller and smaller. The bulky Motorola bricks that were introduced as cellular handsets retailed at US$4000 in the early eighties. Signing up for a line entailed another US$4000. Compare the Motorola brick with your mobile phone.

EPILOGUE:
The Way Forward

As the international development assistance community marks the midpoint of the Millennium Development Goals timeframe, critical questions are being raised on the impact of information and communication technology for development. The correlation between ICT infrastructure and the Gini coefficients/ poverty indices in many Asian countries has been established early on at the macro level (Flor, 2001). Furthermore, anecdotal evidence on the successes of ICT4D at the project level abound. However, two questions have yet to be answered satisfactorily: "Has ICT4D contributed significantly to poverty alleviation?" "What has been the overall impact of ICT4D in agriculture, in education, in health, in governance, in natural resources management?"

Since the 2000 Okinawa Summit of G8 nations, ICT4D has been associated with the social promise of poverty alleviation. Since then, however, many remain unconvinced that it can bring about large-scale societal impacts on poverty and the development process. For instance, there is now a marked hesitance from among key players within regional financial institutions to invest in ICT4D loan projects in Asia, particularly those that are non-infrastructure related. The return on investments of ICT4D projects is being questioned. In a recently concluded ICT4D conference, a joint secretary in the Indian Ministry of Panchayati Raj likened survey evidence of telecentre contributions to economic development to that of survey evidence of the number of tigers in India (i.e. conclusions are based on sightings of tigers' paw marks rather than the sightings of tigers). In the same conference, a member of a keynote panel diplomatically stated that "the impact of ICT on development has not been very clear."

These indictments may have been brought about by three factors: unsound assumptions and thus, unrealistic expectations on ICT4D; the lack of solid evidence and limited use of the evidence-based approach (EBA) or results-based management (RBM) approach in ICT4D undertakings; and the use of defective models of ICT4D.

ICT4D proponents passionately argue that evidence of positive developmental changes are observable on the ground. Clearly, however, there is a need for soul searching among ICT4D practitioners. There is a need to revisit the basic assumptions and foundations of the ICT4D discourse and to chart its future course, particularly in Asia, where the evidence issue is particularly relevant. There is a need to answer the following questions:

- How did the ICT4D discourse evolve and where is it heading?
- What are the current assumptions and perspectives of the international development assistance community on ICT4D?
- How can ICT4D best be situated within the regional development assistance agenda: as a discipline; as a sector; and/or as a theme? What are its implications?
- What are the observable economic and social impacts of ICT4D in Asia?
- What are the technological, economic and social trends that influence ICT4D?
- What adjustments and modifications are required in ICT4D models, strategic thrusts and programs in Asia?

APPENDIX.
ICT4D RESEARCH PAPERS

THE CHANGING PROFILE OF DISTANCE LEARNERS

Alexander G. Flor, Melinda dP. Bandalaria, Emely M. Amoloza,
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ABSTRACT

This study paints a profile of the UPOU student and determines how this profile has significantly changed over the years. It attempts to answer the following questions: What are the demographic characteristics of the average UPOU student? How are these characteristics changing given the new information and communication environment? Its objectives are: to collate the demographics of UPOU enrollees from 1995 to 2005; to construct composite profiles of the UPOU enrollee based on the aforementioned demographics at three-year intervals; to establish clientele patterns based on a comparison of the composite profiles; to anticipate enrollment trends based on the established patterns; to relate these profiles, patterns and trends to the current learning environment; to recommend appropriate policies and future actions based on the anticipated trends; and to incorporate these findings into a multimedia presentation inclusive of an animation sequence morphing the composite profiles from 1995 to 2005.

This is an anticipatory study employing a two-pronged design: retrospective case analysis and trend analysis. Retrospective case analysis employing time-series secondary data produced the composite profiles. Changes in composite profiles revealed patterns. Patterns led to trends. Trends resulted in policy recommendations. The unit of analysis for this study is the UPOU enrollee. A complete enumeration of all enrollees with demographic data stored in the UPOU OUR databases from 1995 to 2005 was used.

The study arrived at the following conclusions: generally, there is a demographic trend among UPOU students to shift from older age groups towards younger age groups; there is demographic trend for UPOU programs to cater to both males and females; there is an

increasing trend to being single among UPOU students; there is a demographic trend for UPOU students to become more and more familiar with Internet technology; there is an increasing trend for UPOU students to come from urban and peri-urban areas; there is a demographic trend among UPOU students to favor newer and less traditional areas of study such as information systems, development communication and public management over traditional programs.

The study recommends that: UPOU should trace our roots and revisit its mandate. Policy interventions that are supportive of UPOU's slogan, "Lifelong learning for all" may be in order. Furthermore, UPOU should institute additional degree programs addressing countryside priorities. Lastly, UPOU should spread its branches, as its seal depicts. More outreach and continuing education programs should be established. Institutional networking arrangements with grassroots organizations and local government units should be explored.

Keywords: *open and distance learning (ODL); demographics; composite profiles.*

INTRODUCTION

Background

Open and distance learning or ODL is one of the fastest changing areas of education in today's world. This phenomenon is due for the most part to advances in information and communication technologies or ICTs. The implications of these changes, however, go beyond the technological and would straddle both the social and the cultural arenas. For instance, casual observation reveals the gradual but distinct demographic changes among enrollees of the University of the Philippines Open University. These changes need to be documented and analyzed to assess social and cultural trends that UPOU should prepare for in line with its forward-looking and anticipatory approach to education.

Statement of the Problem

This study proposes to paint a profile of the UPOU student and determine how this profile has significantly changed over the years. It will attempt to answer the following questions: *What are the demographic characteristics of the average UPOU student? How are these characteristics changing given the new information and communication environment?*

Objectives

The objectives of the study are:

- To collate the demographics of UPOU enrollees from 1995 to 2005.
- To construct composite profiles of the UPOU enrollee based on the aforementioned demographics at 2.5-year intervals.
- To establish clientele patterns based on a comparison of the composite profiles
- To anticipate enrollment trends based on the established patterns.
- To recommend appropriate policies and future actions based on the anticipated trends.

CONCEPTUAL FRAMEWORK

The current post-modernist environment of basic and higher education may be characterized by three pervasive trends: a predisposition towards constructivist learning theories rather than positivist learning principles; a bias towards learner-centered approaches rather than teacher-oriented approaches; and a tendency towards alternative delivery modes. These three trends innately favor open and distance learning models (Pearce and Sharrock, 2000).

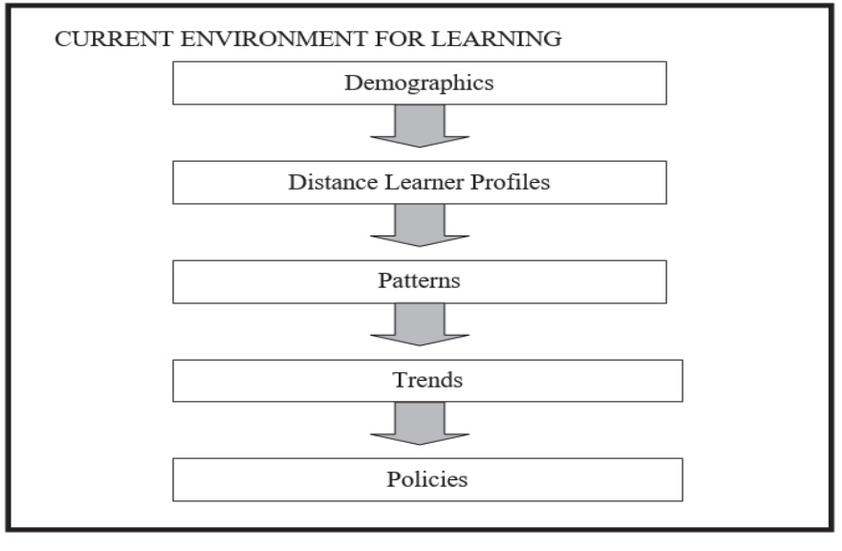
An analysis of current literature point towards these trends. Furthermore, such trends imply the eventual mainstreaming of open and distance learning from the "alternative" status that it has

assumed for so long. However, are these trends borne by empirical evidence? Are they reflected in the enrollment trends of the U.P. Open University?

This research work is based upon the assumption that these trends are reflected in the changing demographics of UPOU enrollees. In the early nineties, the majority of UPOU enrollees were middle-level school teachers and agricultural technicians. They would be in their thirties or forties and come mostly from the provinces. Today, casual observations reveal that the average UPOU enrollee is urban-based, young and employed in development agencies, NGOs or the private sector.

These demographics can lead to composite profiles. Observing changes in these profiles over the years will establish patterns. These patterns in turn will reveal trends that will guide the University in preparing its programs and delivery systems.

A Conceptual Model of the study is found below:



characteristics of these learners are shown in their demographics. These demographics compared over time establish patterns in the profile of the distance learner. These patterns, in turn, will reveal trends. And the trends will allow for the formulation of the appropriate policies.

METHODOLOGY

Design

This is an anticipatory study employing a two-pronged design: retrospective case analysis and trend analysis. Retrospective case analysis employing time-series secondary data produced composite profiles. Changes in composite profiles revealed patterns. Patterns led to trends. Trends resulted in policy recommendations.

Subjects

The unit of analysis for this study is the UPOU enrollee. A complete enumeration of all enrollees with demographic data stored in the UPOU OUR databases from 1995 to 2005 was used.

Procedure

The following procedure was employed:

1. Search queries were developed for use in the current OUR database.
2. Secondary data were collated on the socio-demographic characteristics of UPOU enrollees from 1995 to 2005.
3. Composite profiles of the enrollees were constructed using imaging technology. Visualization of images per characteristic will be pretested.
4. Changes in these profiles at three-year intervals were documented and compared to establish patterns. These patterns were presented with imaging technology (i.e., morphing).
5. Enrollment trends for 2005 to 2015 were forecasted based on the patterns.
6. Policy recommendations will be drafted.

7. The findings were incorporated into a multimedia presentation with animation sequences on the changing profiles.

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Analysis

Secondary data were analyzed using descriptive statistics (i.e., mean, mode, median). Visual representations of composite profiles at three-year intervals were compared for changes. Patterns and trends were analyzed graphically.

RESULTS AND DISCUSSION

Findings

Age. Table 1 shows the age range of the UPOU learners from 1995 to 2005. The least number of enrollees from all the age range/brackets that was observed in Year 1995 wherein few degree programs of UPOU were being offered. These programs were the DST, DSW, MSW and MPH.

It was observed that the highest number of enrollees were in Year 2001 with 564 enrollees belonging to the 20-30 age range and in Year 1998 with 470 enrollees belonging to the 31-40 age range. These findings are consistent with the study of Keegan (1990) who stated that 75 percent of distance education student are in the 30-55 age group.

Table 1. Age Range of UPOU Enrollees

Age Range	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
20-30	63	216	269	453	406	461	564	364	332	340	434
31-40	83	241	317	470	396	365	462	347	282	282	340
41-50	32	113	191	270	219	205	268	205	158	162	168
51-60	4	14	38	44	36	45	53	41	47	54	48
NI	274	843	748	326	433	470	214	770	816	897	732
Total	456	1,427	1,563	1,563	1,490	1,546	1,561	1,727	1,635	1,735	1,722

Sex. Table 2 exhibits the consistent higher number of female enrollees than male enrollees from 1995 to 2005. According to the study of Alip (2002), the apparent higher number of female enrollees may be due to the fact that there are more Filipino women than men reaching or completing college education. Therefore, more females are expected to enroll in post baccalaureate programs.

Table 2. Sex of UPOU Enrollees

Sex	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Male	75	324	312	422	465	541	546	664	609	647	777
Female	381	1,103	1251	1175	1022	1000	1005	1044	1008	1069	918
NI	0	0	0	2	3	5	10	19	18	19	27
Total	456	1,427	1,563	1,599	1,490	1,546	1,561	1,727	1,635	1,735	1,722

Civil Status. Table 3 shows that married enrollees outnumbered single enrollees from 1995 to 2003. This is in accordance to the study of Thompson (1998) that in addition to filling the role of the student, most distance learners also fill the role of spouse. However, single enrollees began exceeding the number of married learners from 2003 onwards. Note that the highest number of no responses was in 2003 and 2004.

Table 3. Civil Status of UPOU Enrollees

Civil Status	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Single	71	248	318	493	406	333	540	282	181	149	908
Married	111	412	542	756	510	411	590	330	210	145	126
Separated	0	0	0	0	0	0	0	0	0	0	0
Widowed	3	10	9	3	7	6	12	7	4	3	0
NI	271	757	694	347	567	796	419	1108	1240	1438	688
Total	456	1,427	1,563	1,599	1,490	1,546	1,561	1,727	1,635	1,735	1,722

***Mobile Phone Ownership*.** Students owned cell phone as early as 1995 although there were only 1.3 percent of the total enrollees had cell phones during that year. In the following year, cell phone ownership increased to 1.8 percent.

Year 2002 has the most number of cell phone ownership among the students, with more than half (51.8 percent) of total enrollees. Second highest percentage of cell phone ownership is in the following year 2003, with 45.2 percent. A sharp drop in ownership was observed in 2004 and 2005.

Table 4. Cellular Phone Ownership of UPOU Enrollees

Cell phone Ownership	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
With	6	27	52	111	159	298	494	895	740	315	246
NI	450	1400	1511	1488	1331	1248	1067	832	895	1420	1476
Total	456	1,427	1,563	1,599	1,490	1,546	1,561	1,727	1,635	1,735	1722

Email Account Ownership. None of the students claimed he/she had an email account in the year 1995. However, in the following year, 1.4 percent had acquired email accounts. By the year 2002, more than two thirds (71.8 percent) of the student population had email accounts.

The years 2003 & 2004 have the highest percentage of email account ownership among the students (85.1 percent). It was followed by 78.1 percent in the following year, 2005.

Table 5. Email Account Ownership of UPOU Enrollees

Email Address Ownership	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
With	0	20	47	90	151	341	606	1236	1391	1477	1345
NI	456	1407	1516	1509	1339	1205	955	485	244	258	377
TOTAL	456	1,427	1,563	1,599	1,490	1,546	1,561	1,721	1,635	1,735	1,722

Regional Distribution. During the year 1995, the highest number of UPOU enrollees came from Region 6 (16.9 percent). It was followed by Region 11 (14.2 percent) and then by Region 5 (12.5 percent) and Region 4 (12.3 percent). On the other hand, the smallest numbers of enrollees are from Region 9 and Region 10, with 0.2 percent.

Region 4 has the highest enrollees in the year 1996 (16 percent) and 1997 (18.4 percent) while CARAGA has the lowest enrollees, .2 percent in 1996 and .4 percent in 1997.

From 1998-2005, the number of enrollees were consistently high in Region 4 and NCR and consistently low in Region 9 and CARAGA.

There were no enrollees from abroad (INT) during the early years but there was 1 in 2004 and 10 (.6 percent) in 2005.

On the other hand, there were a large percentage of enrolled students who did not indicate (NI) their respective places of origin. In 1995, 46 (10.08 percent) did not indicate the region where they belong. In the year 2000, there were 218 (14.10 percent) and 273 (15.85 percent) in the year 2005.

Table 6. Regional Distribution of UPOU Enrollees

Region	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CAR	38	79	70	29	40	40	66	52	47	45	53
NCR	20	93	106	227	319	393	375	503	434	450	412
CARAGA	4	3	6	10	9	3	1	3	1	1	1
I	2	16	35	36	43	33	51	40	49	44	41
II	24	115	86	76	58	17	29	31	34	28	38
III	3	28	29	36	48	62	69	79	73	91	77
IV	56	228	288	360	303	319	362	403	368	412	396
V	57	93	163	153	97	81	69	74	64	87	87
VI	77	100	150	114	102	81	66	75	95	89	75
VII	26	127	122	112	120	98	99	113	88	82	61
VIII	15	178	104	78	63	18	39	36	39	55	57
IX	1	129	7	7	8	5	5	4	10	5	2
X	1	82	88	65	73	45	57	50	50	52	42
XI	65	109	103	54	59	96	78	75	72	63	59
XII	17	9	13	21	18	17	18	21	23	13	12
XIII	4	15	52	45	28	20	29	29	30	29	26
INT	0	0	0	0	0	0	0	0	0	1	10
NI	46	23	141	176	54	218	148	139	158	188	273
TOTAL	456	1,427	1,563	1,599	1,490	1,546	1,561	1,721	1,635	1,735	1,722

Program Enrolled. For the Associate in Arts Program, the number of enrollees is regularly fluctuating. It had its most number (160) of enrollees in 2002, and had the lowest enrollees (100) on its initial offering in 1998.

The number of enrollees for DLST program also varies each year. During its second year of offering (1997), it had its most number of enrollees (225) while its lowest number of enrollees (56) was in 2004.

DSSE, like DLST, had its most number of enrollees (204) in 1997. In 2005, it had its lowest number of enrollees (8).

The initial offering of the DA Program was in 1996 with ten enrollees. The offering of this program was discontinued in 2000. However, there was a continuing student who enrolled in 2003 to finish the course.

The DCS Program had its least number of enrollees (44) during its initial offering in 1997. Its most number of enrollees reached to 183 in 2002.

In 2000, the DENRM was initially offered with 54 enrollees. It had its most number of enrollees in 2003 (124).

The DMT Program had its most number of enrollees (126) on its second year of offering (1998). It had its least number of enrollees (10) during its initial offering in 1997.

In 1996, the DR&DM Program was initially offered. The highest number of enrollees for this program was in 2000 with 87 enrollees and it had its lowest number of enrollees (35) in 2003.

In 1995, only four programs were being offered, namely: DST, DSW, MPH and MSW. The DSW MSW and MPH programs had its most number of enrollees during their initial offerings. The DSW Program had a continuous decrease in its enrollment throughout the years, while the DST has recorded the highest number of enrollees (870) among all programs throughout the years.

The MAN Program had its most number of enrollees (103) in 2005. It had its least number of enrollees (13) during its initial offering in 1997.

In 2000, the MENRM was initially offered with 108 enrollees. It had its most number of enrollees in 2002 (159) and its lowest enrollees (108) in 2000.

The MHA Program had its most number of enrollees (80) in 2005. It had its least number of enrollees (10) in 1999.

The MIS Program which is now on its fifth year of offering had its highest number of enrollees (208) in 2005. It had its lowest (24) during its initial offering in 2002.

Of all the programs, only MAED Program had shown a continuous increase in its enrollment during the five years of offering (2001-2005).

Both the MPM and MDC Programs were initially offered in 1998. The MPM Program had its most number of enrollees (195) in 2002 while it was in 2004 when MDC Program had its most number of enrollees (221). In 1998, the MPM Program had its least number of enrollees (138) while it was during its initial offering (1998) when MDC had its least number of enrollees (61).

The only PhD Program (PhD Education) had its least number of enrollees during its initial offering in 1996. Its highest number of enrollment (54) was in 1998.

Total Enrollment. Table 8 shows a continuous increase in the total enrollment from 1995 to 1998. There was a decrease (109 enrollees) in the total enrollment in 1999. During the period 1999 to 2002, there was another continuous increase in the total enrollment. While enrollment again decreased (86 enrollees) in 2003 which increases (100 enrollees) again in 2004. A very slight decrease (13 enrollees) in enrollment was experienced in 2005.

Table 7. UPOU Enrollment by Program

Program	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AA	0	0	0	100	157	158	110	160	135	145	129
DLST	0	155	225	191	104	114	112	61	59	56	82
DSSE	0	112	204	173	96	42	32	23	19	11	8
DA	0	10	7	15	6	0	0	0	1	0	0
DCS	0	0	44	111	153	149	158	183	95	73	66
DENRM	0	0	0	0	0	54	102	100	124	106	94
DMT	0	0	10	126	111	38	38	51	38	43	39
DR & DM	0	60	82	65	65	87	59	41	35	85	84
DST	300	870	802	448	289	122	79	59	41	35	65
DSW	25	15	11	0	10	10	8	3	2	0	0
MAN	0	0	13	18	58	72	36	24	38	39	103
MENHRM	0	0	0	0	0	108	157	159	137	126	118
MHA	0	33	14	14	10	32	61	77	67	78	80
MIS	0	0	0	0	0	0	0	24	101	179	208
MAED	0	0	0	0	0	0	27	37	75	102	104
MPH	31	112	64	41	125	176	169	168	151	147	121
MPM	0	0	0	153	138	167	143	195	152	171	149
MDC	0	0	0	61	97	148	170	202	191	221	192
MSW	95	19	14	4	6	8	12	5	4	4	3
PTC	0	0	0	0	0	0	0	0	0	0	0
PHD EDUC	0	20	42	54	51	41	42	38	46	45	34
NI	5	21	31	25	14	20	46	111	124	69	43
TOTAL	**456**	**1,427**	**1,563**	**1,599**	**1,490**	**1,546**	**1,561**	**1,721**	**1,635**	**1,735**	**1,722**

Table 8. Total Enrollment

Enrollment	Year										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TOTAL	**456**	**1,427**	**1,563**	**1,599**	**1,490**	**1,546**	**1,561**	**1,721**	**1,635**	**1,735**	**1,722**

B. Analyses

Composite profiles

The above findings generated four composite profiles: the UPOU student (1995-1997); the UPOU student (1997-1999); the UPOU student (1999-2001); the UPOU student (2001-2003); and the UPOU student (2003-2005).

The UPOU Student (1995-1997). The average UPOU student during the years 1995 to 1997 would be female, married, middle aged and most probably enrolled under the Diploma in Science Teaching program. She would be based in the provinces, most possibly from Western Visayas or the Southern Tagalog region.

The UPOU Student (1997-1999). The average UPOU student during the years 1997 to 1999 would be female, married, middle aged but a little younger than her predecessors. Again she would most probably be enrolled under the Diploma in Science Teaching program. She would be based in the Southern Tagalog region

The UPOU Student (1999-2001). The average UPOU student during the years 1999 to 2001 would also be female, married, younger than middle aged and most probably enrolled under the Master of Public Health program. She would be based in the National Capital Region or the Southern Tagalog region

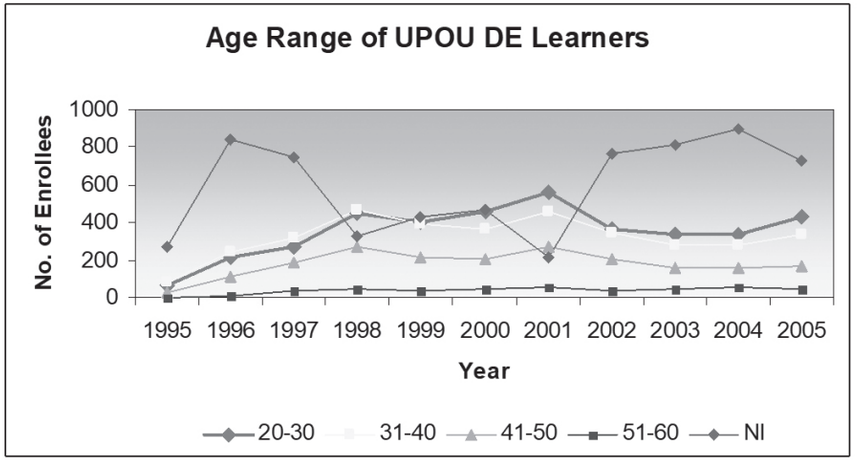
The UPOU Student (2001-2003). The average UPOU student during the years 2001 to 2003 would be female, married, in her thirties and most probably enrolled under the Master of Development Communication or Master of Public Management program. She would be based in the Metro Manila or the Southern Tagalog region

The UPOU Student (2003-2005). The average UPOU student during the years 2003 to 2005 would be female, single, in her late twenties or early thirties and most probably enrolled under the Master of Information Science or Master of Development Communication programs. She would be based in Metro Manila or the Southern Tagalog region.

Patterns and Trends

Age. Table 1 shows the age range of the UPOU learners from 1995 to 2005. The least number of enrollees from all the age range/brackets that was observed in Year 1995 wherein few degree programs of UPOU were being offered. These programs were the DST, DSW, MSW and MPH.

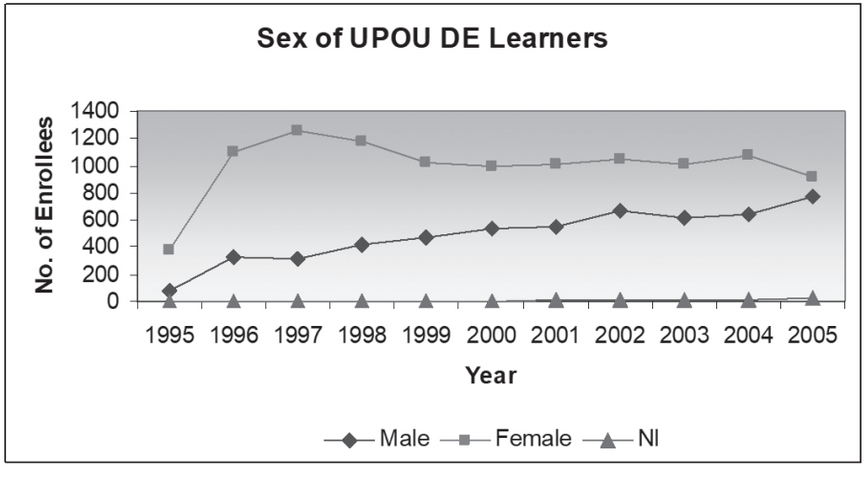
It was observed that the highest number of enrollees were in Year 2001 with 564 enrollees belonging to the 20-30 age range and in Year 1998 with 470 enrollees belonging to the 31-40 age range. These findings are consistent with the study of Keegan (1990) who stated that 75 percent of distance education student are in the 30-55 age group.



Based on this pattern, we conclude that, generally, there is a trend for UPOU students to get younger.

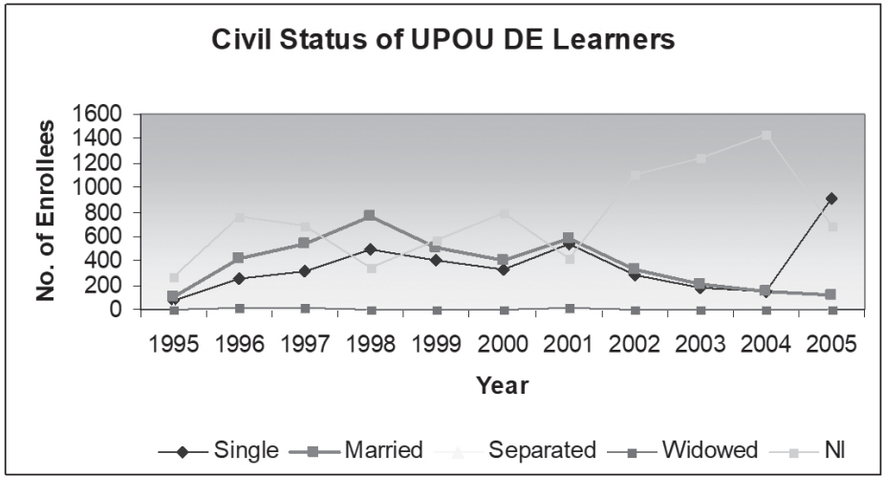
Sex. Table 2 exhibits the consistent higher number of female enrollees than male enrollees from 1995 to 2005. However, the gap is decreasing significantly.

According to the study of Alip (2002), the apparent higher number of female enrollees may be due to the fact that there are more Filipino women than men completing college education. Therefore, more females are expected to enroll in post baccalaureate programs. In spite of this, the ratio between female and male UPOU students is leveling off.



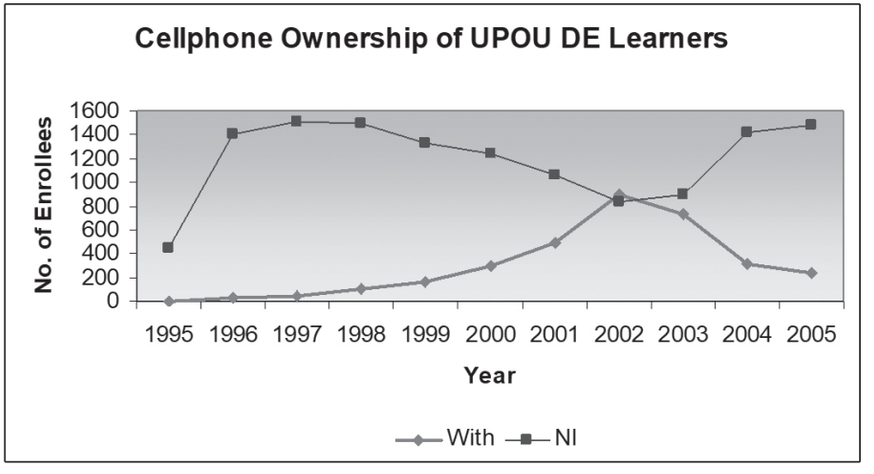
Based on this pattern, we conclude that there is a demographic trend among UPOU students to shift from older age groups towards younger age groups.

Civil Status. Table 3 shows that from 1995 to 2003 a continual larger number of married enrollees were observed. This is in accordance to the study of Thompson (1998) that in addition to filling the role of the student, most distance learners also fill the role of spouse. However, in 2004 the number of single enrollees began exceeded the number of married learners. Today, single students far outnumber married students. It should be noted, however, that many of the students did not indicate their civil status. Nevertheless, the latest data show that single students outnumber even those who did not specify their civil status.



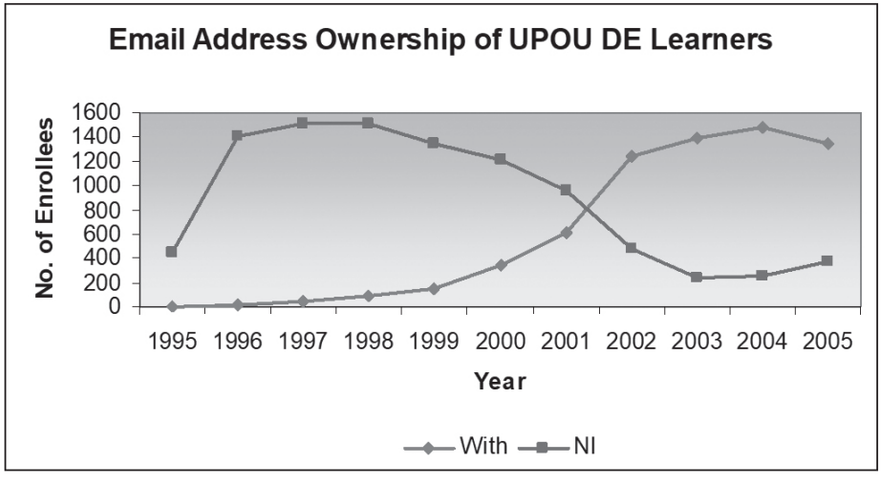
Based on this pattern, we conclude that there is an increasing trend to be single among UPOU students.

Mobile Phone Ownership. Students owned cell phone as early as 1995 although there were only 1.3 percent of the total enrollees have cell phones during that year. In the following year, cell phone ownership increased to 1.8 percent.



Year 2002 has the most number of cell phone ownership among the students, with more than half (51.8 percent) of total enrollees. Second highest percentage of cell phone ownership is in the following year 2003, with 45.2 percent. However, the decrease in cell phone ownership likewise corresponded with the increase in the number of no response. Thus, we reserve judgment in this case.

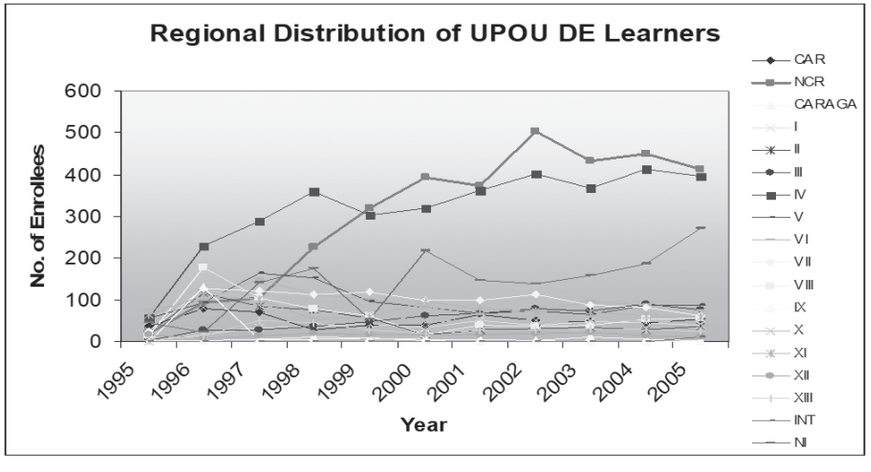
Email Account Ownership. No student has an email account in the year 1995. However, in the following year, 1.4 percent had acquired email accounts. By the year 2002, more than half (71.8 percent) of the students had email accounts.



The years 2003 & 2004 have the highest percentage of email account ownership among the students (85.1 percent). It was followed by 78.1 percent in the following year, 2005.

Based on this pattern, we conclude that there is a trend for UPOU students to become more and more familiar with Internet technology.

Regional Distribution. During the year 1995, the highest number of UPOU enrollees came from Region 6 (16.9 percent). It was followed by Region 11 (14.2 percent) and then by Region 5 (12.5 percent) and Region 4 (12.3 percent). On the other hand, the smallest numbers of enrollees are from Region 9 and Region 10, with 0.2 percent.



Region 4 had the highest enrollees in the year 1996 (16 percent) and 1997 (18.4 percent) with CARAGA having the lowest enrollees, .2 percent in 1996 and .4 percent in 1997.

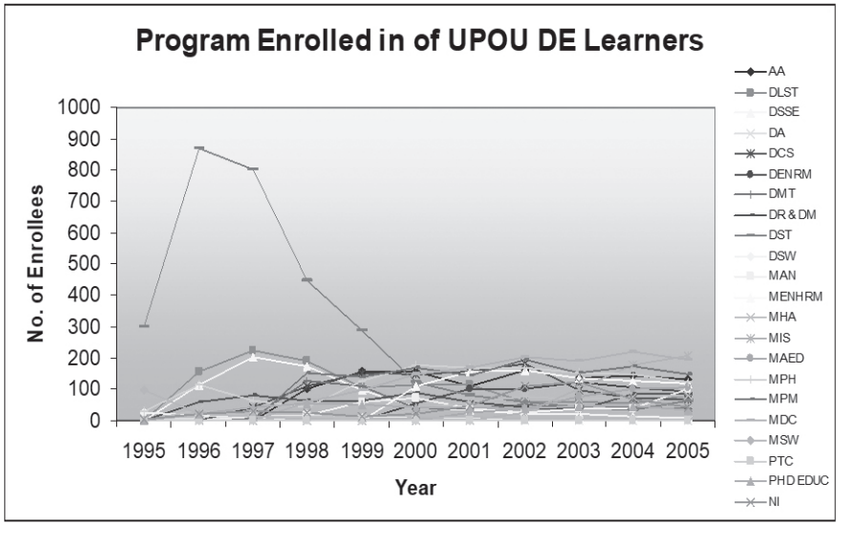
From 1998-2005, the number of enrollees coming from Region 4 and NCR became consistently high and consistently low in Region 9 and CARAGA. Region 4 is neither rural nor urban but peripheral-urban or peri-urban.

However, there was also a significant number of students who did not indicate (NI) their respective places of origin. In 1995, 46 (10.08

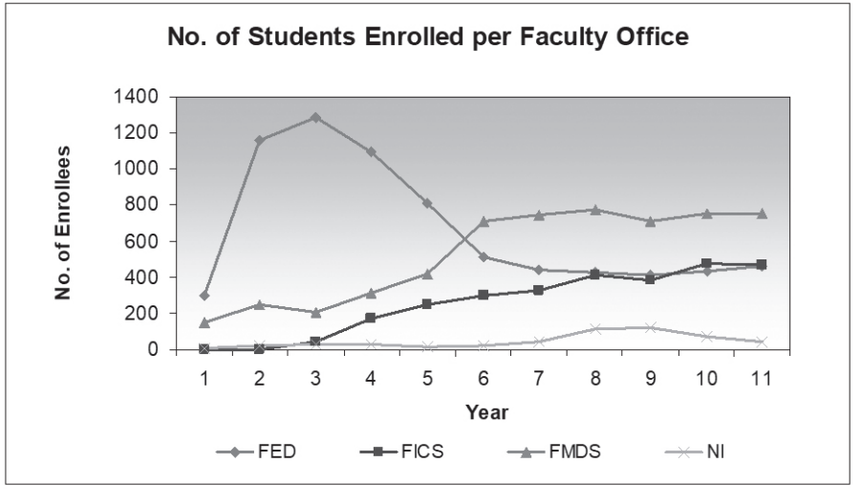
percent) did not indicate the region where they belong. In the year 2000, there were 218 (14.10 percent) and 273 (15.85 percent) in the year 2005. Nevertheless, the urban/ peri-urban numbers were dominant.

Based on these patterns, we conclude that there is an increasing trend for UPOU students to come from urban and peri-urban areas.

Program Enrollment. Until 1999, the clear majority of UPOU students were employed under the Diploma in Science Teaching program. However, towards 2005, the top four programs in terms of students enrolled were: the Master of Information Systems program; the Master of Development Communication program; the Master of Public Management program; the Associate in Arts program; and the Master of Public Health program.



Considering, however, that there are 21 programs currently being offered by the UP Open University, a clearer analysis would be made if the programs are clustered in terms of the Faculties offering the programs, i.e., the Faculty of Education, the Faculty of Information and Communication Studies, and the Faculty of Management and Development Studies.



The above graphs reveal that the largest number of enrollees fall under the Faculty of Management and Development Studies, followed by the Faculty of Information and Communication Studies, with the Faculty of Education closely following suite. What is interesting in the patterns given in the two preceding graphs is the steep drop in enrollment among education majors, who dominated the chart during UPOU's early years.

Based on these patterns, we conclude that there is a trend among UPOU students to favor newer and less traditional areas of study such as information systems, development communication and public management over traditional programs.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study paints a profile of the UPOU student and determines how this profile has significantly changed over the years. It attempts to answer the following questions: What are the demographic characteristics of the average UPOU student? How are these characteristics changing given the new information and communication environment? Its objectives are: to collate

the demographics of UPOU enrollees from 1995 to 2005; to construct composite profiles of the UPOU enrollee based on the aforementioned demographics at three-year intervals; to establish clientele patterns based on a comparison of the composite profiles; to anticipate enrollment trends based on the established patterns; and to recommend appropriate policies and future actions based on the anticipated trends.

This is an anticipatory study employing a two-pronged design: retrospective case analysis and trend analysis. Retrospective case analysis employing time-series secondary data produced the composite profiles. Changes in composite profiles revealed patterns. Patterns led to trends. Trends resulted in policy recommendations. The unit of analysis for this study is the UPOU enrollee. A complete enumeration of all enrollees with demographic data stored in the UPOU OUR databases from 1995 to 2005 was used.

Conclusions

The study arrived at the following conclusions:

1. Generally, there is a demographic trend among UPOU students to shift from older age groups towards younger age groups.

2. There is demographic trend for UPOU programs to cater to both males and females.

3. There is an increasing trend to being single among UPOU students.

4. There is a demographic trend for UPOU students to become more and more familiar with Internet technology.

5. There is an increasing trend for UPOU students to come from urban and peri-urban areas.

6. There is a demographic trend among UPOU students to favor newer and less traditional areas of study such as information systems, development communication and public management over traditional programs.

Recommendations

The UPOU Factbook (2003) states that "…the University saw in distance education a means for *democratizing access* to quality education and increasing the capacity of the University to respond to growing demands for quality graduate and undergraduate education *even in areas that do not have a UP campus*."

The findings imply that UPOU now caters to students who would have access to conventional residential programs in other UP units. Their demographics suggest young, single professionals residing in regions serviced by the two largest UP campuses, Diliman and Los Baños.

In lieu of these trends, we recommend that:

1. UPOU should trace our roots and revisit its mandate. Policy interventions that are supportive of UPOU's slogan, "Lifelong learning for all" may be in order.

2. UPOU should institute additional degree programs addressing countryside priorities.

3. UPOU should spread its branches, as its seal depicts. More outreach and continuing education programs should be established. Institutional networking arrangements with grassroots organizations and local government units should be explored.

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FEASIBILITY STUDY OF A DISTANCE LEARNING PROGRAM TO BUILD THE CAPACITIES OF LOCAL GOVERNMENT UNITS FOR GIS BASED LAND USE PLANNING

Alexander G. Flor, Franjel dC. Consolacion, Ma. Estrella O. Sibal, Margaret S. Jarmin, Emely M. Amoloza and Ruby Lynn S. Salac[5]

ABSTRACT

The flooding and landslides that took lives and destroyed the infrastructure in Quezon province during the December 2004 typhoons may have been a function of the lack of land-use expertise, specifically GIS knowledge and skills, among municipal planning and development officers in LGUs. This study sought to assess the demand for formal and nonformal training courses on Geographic Information Science that may be offered via the distance mode among municipal planning and development officers in four Region IV provinces. The research utilized a one short-survey design and was conducted in the provinces of Laguna, Rizal, Cavite and Quezon. The unit of analysis of this study is the Municipal Planning and Development Officer (MPDO) or City Planning Development Officer (CPDO). Most of the respondents were male, married, middle-aged, well-educated and had worked with the government for ten years average.

Interestingly enough, half of the respondents have had adequate exposure to GIS, some of whom are applying it in their current jobs as Municipal Planning and Development Officers. However, all of those who have had exposure to GIS feel that they lack the needed proficiency. They plan to enhance their skills through advanced training. Infrastructure does not appear to be a problem because the great majority of the respondents have access to the Internet. Access is regular and utilization is frequent. All except one of the respondents felt that the Internet is a good educational medium.

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Most of the respondents had good impressions regarding distance education. All of them were interested in enrolling in a GIS program via the distance mode if offered. The majority were also willing to pay for enrolling in such a program given the prevailing UP tuition fee rates.

INTRODUCTION

Background

In December 2004, four typhoons struck the Philippines entering the country through the eastern seaboard. Its aftermath saw one of the worst disasters in Philippine history: landslides, floods, and large scale destruction of roads, public utilities as well as private property. The local government units (LGUs) which were affected the most were not prepared for this disaster.

The public was quick to note that the floods and landslides were caused by deforestation of the uplands in the mountainous range lining the eastern seaboard. Equally responsible, however, was the lack of preparedness among the LGUs concerned. This lack of preparedness was a result of poor land use planning.

A recent administrative order of the Department of Interior and Local Government (DILG) required local government units at the municipal level to prepare land-use plans. It was assumed that municipal governments are certain to prepare and submit the municipal land-use plans because this is a requirement for the release of their internal revenue allotment (IRA), which provides them with their annual budget (Flor, 2001). Unfortunately, however, the preparation of land-use plans was outsourced to service providers and done by many municipalities as a matter of compliance rather than utility resulting in unsound plans.

The current standard for land-use planning prescribes the use of geographic information systems (GIS). Yet very few planners at the provincial or municipal levels are GIS application users, more so,

accredited GIS certificate holders. As much as they need to, local government planners do not have the time to attend regular classes and training courses on GIS nor would they have the funds to pursue these.

Statement of the Problem

One of the goals of the University of the Philippines OPEN UNIVERSITY (UPOU) is to provide continuing educational opportunities to every Filipino, overcoming financial, temporal and geographic barriers. To address the lack of preparedness resulting from poor land-use planning, the UPOU Faculty of Information and Communication Studies is now exploring the design and implementation of a three-tiered Geographic Information Science Program composed of a Certificate in GIS, a Diploma in GIS, and a Master of Science in GIS. This three-tiered curriculum is composed of courses that may be taken as part of the GIScience program or as stand-alone short courses at the formal and non-formal levels. Thus, the program will address both training skills and certification needs. A preliminary draft of the curriculum is found in Annex A. The course analysis for the introductory subject is found in Annex B.

However, a feasibility study whose findings will be the basis for decisions and/or refinements on the proposed curriculum needs to be conducted. This study will answer the following questions:

- Will the GIScience program/stand-alone short course to be offered by the UPOU via distance mode for local government planners technically viable in terms of hardware, software and people-ware?

- Will the GIScience program/stand –alone course to be offered by the UPOU via distance mode for local government planners financially feasible from both the enrollees and educational institution's end? In other words, can LGU official afford it? Can UPOU-FICS maintain it?

- Will the GIScience program/stand –alone course to be offered by the UPOU via distance mode for local government planners socially acceptable among the program stakeholders?

Objectives of the Study

The objectives of this feasibility study are as follows:

- to determine the technical viability of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners;
- to determine the financial feasibility of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners;
- to determine the social acceptability of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners among the program stakeholders; and
- to determine the institutional desirability of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners.

METHODOLOGY

Design

This study has adopted a one short-survey design triangulated by key informant interviews (KII).

Locale

The study was conducted in Region IV, specifically in the provinces of Laguna, Rizal, Cavite and Quezon. The last province included the municipalities of Infanta, General Nakar and Real, which were hardest hit by the December 2004 landslides.

Respondents

The unit of analysis of this study is the Municipal Planning and Development Officer (MPDO) or City Planning Development Officer (CPDO). Local government officials served as the subjects for key informant interviews.

Analysis

Survey data was analyzed using descriptive statistics, i.e. mean, median and/or mode.

RESULTS AND DISCUSSION

Profile of Respondents

A total of 12 Municipal Planning and Development Officers (MPDO) and City Planning Development Officers (CPDO) from Laguna (Calamba, Sta Rosa, and Cabuyao), Rizal (Angono, Antipolo, and Taytay), Cavite (Tagaytay, Silang, and Dasmariñas), and Quezon Infanta, General Nakar, and Real) were tapped as respondents of the study. Most of the respondents were male, married, middle-aged, well-educated and had worked with the government for ten years average.

Sex. More than half of the respondents (58.33%) were male while five (or 41.67%) were female (Table 1).

Table 1. Sex of Respondents

Sex	Frequency (n=12)	Percentage
Female	5	41.67
Male	7	58.33

Age. Most (33.33%) of the respondents were between 41 to 50 years old. On the other hand, two (16.67%) of the respondents were between 51-60 years old. The rest (8.33%) aged from 21 to 30 years old and 31 to 40 years old. Four of the 12 respondents, however, did not give their age (Table 2).

Table 2. Age of Respondents

Age	Frequency (n=12)	Percentage
21-30	1	8.33
31-40	1	8.33
41-50	4	33.33
51-60	2	16.67
no answer	4	33.33

Marital Status. Except for one respondent, all of the respondents were already married (Table 3).

Table 3. Civil Status

Civil Status	Frequency (n=12)	Percentage
S	1	8.33
M	11	91.67

***Educational Background*.** Table 4 shows that more than half (58.33%) of the respondents were college graduates while three of the respondents (25%) already earned their master's degree. On the other hand, two (or 16.67%) of the respondents did not indicate their highest education attained.

Table 4. Education of Respondents

Education	Frequency (n=12)	Percentage
BS/BA	7	58.33
MS/MA	3	25.00
no answer	2	16.67

Number of Years in Work. Five of the respondents (41.67%) were only in their 1st to 10th year in work while four (33.33 %) have been in the municipality/city for 11-20 years. One, however, have been working there for 21-30 years and another have been there the longest time (between 31-40 years). Meanwhile, the other one had no answer (Table 5).

Table 5. Respondents' Years in Work

Years in Work	Frequency (n=12)	Percentage
1 to 10	5	41.67
11 to 20	4	33.33
21 to 30	1	8.33
31 to 40	1	8.33
no answer	1	8.33

GIS Based Land Use Planning

Interestingly enough, half of the respondents have already had adequate exposure to GIS, some of whom are applying it in their current jobs as Municipal Planning and Development Officers. However, all of those who have had exposure to GIS feel that they lack the needed proficiency. In fact, half of the respondents who use GIS in their work state that they are not experts. They plan to enhance their skills through advanced training.

Respondents' Expertise in GIS. Half of the respondents have enough expertise on GIS and were capable of using GIS. On the other hand, four of the respondents (33.33 %) admitted of not having enough knowledge or expertise on GIS. Two (or 16.67%) gave no answer (Table 6).

Table 6. Number of Respondents with Enough Expertise on GIS

	Frequency (n=12)	Percentage
With Expertise	6	50.00
W/o Expertise	4	33.33
no answer	2	16.67

Capacity Enhancement. The four respondents without enough expertise on GIS have plans for capacity enhancement for themselves and their staff. Likewise, three of the respondents with enough expertise on GIS also considered capacity enhancement for their offices. (Table 7).

Table 7. Number of Respondents with Plans for Capacity Enhancements

	Frequency (n=12)	Percentage
With Plans	7	100
W/o Plans	0	0
no answer	0	0

Use of GIS. Half of the respondents were already using GIS in their work while the other half were not yet applying GIS (Table 8).

Table 8. Number of Respondents who Uses GIS

	Frequency (n=12)	Percentage
Yes	6	50
No	6	50
no answer	0	0

Notably, half of the respondents who use GIS in their work have no expertise on GIS (Table 9).

Table 9. Number of respondents using GIS

	Frequency (n=6)	Percentage
with expertise	3	50
w/o expertise	3	50

Meanwhile, half of the respondents not using GIS have enough expertise to initiate the program (Table 10). Their reason for not engaging their office to GIS was the lack of technology.

Table 10. Number of Respondents Not Using GIS

	Frequency (n=6)	Percentage
with expertise	3	50
w/o expertise	3	50

When asked how many of the 12 respondents trained on GIS, half of them said yes while the other half said no (Table 11). However, this latter half was willing to consider enrolling in a GIS program (Table 12).

Table 11. Number of Respondents Trained on GIS

	Frequency (n=12)	Percentage
Yes	6	50
No	6	50
no answer	0	0

Table 12. Number of Respondents who Considers Enrolling in a GIS Program

	Frequency (n=6)	Percentage
With Plans	6	100
W/o Plans	0	0
no answer	0	0

Infrastructure

Infrastructure does not appear to be a problem because the great majority of the respondents have access to the Internet. Access is regular and utilization is frequent. All except one felt that the Internet is a good educational medium.

Access to the Internet. Majority (83.33%) of the respondents have used the internet before while the rest (16.67%) have not (table 13). most common reason for their internet use was for information search. next were for communication (90%), accessing websites (90%), downloading forms (60%), and others (10%). (table 14).

Table 13. Number of Respondents who have used the Internet Before

	Frequency (n=12)	Percentage
Used	10	83.33
Not Used	2	16.67
no answer	0	0

Table 14. Purposes of the Respondents for Using the Internet*

	Frequency	Percentage
Information search	10	100
Communication	9	90
Downloading forms	6	60
Accessing websites	9	90
Others	1	10

* multiple responses

Among the 12 respondents, nine (or 75%) have regular access to the Internet, while only three (25%) have none (Table 15). Their most common access area was the office (88.89%) while they also access the Internet at their homes (55.56%) and Internet Cafés (22.22%) (Table 16).

Table 15. Respondents with regular Access to the Internet

	Frequency (n=12)	Percentage
Yes	9	75
No	3	25
no answer	0	0

Table 16. Place of Access of the Internet

	Frequency (n=12)	Percentage
Office	8	88.89
Home	5	55.56
Internet Café	2	22.22
Others	0	0

Frequency of Internet Use. Majority (88.89%) of the respondents use the Internet everyday while one respondent only used the Internet twice a week and two of the respondents (22.22 %) have other schedules in using it, like they only use the Internet when they needed it (Table 17).

Table 17. Respondents' use of the Internet

	Frequency (n=12)	Percentage
Everyday	8	88.89
Twice a Month	0	0
Twice a Week	1	11.11
Once a Month	0	0
Once a Week	0	0
Others	2	22.22

Internet as a Good Education Medium. All the respondents regardless of whether they had used the Internet or not, were asked if they think that the Internet is a good education medium. Except for one, all (90%) of the respondents viewed the Internet to be a good education medium (Table 18). For former respondents, the Internet is a good education medium because it is accessible, have various sources and full of information (Table 19).

Table 18. Number of Respondents who believes that Internet is a Good Education Medium

	Frequency (n=12)	Percentage
Yes	9	90
No	1	10
no answer	0	0

Perception On Distance Learning

Majority (83.33%) of the respondents were aware of distance learning while two (16.67%) were not (Table 20).

Table 20. Number of Respondents Aware of Distance Learning

	Frequency (n=12)	Percentage
Aware	10	83.33
Not aware	2	16.67
No answer	0	0

For those respondents who were aware of distance learning (DL), five of them (41.67%) got the information through staff members, co-employees, neighbor, CSC/org members. Two (or 16.67%) relied on the media like the newsletters and one got it from the Internet. Three respondents, however, had no answer (Table 21).

Table 21. Respondents' Sources of information about distance learning*

	Frequency	Percentage
Interpersonal (staff members, co-employees, neighbor, CSC/org members)	5	41.67
Media (newsletters, etc)	2	16.67
Internet	1	8.33

* multiple responses

***Meaning of Distance Learning*.** Seventy-five per cent of the respondents defined distance learning as cost effective and accessible education while seven of the respondents (58.33 %) viewed DL as self-study through reading. On the other hand, one-half defined DL as education through correspondence, four (or 33.33 %) viewed it as media-facilitated learning, three (25 %) said it was

meeting teachers only once a month, and two of the respondents (16.67 %) believed it was equal education through opportunities among different sectors (Table 22).

Table 22. Meaning of Distance Learning for the Respondents*

	Frequency	Percentage
Cost effective and accessible education	9	75.00
Self-study through reading	7	58.33
Education through correspondence	6	50.00
Media-facilitated learning	4	33.33
Meeting teachers only once a month	3	25.00
Equal education opportunities among different sectors	2	16.67

*multiple responses

When asked whether DL is advantageous to them, ten (83.33 %) of the respondents said yes while two (or 16.67) gave no answer (Table 23). The reasons why DL is advantageous were because: 1) it provides opportunities to pursue higher studies in the respondent's convenient time and it would not have conflict with work schedule and family time; 2) it allows respondent to balance work and study load; 3) respondent could learn at home; and 4) it saves respondent's time and money.

Table 23. Respondents' Response on Whether DL is Advantageous to Them

	Frequency (n=12)	Percentage
Yes	10	83.33
No	0	0
no answer	2	16.67

Interest in Distance Learning

***Perception on Continuing Education*.** Fifty per cent of the respondents agreed about continuing education and 41.67 per cent strongly agreed about it. However, one respondent was undecided about the prospect of continuing education (Table 24).

Table 24. Respondents' Perception on Continuing Education

	Frequency (n=12)	Percentage
Agree (A)	6	50
Strongly Agree (SA)	5	41.67
Undecided (U)	1	8.33
Disagree (D)	0	0

When asked about their views on studying on their own, five of them (41.67 %) said they agreed to it. This view is further supported by another 41.67 per cent who claimed that they strongly agreed on studying on their own. However, one respondent (8.33%) was undecided and another one (8.33%) had no answer (Table 25).

Table 25. Respondents' View on Studying on their Own

	Frequency (n=12)	Percentage
Agree (A)	5	41.67
Strongly Agree (SA)	5	41.67
Undecided (U)	1	8.33
Disagree (D)	0	0

Fifty-eight per cent of the 12 respondents were interested to enroll in a post baccalaureate studies in GIS while three (or 25 %) said they were very much interested about it and one (8.33 %) expressed his mild interest on enrolling. On the other hand, another respondent (8.33%) was undecided about post baccalaureate studies in GIS (Table 26).

Table 26. Respondents' Interest on Enrolling in Post Baccalaureate Studies in GIS

	Frequency (n=12)	Percentage
Interested (I)	7	58.33
Very Much Interested (VMI)	3	25.00
Mildly Interested (MI)	1	8.33
Undecided (U)	1	8.33
Not Interested (NI)	0	0
No answer	0	0

When asked about the time the respondents would be able to allot for studying on their own, half of them opted for 3 hours per week while four (or 33.33 %) chose 5 hours. On the other hand, one respondent (8.33%) selected 1 hour and another (8.33%) fancied a schedule of 4 hours a week (Table 27).

Table 27. Time Allotment of Respondents Who are Interested to Enroll

	Frequency (n=12)	Percentage
3 hrs	6	50.00
5 hrs	4	33.33
1 hr	1	8.33
Others (4 hrs)	1	8.33
30 min	0	0.00

As for the preferred times of meeting with tutors for face-to-face sessions, three respondents (25 %) chose only once per semester, another 25 per cent opted to meet their tutors twice per semester, and another 25 per cent wanted to meet with tutors four times per

semester. While two (16.67 %) of the respondents picked thrice per semester and one (8.33%) chose others, although he did not specify his preferred schedule (Table 28).

Table 28. Respondents' Preferred Times of Meeting with Tutors

	Frequency (n=12)	Percentage
once	3	25.00
twice	3	25.00
four times	3	25.00
thrice	2	16.67

***Decision to Enroll*.** All of the respondents were interested to apply for a certificate program on GIS under the UP Open University (Table 29).

Table 29. Number of Respondents Interested to Apply for UPOU GIS

	Frequency (n=12)	Percentage
Yes	12	100.00
No	0	0.00
no answer	0	0.00

When asked about their preferred mode of receiving their learning packages, half of the respondents selected the courier services such as LBC, DHL, JRS Express, etc. On the other hand, five (41.67 %) wanted their learning packages mailed, one (8.33%) respondent preferred to get hers through the learning center and another one (8.33%) opted for the materials to be emailed to him.

Table 30. Respondents' Preference of Receiving Learning Packages

	Frequency (n=12)	Percentage
Courier services	6	50.00
Mailed	5	41.67
Learning center	1	8.33
Others (email)	1	8.33

When asked about their preferences on which media they wanted their materials to come in, nine (75 %) of the respondents opted for print, eight (66.67 %) chose CDs/VCDs, six (50 %) selected course modules, five (41.67 %) chose interactive media and reference books, and two (16.67 %) wanted it through broadcast (Table 31).

Table 31. Respondents' Preference on which Media the Materials would Come in*

	Frequency	Percentage
printed	9	75.00
CDs/VCDs	8	66.67
course modules	6	50.00
interactive	5	41.67
reference books	5	41.67

* multiple responses

Willingness to Pay. Majority (83.33%) of the respondents were willing to pay the amount for enrolling in a certificate program under UP Open University while two respondents (16.67%) said no. One reason was that the respondent was willing to shoulder half of the total amount while his office would pay the other half. Likewise, the other respondent who refused to pay the amount said she could only shell out P1, 500 for the program (Table 32).

Table 32. Number of Respondents Willing to Pay the Enrollment Fee

	Frequency (n=12)	Percentage	Reasons/Remarks
Yes	10	83.33	
No	2	16.67	50% only; P1,500 only
no answer	0	0.00	

When asked about their means of financing their studies, most (75 %) of the respondents said they would get the money from their personal funds. On the other hand, 50 per cent would seek scholarships through other agencies and institutions. One respondent (8.33%), however, would use the municipal training funds.

Table 33. Respondents' Ways of Paying the Enrollment Fee

	Frequency (n=12)	Percentage
personal funds	9	75.00
scholarships through other agencies/institutions	6	50.00
others(thru municipal training funds)	1	8.33

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The flooding and landslides that took lives and destroyed the infrastructure in Quezon province during the December 2004 typhoons may have been a function of the lack of land-use expertise, specifically GIS knowledge and skills, among municipal planning and development officers in LGUs. This study sought to assess the demand for formal and nonformal training courses on Geographic

Information Science that may be offered via the distance mode among municipal planning and development officers in four Region IV provinces.

Specifically, the project's research objectives were: to determine the technical viability of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners; to determine the financial feasibility of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners; to determine the social acceptability of a proposed GIS program (or stand alone short courses) to be offered by the UPOU via distance mode for local government planners among the program stakeholders; and to determine the institutional desirability of a proposed GIS program (or stand-alone short courses) to be offered by the UPOU via distance mode for local government planners.

This study utilized a one short-survey design and was conducted in the provinces of Laguna, Rizal, Cavite and Quezon. The unit of analysis of this study is the Municipal Planning and Development Officer (MPDO) or City Planning Development Officer (CPDO). Most of the respondents were male, married, middle-aged, well-educated and had worked with the government for ten years average.

Interestingly enough, half of the respondents have had adequate exposure to GIS, some of whom are applying it in their current jobs as Municipal Planning and Development Officers. However, all of those who have had exposure to GIS feel that they lack the needed proficiency. They plan to enhance their skills through advanced training.

Infrastructure does not appear to be a problem because the great majority of the respondents have access to the Internet. Access is regular and utilization is frequent. All except one of the respondents felt that the Internet is a good educational medium.

Most of the respondents had good impressions regarding distance education. All of them were interested in enrolling in a GIS program

via the distance mode if offered. The majority were also willing to pay for enrolling in such a program given the prevailing UP tuition fee rates.

Given the above, the study concludes that:

1. A proposed GIS program (or stand-alone short courses, to be offered by the UPOU via distance mode for local government planners, is technically viable.

2. A proposed GIS program (or stand-alone short courses), to be offered by the UPOU via distance mode for local government planners, is financially feasible.

3. A proposed GIS program (or stand-alone short courses), to be offered by the UPOU via distance mode for local government planners is socially acceptable among the program stakeholders.

4. A proposed GIS program (or stand-alone short courses), to be offered by the UPOU via distance mode for local government planners, is institutionally desirable.

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ANNEX A

University of the Philippines
OPEN UNIVERSITY

GEOGRAPHIC INFORMATION SCIENCE (GISCIENCE)
PROPOSED THREE-TIERED PROGRAM

GISCIENCE CERTIFICATE (15-20 UNITS)

Program: Certificate In GIScience
Units: 15 CEUs (College Earned Units), at least
Duration: 12 Months (full time), 18-24 Months (part time)

Core Subjects

GIS 101: Introduction To GIScience: Concepts and Practices (3-5 Units)
GIS 102: Geographic Database Design and Development (3 Units)
GIS 103: Geographic Analysis, Modeling, and Visualization (3 Units)
GIS 104a: GIS Planning, Implementation, and Management (3 Units)
GIS 104b: GIS Project (3 Units)

Elective Subjects

GPS 101: Applying Global Positioning System (3 Units)
RSE 101: Introduction To Remote Sensing (3 Units)
GIS 105: GIS Programming (3 Units)
GIS 106: GIS and GPS Integration (3 Units)
GIS 107: Internet GIS Design and Development (3 Units)
GIS 201: Implementing GIS in Natural Resource Management (3 Units)
GIS 202: Implementing GIS in Urban and Regional Planning (3 Units)

GIS 203: Implementing GIS in Real Property and Tax Admin (3Units)
GIS 204: Implementing GIS in Environmental Impact Assessment
GIS 205: Implementing GIS in Disaster Preparedness and Management

II. GIScience Diploma (24-27 Units)

Requirement: GIS Science Certificate + GPS 101, RSE 101, GIS 105&106
Core: GIS 101–106, GPS 101, and RSE 101
Elective: GIS 107, 201-205

III. M.S. GIScience (33-39 Units)

Requirement: GIScience Diploma + GIS 300 (6-Unit Thesis) OR 2 Elective GIS Subjects
Core: GIS 101–106, GPS 101, RSE 101, 1 Elective GIS Subject, and GIS 300 or plus 2 more Elective Subjects.
Elective: GIS 107, 201-205

ANNEX B

University of the Philippines
OPEN UNIVERSITY

COURSE PROPOSAL

I. IDENTIFYING INFORMATION

Course Title	:	Introduction to Geographic Information Science: *Basic Concepts and Practices in GIS Application*
Course Type	:	Stand-Alone Distance Education Course
Course Credit	:	Three (3) Units
Course Status	:	New
Course Clientele	:	Private and Public Sectors
CourseRequirement	:	Basic knowledge in computer operation, and Licensed GIS software or runtime software version
Course Proponent	:	UP Open University
Course Devt. Cost	:	PhP 120,000 – PhP200,000

II. BRIEF DESCRIPTION

This proposal is aimed at developing a distant mode GIScience course that would provide students with the basic and necessary knowledge towards successful GIS implementation. The course imparts technical (i.e., geographic data capture, manipulation, analysis) and planning skills (i.e., needs assessment) in technology application. While the course could provide students with proficiency in using ArcView GIS, this is not a software training course. The students are encouraged to apply the learned GIS tools and techniques through a small GIS project towards the last module. When fully developed and tested, the course can be taken anytime, anywhere.

III. RATIONALE

A geographic information system is a system used to capture, store, manipulate, analyze, and display all types of referenced geographic information about *what is where* on the earth's surface and how they relate to each other. In other words, GIS provides a means of linking databases to maps, creating visual representation of the statistical data, and analyzing how location influences features and events on the earth's surface. A GIS combines software with hardware and information stored in computer databases to assist a user in solving complex research, planning, and management problems (Fischer and Nijkamp, 1992 as quoted by ESRI).

GIS is an evolving technology that has become an essential tool in government and business. Many educational professionals believe that GIS acts as a catalyst for creative thought and problem-solving skills and facilitate spatial reasoning that supports higher levels of learning among students. School administrators are beginning to understand and use GIS for the business of education. There has been a tremendous growth of GIS programs in the educational sector over the past 15 years. Demand by the workforce for GIS education and training and the spread of GIS as a tool across disciplines are two of the factors driving this growth. While the rapid growth has presented educators with exciting challenges and opportunities, it has also added logistical, administrative, pedagogical, and curriculum demands that must be considered when implementing a GIS program.

The growing demand for professionals trained in the use of GIS has helped a variety of university departments that offer GIS. These programs range from simply offering courses in GIS and using GIS as a tool in other disciplines to offering GIS certificates; minors in GIS; GIS distance education; and associate's, bachelor's, master's, and PhD degrees. This demand will continue to grow as more careers require some GIS knowledge.

Several factors have helped support the successful integration of GIS into higher education. Rapid advancement of computer technology, cost-effective computer hardware, user-friendly and powerful software, and the widespread availability of spatial data have made integrating GIS into higher education affordable. The pedagogical applications and benefits of GIS have also contributed to the widespread use of GIS in higher education.

The use of GIS continues to increase across business, industry, academia, and government sectors. In its early life, primary users of GIS included landscape architects, engineers, and land use managers. Today, this powerful technology is used in almost any field one can imagine. Water management uses GIS to identify contamination sources; police departments use GIS for crime analysis; precision agriculture use GIS to analyze crop yields, track pesticide and fertilizer use, and analyze crop health; epidemiologists use it to track and analyze the spread of diseases.

More than 70 disciplines and departments at colleges and universities incorporate GIS into their teaching and /or research. Modules are included in many subject areas that show how GIS is used as analysis tool in those disciplines. Types of programs range from vocational to workforce programs, with focus on entry-level technology education and training, to traditional academic course with in-depth mathematical and scientific foundations in GIScience. Courses are also provided in various settings including on-campus and distance education course of varying lengths including hand-on technology workshop, short courses, certificate programs, and degree programs.

The process of developing a GIS program at a college level or university shares many elements with the development of an enterprise GIS program at a small city. Developing a GIS program requires activities such as needs assessment, market analysis, database planning, finding and acquiring data, funding, staffing and training, marketing and advertising,

among others – from planning to system acquisition to managing phase.

Distance learning has become a widely used teaching and learning resource over the past few years. The Internet and the Web have changed the way educators, researchers, students, and professionals gather information and collaborate and communicate with each other. With more than 50 percent of students in two-year and extension programs being working professionals, the need for distance learning course has soared. In addition, many professionals are looking for ways to upgrade their skills or simply acquire some knowledge of GIS, which has increased the demand for distance education courses as well as the need for faculty to be trained to teach or develop these courses.

While there is an increasing demand for GIS distance education courses, there are no organizations in Southeast Asia and the Philippines that are currently offering GIS courses in distant mode. And while there are number of international educational institutions, particularly in Western Europe and North America that offer GIS distance education, majority of course takers in Southeast Asia, particularly in the Philippines, cannot afford the relatively high cost of tuition. Moreover, the data sets and case studies used in foreign GIS courses suit westerners but not necessary Asians. There is a need to develop a distant mode GIS courses that are comparable to those developed by pioneer organizations, but uses local GIS data, exemplifies local practices, and more affordable to Asians, particularly to Filipinos. The UP Open University is the best suited institution mandated to develop distant mode course, hence this proposal.

IV. OBJECTIVES

I. General: To provide university-grade and cost-effective introductory GIS course to all interested groups and individuals from both public and private sectors.

II. Specific: At the end of this course, the participants/ students are expected to:

1. Understand the concepts and principles of spatial thinking;
2. Learn the science behind GIS technology and the techniques for GIS applications;
3. Understand the data requirements of GIS as well as data quality issues;
4. Obtain insights into the relevance of using GIS in their field of expertise;
5. Be able to demonstrate skills in capturing and analyzing geo-referenced data using GIS techniques;

Be able to use various GIS and related spatial analysis tools in problem-solving situations; and
Be able to initiate project GIS implementation

V. COURSE DEVELOPMENT AND DELIVERY

The course will be written and developed for distance education purposes. The course will be designed to serve as a *stand-alone GIS course* for all interested one-time GIS course takers, and as a *preparatory foundation GIS subject* for those who plan to pursue a certificate, diploma, or masters degree in GIScience. Refer to Annex A to see a rough draft of UPOU GIS Education Program.

Moreover, the course will be developed based on the current needs in the GIS workplace and the recent significant developments in the GIS community. During the development and testing phase, the course will be routinely compared to existing distance GIS courses abroad and will be improved accordingly to make it competitive and as much as possible up to date.

There are two options for delivering distance GIS course: (1) through the Internet or online GIS education, or (2) through stand-alone interactive multimedia learning CD and written course materials. Each option has advantages and disadvantages, and suits the needs and/ or preference of particular groups or individuals. Either delivery option

will make use of existing UPOU Learning Centers, which can serve as mirror sites (online GIS) or material distribution center or both, as well as examination sites.

VI. COURSE CLIENTELE

The introductory GIS course is intended for all interested groups and individuals from state colleges and universities, educational institutions, local government agencies, national government agencies, private sector, and others. Land use planners, resource managers, tax assessors, decision makers, graduate students, professors, and researchers among others, would find this course very useful. This course extends its target clientele to existing GIS and related professionals, especially those with software training only, who want to upgrade their skills.

VII. COURSE DEVELOPMENT ACTIVITIES

Development (3-4 months)	:	February – May 2005
Testing and Revision (2-3 months)	:	May – July 2005
Target Course Deployment	:	August/ September 2005

VIII. COURSE OUTLINE / MODULE DESCRIPTION

Module 1: GIS Fundamentals

This module familiarizes the student with basic concepts, techniques, and terminologies being used in GIS. It discusses the GIS historical evolution, theoretical foundation, related technologies and their integration. The module tackles coordinate system, latitude, longitude, shape of the earth, projection and transformations, map as a model of reality and others. This module immediately introduces the students to the chosen software for this course, ESRI's ArcView GIS. Two computer GIS exercise(s) can be accommodated in the module.

- Overview and definition
- Foundations and history
- Components and characteristics
  Capabilities and limitations
- Representing the earth digitally
- Position on the earth
- Mapping the earth
- Related technologies
- Introduction to ArcView GIS

Module 2: Data Capture and Editing

The second module provides students with basic knowledge of data requirements of a GIS. The discussion includes how geographic data can be acquired, sourced out, captured, edited, manipulated, transformed, and projected. This module also includes topics such as data quality, error propagation, handling, and the use metadata. Two to three computer GIS exercises will be covered in this module.

- Data acquisition
- Representing fields, discrete data, and networks
- Populating the GISystem
- Kinds of geospatial data
- Converting digital spatial data between formats and systems
  Projecting data
- Error checking
  Handling
- Using and interpreting metadata

Module 3: Spatial Analysis and Visualization

The module tackles different analysis operations such as buffering, interpolation, neighborhood, point in polygon, line in polygon, polygon in polygon, and others. This module discusses in detail the

core topics in spatial analysis such as map algebra, cartographic modeling, and topological overlay. This module also tackles visual display analysis and map preparation. Three to four computer GIS exercises will be provided in this module.

- Map algebra
- Cartographic modeling
- Finding and quantifying relationships
- Generalization
- Spatial interpolation
- Topological overlay and buffering
- Neighborhood filtering
- Pattern recognition
- Preparing maps/ digital representations

Module 4: Application Areas and Case Studies

This module provides students with insights on how they could use GIS in their respective fields of expertise. The module contains discussion of common examples of GIS applications. Local data gathered from different case studies or projects will be used in the three computer GIS exercises.

- Land information system
- Cadastral mapping
- Resource management (agriculture, forestry)

Module 5: Planning and Implementation

This final module guides students towards successful GIS application – from the first step (planning) or pre-implementation until implementation proper. The module finalizes the course through

an independent GIS project, which prepares students to actual GIS application in their field of specialization. Two exercises and one mini GIS project are required to complete this module.

- User, data, technology and training needs assessment
- Organizational business flow evaluation
- GIS operational framework development
- Project GIS application and management

PROCESS DOCUMENTATION OF AN ONLINE BRIDGING PROGRAM ON THE NON-TECHNICAL DIMENSIONS (NTD) OF ICT FOR THE CYBER CORRIDOR WORKFORCE

Alexander G. Flor, Ma. Estrella O. Sibal, Margaret S. Jarmin, Emely M. Amoloza and Franjel Consolacion[6]

ABSTRACT

The Philippine Cyber Corridor workforce should be considered *world class* in three areas: ICT knowledge; ICT appreciation, particularly in its social impacts; and ICT skills. Conventional baccalaureate programs on computer science, computer engineering and information technology adequately covers ICT knowledge and skills. However, the non-technical dimensions of ICT inclusive of social impacts, ICT governance, ethics, IPR policies, appropriate use, acceptable use, *netiquette* and others are, by and large, neglected. The Philippines cannot claim *world class* status if its ICT workforce is, at best, ignorant or, at worst, unappreciative, of these so-called "non-techie" dimensions of ICT. Thus, the UPOU Faculty of Information and Communication Studies (FICS) has proposed an Online Bridging Program on the Non-Technical Dimensions (NTD) of ICT. It aims to empower the Filipino ICT professional with the ethical, legal and social standards demanded of a knowledge worker by the global job market. It is composed of three courses: Computer Ethics; Social Impacts of ICT; and Intellectual Property Rights. These courses will be offered online using third generation (3G) eLearning techniques. What exactly are the processes and features of the OBP that may be replicated by other online learning programs? This paper presents a study that attempted to answer the foregoing question. Then objective of the study is to document 3G eLearning methods and techniques employed in the OBP.

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INTRODUCTION

Background

The Philippine Cyber Corridor is a 600-mile information and communications technology (ICT) channel that cuts through the archipelago from Baguio City in the north to Zamboanga down south. It is an innovative approach to regional development that cements the Philippines' claim to prominence in the global knowledge society. Through the Cyber Corridor, the so-called Super Regions in the country avail themselves of a common infrastructure. With the synergies generated by this corridor, the Super Regions can leapfrog from agricultural to information-based economies, foregoing the industrial phase. More importantly, they can participate actively in the international ICT market covering a vast array of knowledge products and services from components to systems, from manufacturing to testing on to failure analysis, and from software development to contact center solutions.

However, the workforce that would man the Cyber Corridor should be *certified world class* in three areas: ICT knowledge; ICT appreciation, particularly in its social impacts; and ICT skills. Conventional baccalaureate programs on computer science, computer engineering and information technology adequately covers ICT knowledge and skills. However, the non-technical dimensions of ICT inclusive of social impacts, ICT governance, ethics, IPR policies, appropriate use, acceptable use, *netiquette* and others are, by and large, neglected.

The Philippines cannot claim *world class* status if its ICT workforce is, at best, ignorant or, at worst, unappreciative, of these so-called "non-techie" dimensions of ICT. Thus, the UPOU Faculty of Information and Communication Studies (FICS) has proposed an Online Bridging Program on the Non-Technical Dimensions (NTD) of ICT (See Annex A). The program is post baccalaureate and nonformal. It would cater to the Cyber Corridor workforce as well as ICT professionals all over the country. UPOU FICS specializes on the social impact and policy implications of ICT.

The Program is intended for personnel assigned to junior supervisory positions and above. It aims to empower the Filipino ICT professional with the ethical, legal and social standards demanded of a knowledge worker by the global job market. Successful completion of this program qualifies the participant for an information and communication technology for development (ICT4D) Certification.

The Online Bridging Program (OBP) is composed of three courses: Computer Ethics; Social Impacts of ICT; and Intellectual Property Rights. These courses will be offered online using third generation (3G) eLearning techniques. In other words, it will be implemented with an open-ended schedule aside from being asynchronous, non-linear and non-sequential. Furthermore, it will employ mentoring and coaching instead of tutoring or instructing. Participants are offered the flexibility of engaging in their courses with a virtual community of learners anytime, from anywhere and at any pace, in a user-friendly learning environment. The learning management system (LMS) employed in the program is the Modular Object Oriented Dynamic Learning Environment or Moodle, an open-source course management system that is user-friendly enough for new online students.

The Commission on Higher Education has awarded a grant (Annex B) to the UPOU Faculty of Information and Communication for the implementation of the first course offering under the program, Computer Ethics of CET_1_2007. This report describes the mechanics, enumerates accomplishments, and offers recommendations for this online bridging course.

Program Goal

After completing the Program, the Cyber Corridor employee will be able to perform his assigned functions in his given profession within the ICT sector, with the highest ethical, legal and social standards demanded of a global knowledge worker by the global job market.

Conceptual Framework

Experts maintain that eLearning programs and courses have now spawned Third Generation strategies, methods and techniques. First Generation eLearning courses have been characterized as analogous to its residential counterparts: i.e., they are non-scalable; they are structured in the same manner; and they utilize the same instructional materials. These courses are generally considered as poor analogues to their residential counterparts.

On the other hand, Second Generation eLearning courses are scalable and were developed from the beginning as eLearning courses, thus having no residential analogues. The next generation of eLearning programs and courses assume Second Generation characteristics with the following added features. These are ladderized with several entry and exit points. These are learner-centered. Lastly, they are mentored/ coached instead of tutored or instructored (Cleaver, 2003).

FICS attempts to apply Third Generation or 3G eLearning methods and techniques to the Online Bridging Program on the Non-technical Dimensions of ICT. The OBP courses were or will be developed exclusively as online courses and have no residential analogues. They are scalable since these can be offered not only at the regional level but at the national and global levels as well. The courses can be offered as part of existing formal curricula such as the Diploma in Computer Science, the Master of Information Systems, and the Bachelor of Arts in Multimedia Studies. The OBP may be considered ladderized in itself since it may serve as a transition between the baccalaureate level and post baccalaureate degrees. The OBP offering is learner centered because of its open-ended schedule, asynchronous approach, autonomous learning and testing techniques, and learner-initiated activities. Lastly, OBP course have mentors instead of tutors or faculty members-in-charge.

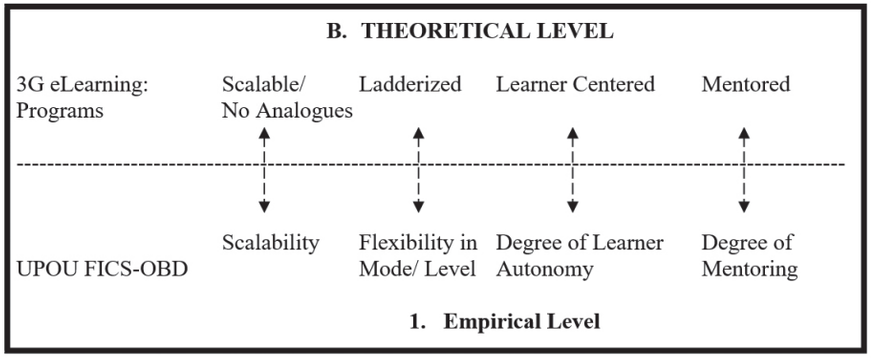


Figure 1. Conceptual Model

This framework forms the conceptual basis of the UPOU-FICS Online Bridging Program.

MECHANICS OF THE ONLINE BRIDGING PROGRAM

Curriculum

The Bridging Program is composed of three courses: Social Impacts of ICT; Computer Ethics; and Intellectual Property Rights. These courses will be *laymanized*, i.e., designed and packaged in a way that a college graduate can appreciate and apply them.

Delivery and Design Features

The Bridging Program is offered online on the UPOU learning platform, My Portal.UPOU.org.

The Bridging Program is offered with an open learning schedule. The program is not being offered in a regular semester following a school year calendar. A prospective student may enroll anytime and may complete the program at his own pace, anytime between three months to one year, on a part-time basis.

The Bridging Program is asynchronous. The student may log-in anytime of the day, any day of the week at his course workspace to go through the learning objects and activities. He may take the assessment tests at his chosen time and pass (or fail) accordingly.

The Bridging Program is non-linear or non-sequential. A student enrolled in the program may take any of the three courses in any sequence or combination. The courses may also be considered as stand alone courses.

Learning Management System

The learning management system (LMS) used is the Modular Object Oriented Dynamic Learning Environment or Moodle, an open-source course management system that is user-friendly to new online students.

Mobilization of Online Mentors

Online mentors and facilitators from the UPOU Faculty of Information and Communication Studies are being mobilized for course design, development and implementation.

Enrollment Costs

The entire program will cost P 6000 per student or P 2000 per course. This report covers scholarships for the first 100 students of the first course, Computer Ethics, and the promotion of the program.

Workplan

The tasks for the implementation of the Computer Ethics course may be classified under four major activities: planning; course development; enrollment campaign; and program implementation. Figure 2 presents the Gantt Chart of project activities.

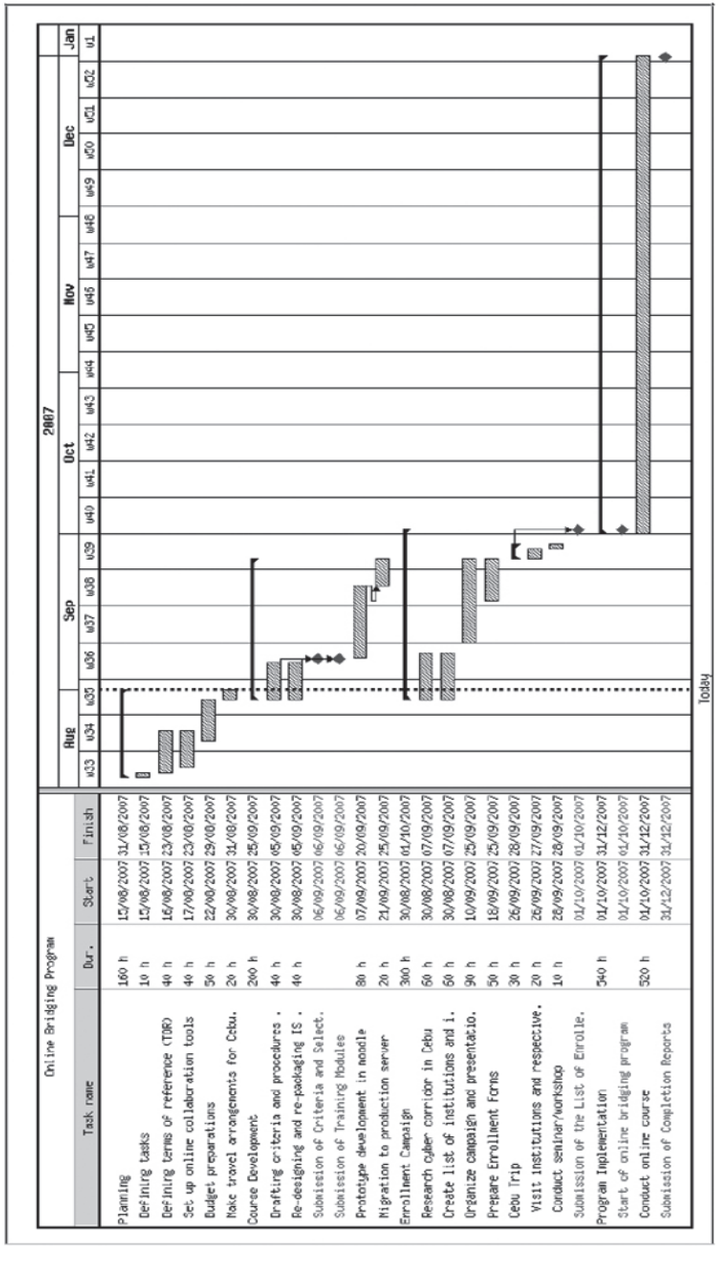


Figure 2. OLB Program Gantt Chart

DOCUMENTATION

Completion of Training Modules

The major accomplishment of the project is the completion of four modules on Computer Ethics. These four modules have been uploaded to the Moodle course site of CET_1_2007 in my.portal@upou.org, the online learning platform of UPOU. CET_1_2007 is the course code used for the nonformal version of Computer Ethics.

Annexes H and I gives the course guide and the study schedule of CET_1_2007.

Development of Systems and Procedures

Several systems and procedures were developed under the project.

***Selection of the Scholars*.** Upon collection of the application forms, each one undergoes an evaluation procedure for the selection of the training participants which follows the sequence of steps outlined in Figure 3. To qualify for the CHED scholarship, the applicant must meet the following criteria;

- Must be a college graduate
- Must be employed in an ICT-related industry
- Must possess knowledge and skills in ICT

As Figure 3 illustrates, if any of the criteria is not met, then the applicant does not qualify for the scholarship. Otherwise, the applicant does qualify for the scholarship and is notified immediately.

***Data Flow*.** The data flow diagram illustrated in Figure 4, models the process for admitting students. This process begins with the collection of the application forms. These can be paper forms or online forms accessed via the UPOU online registration system for non-formal courses. These application forms are recorded in a simple database. The collected forms then undergo an evaluation procedure as depicted in Figure 3. Students that qualify for the CHED scholarship are noted in the database and are immediately

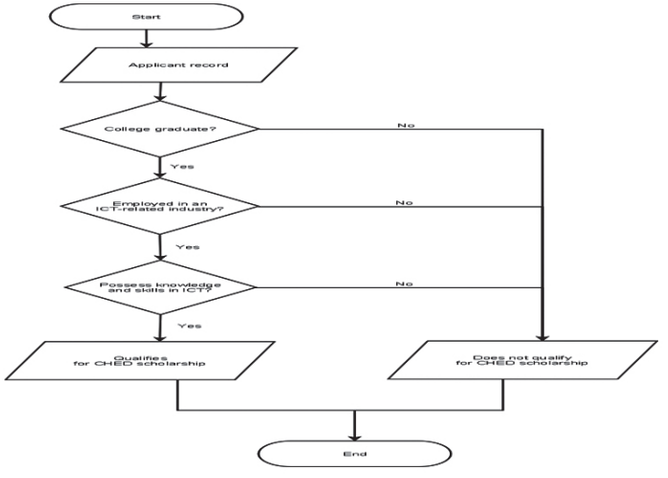


Figure 3. Evaluating an Application

notified. Notification comes in the form of an admission letter sent to the applicant via email. Along with the admission letter are instructions for accessing the online course in the UPOU Moodle Site.

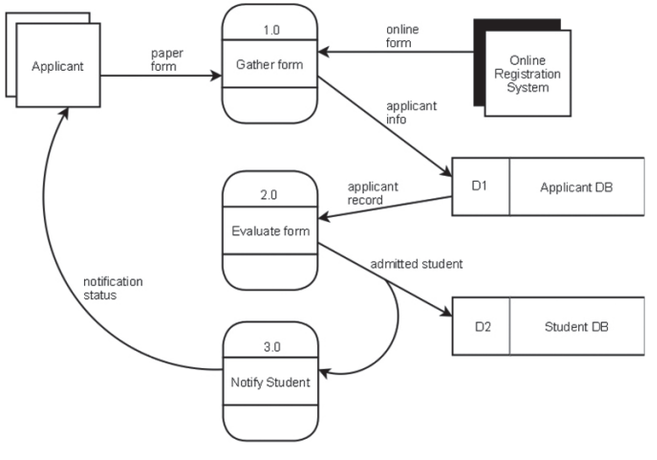


Figure 4. Data Flow Diagram

Accessing the Moodle Course Site. Instructions for accessing the online course in the UPOU Moodle Site begin by prompting the student to point his or her browser to http://myportal.upou.edu.ph and then clicking on the "Create new account" link in the login block and fill up the form which requires the student to provide personal information such as name, email address, etc. Alternatively, students can directly point their browsers to the URL http://myportal.upou.edu.ph/login/signup.php. After filling out the form and submitting it, the student waits for a confirmation that is sent to the email address he or she provided in the form. This confirmation email contains a link that upon clicking confirms the student's registration in the UPOU Moodle Site and at the same time logs the student in the site. Once in side the Moodle environment as a logged in user, the student must find the online course under the Non-Formal Courses category and enter it by clicking on its link. If the student is entering the course for the first time, then he or she is prompted for the enrollment key which is provided along with the admission letter. Entering the enrollment key correctly grants the student access to the course site and enrolls the student for that class.

If at any point in the procedure for accessing the course site the students encounter a problem, then they can simply go to http://myportal.upou.org/contacttechsupport.htm where they can find contact information for TechSupport and ways to get help.

Enrollment Campaign

The campaign for the Online Bridging Program started with a meeting with Atty. Heidi Acuña, a host at the ABS-CBN TV in Cebu.. The program was introduced to her by showing the Audio-Video Production (AVP) on the OBP. She arranged to have a campaign on the program at the ABS-CBN AM radio talk show with Mr. Leo Lastimosa.

An orientation on the OBP was held on the following day at the Cebu Educational Foundation for Information Technology (Cedf-it). A total of 30 representatives from various organizations attended the orientation. Cedf-it Project Manager, Mr. Arnold Banogon, gave the welcome remarks. It was followed by showing of the AVP on the

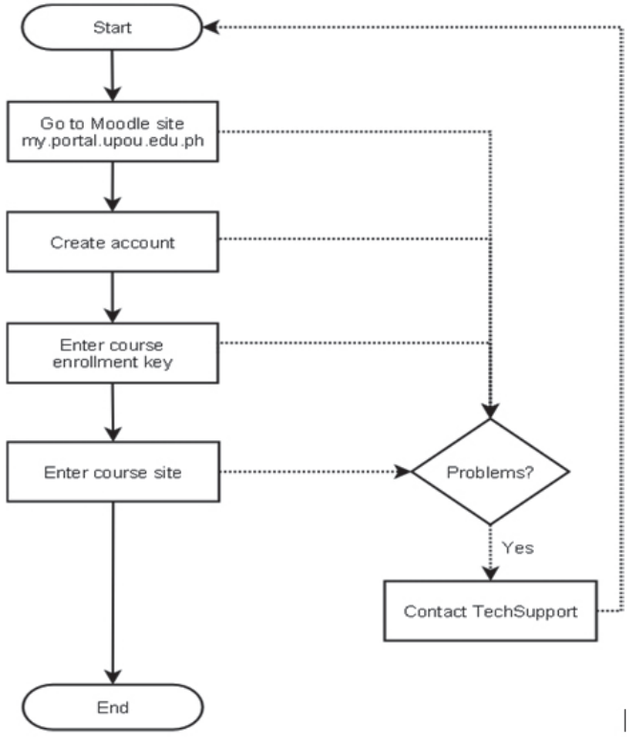


Figure 5. Accessing the Moodle Course Site

Online Bridging Program. Then the UPOU Learning Management System and Moodle were introduced to the participants. They were encouraged to enroll in the OBP during the open forum.

The last day of the campaign was on the morning talk show of Mr. Leo Lastimosa. The Online Bridging Program was introduced via the radio program and the listeners were invited to enroll.

Enrollment of 100 Online Students

A total of 100 students enrolled in the first course, Computer Ethics. Some of them register online through http://myportal.upou.org/

while the others submitted printed registration forms. There are a lot of enrollees who came from the same institution. The list composed of 45 enrollees form the academe and 55 from the industry.

CONCLUDING REMARKS

At this juncture, we observed that the open-ended semestral system has brought about distinct disadvantages. First and foremost, very few with our students have taken the final examination. Moreover, the Project Coordinator has to fulfill other commitments and leave the project before a critical mass of students could take the final examination and provide data for the project evaluation.

ANNEX A
UPOU DIGITAL FLYER

ANNEX A
UPOU DIGITAL FLYER

Are you a world class ICT professional?

The top 100 information and communications technology (ICT) companies in the world prefer employees certified in three areas:

- ICT knowledge
- ICT skills
- ICT outlook and appreciation

The Faculty of Information and Communication Studies of the UP Open University offers

An Online Bridging Program on the Non-Technical Dimensions of ICT for the Cyber Corridor Workforce

What is it all about?

- Empowering the Cyber Corridor employee with the highest ethical, legal and social standards demanded of a global knowledge worker
- Gaining knowledge and understanding in the following areas: Computer Ethics, Social Impacts of ICT, and Intellectual Property Rights
- Being ICT4D certified after successful completion of the program

Qualifications?

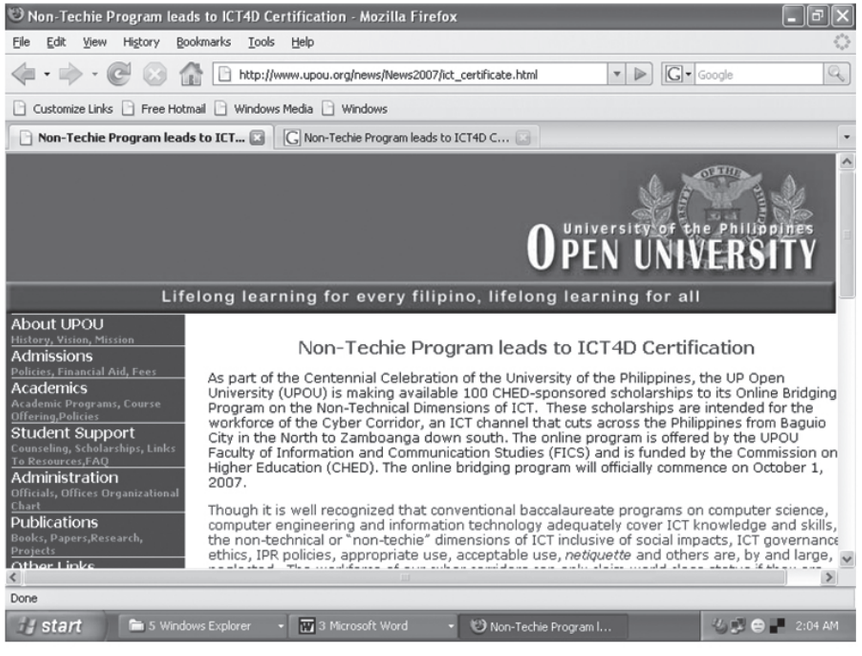
- Employed in an ICT related industry
- Possess knowledge and skills in ICT
- At least a high school graduate

Interested? Then...

- Avail of the 100 scholarships sponsored by the Commission on Higher Education (CHED) Cyber Corridor Development Program for those who meet the qualifications
- Complete the program anytime, anywhere and any pace through a user-friendly virtual learning environment

For more information, please contact:
Faculty of Information and Communication Studies
UP Open University
Los Baños, Laguna 4031
Tel. No.: (049) 536-6001 to 6006 local 840 or 334
Email Address: fics@upou.net

ANNEX B
SCREENSHOT OF UPOU WEBPAGE FEATURING PROJECT



ODL FOR AGRICULTURAL DEVELOPMENT AND RURAL POVERTY REDUCTION: A COMPARATIVE ANALYSIS OF INNOVATION AND BEST PRACTICE IN ASIA AND THE PACIFIC[7]

Scott McLean, Alexander G. Flor and Malcolm Hazelman [8]

ABSTRACT

The object of this project, in general, was to understand and improve the application of ODL strategies to the challenges of agricultural development and rural poverty reduction.

Implemented by the University of Calgary Center for Continuing Education, the UP Open University Faculty of Information and Communication Studies, and the FAO Regional Office for Asia and the Pacific and funded by the Commonwealth of Learning, this project studied five institutions in Asia and the Pacific and documented innovative or exemplary practices in open and distance learning for agricultural development and rural poverty reduction. These institutions were: National Institute of Agricultural Extension Management of India; Allama Iqbal Open University of Pakistan; The Open Academy for Philippine Agriculture of the Philippines; Sukhothai Thammathirat Open University of Thailand and lastly University of the South Pacific, School of Agriculture of Samoa.

The case studies were constructed, assessed and compared to generate policy and programmatic recommendations. The analysis was based on a framework developed by the Food and Agriculture Organization for the conduct of distance learning projects on agriculture and rural development. This framework suggested that:

[7] *Research Project jointly conducted by the Center for Continuing Education, University of Calgary, the UPOU Faculty of Information and Communication Studies, and the FAO Regional Office for Asia and the Pacific under a grant from the Commonwealth of Learning*

[8] *Director of Continuing Education, University of Calgary; Professor and Dean, UPOU-Faculty of Information and Communication Studies; and Senior Extension Education and Communication Officer, FAORAP Bangkok, respectively.*

ODL should: be undertaken for the right reasons, be sensitive to the context in which it is being applied, make use of existing infrastructure with sustainable cost structures, engage stakeholders in participatory processes and use sound pedagogical and administrative models.

INTRODUCTION

Background. Education and learning are widely recognized as essential to processes of development and poverty reduction. In many developing countries, issues of educational access, equity, and quality have been identified as prerequisites to the achievement of development goals. Given the inadequacies of conventional systems of education, training, and agricultural extension, many developing countries have introduced innovative approaches to open and distance learning (ODL).

Over the past decade, there has been a resurgence of international interest in distance learning and distance education as potentially useful strategies for addressing human development issues. This resurgence has been rooted in part in the evolution of new information and communications technologies, and in part in the improvement of pedagogical and administrative models for facilitating learning at a distance.

In 2000 and 2001, the Food and Agriculture Organization of the United Nations (FAO) surveyed the experiences of ODL for agriculture and rural development in low-income countries [http://www.irrodl.org/content/v3.1/mclean.html]. From this survey, the FAO argued that, to be effective in developing countries, ODL should:

1. Be undertaken for the right reasons;
2. Be sensitive to the context in which it is being applied;
3. Make use of existing infrastructure, with sustainable cost structures;
4. Engage stakeholders in participatory processes; and
5. Use sound pedagogical and administrative models.

In recent years, there have been numerous examples of institutions in developing countries using ODL strategies to address the challenges of agricultural development and rural poverty reduction. We believe that much could be learned from identifying the common elements of successful innovation and best practice from leading institutions in this field. The primary audiences for the results of this research are institutional leaders and policy-makers in the fields of education, agriculture, and rural development around the world.

Objectives. The object of this research, in general, was to understand and improve the application of ODL strategies to the challenges of agricultural development and rural poverty reduction. To pursue this objective, the following research questions were defined:

6. What are some of the key innovations and best practices developed by institutions in their efforts to apply ODL strategies to the challenges of agricultural development and rural poverty reduction?
7. To what extent do these innovations and practices follow the five principles defined by the FAO?
8. What are the common elements of successful innovation and best practice among these institutions in Asia and the Pacific?
9. How could institutions from other developing countries successfully replicate or adapt the innovations and best practices identified among these institutions?
10. What recommendations should guide or facilitate the dissemination of successful innovation and best practice in this area?

METHODOLOGY

Design of the Project. This project was a collaboration from five institutions from Asia and the Pacific through developing case studies of their innovative or exemplary practices in open and distance learning for agricultural development and rural poverty reduction. These institutions were: National Institute of Agricultural Extension Management of India; Allama Iqbal Open University of Pakistan;

The Open Academy for Philippine Agriculture of the Philippines; Sukhothai Thammathirat Open University of Thailand and lastly University of the South Pacific, School of Agriculture of Samoa. The case studies were undertaken by collaborating researchers. Each researcher developed a report about the innovative or exemplary practices in ODL for agricultural development and rural poverty reduction in one institution.

These case studies were constructed, assessed, and compared in order to create policy and programmatic recommendations. The framework for analysis was developed through work of the project investigators with the Food and Agriculture Organization of the United Nations.

Subject of the Project. The subjects of the research study were five institutions with open and distance learning offerings in agriculture and/or rural development. These are:

- National Institute of Agricultural Extension Management of India
- Allama Iqbal Open University of Pakistan
- The Open Academy for Philippine Agriculture of the Philippines
- Sukhothai Thammathirat Open University of Thailand
- University of the South Pacific, School of Agriculture of Samoa

***Data Collection*.** This research project involved two phases of activity. In Phase One, the collaborating researchers completed background papers, and then held a workshop (28 – 30 June, 2005 at the FAO Regional Office for Asia and the Pacific, Bangkok) at which they developed a template for the case studies. In Phase Two, the collaborating researchers completed the case studies, and then held an online conference (1 – 15 February, 2006) hosted by the University of the Philippines Open University.

RESULTS AND DISCUSSIONS

Starting with the right reasons

In the context of the contemporary development of new information and communications technologies, there is a danger that ODL initiatives might be driven by the availability or attractiveness of innovative technologies, rather than by the educational needs of individuals and communities. It is important that ODL initiatives be firmly grounded at the intersection of the sponsoring organizations' mission, and the needs and aspirations of the individuals and communities to be involved in such initiatives. In some cases, ODL strategies are appropriate, cost-effective, and sustainable means to address people's needs and aspirations. In other cases, another approach would be more suitable. Ultimately, in the quest to reduce poverty and promote the sustainable development of agriculture, ODL should be seen as a means to an end.

The five case studies compiled for this project shared in common a firm grounding in the mission of the institutions and the needs and aspirations of the communities they serve.

The mission statement of MANAGE is: "Facilitating the Acquisition of Managerial and Technical skills by Extension Officers, Managers, Scientists and Administrators in all sectors of Agricultural economy to enable them to provide most effective support and services to Farmers and Fishermen for practicing Sustainable Agriculture." The vision of MANAGE is "To be counted among the most pioneering, innovative, farmer-focused and self-supporting agricultural management institutes in the world."

While, the objectives of AIOU are: to provide facilities to people who cannot leave their homes and jobs in such manner as it may determine; to provide such facilities to the masses for their educational uplift as it may determine; to provide facilities for the training of teachers in such manner as it may determine; provide for instruction in such branches of learning technology or vocation as it may deem fit, and to make provision for research and for the advancement and dissemination of knowledge in such manner as

it may determine; and hold examinations and to award and confer degrees, diplomas, certificate and other academic distinctions.

OPAPA has the following objectives:

- To provide online web-based services to extension workers and farmers
- To tap ICT infrastructure and network backbones to provide an open learning environment
- To organize experts and digitize all available information and data in agriculture to make them accessible to farmers
- To link policy makers, scientists, markets, businesses, organizations, and farming communities in an open environment using ICT

The STOU mission is to offer distant learning as a continuing education opportunity for the masses as a part of "to learn and to live" under the adult education program. Its main mandate is to provide educational services to society through open and distance learning. STOU offers affordable, flexible, and equitable access to undergraduate, graduate, and professional development courses, enabling Thai people to develop their expertise and their careers while maintaining their quality of life and family commitments.

The USP School of Agriculture and Food Technology (SAFT) is an institution dedicated to education, research, and information dissemination in the field of agriculture. SAFT makes several fundamental contributions to agricultural development and rural poverty reduction across the South Pacific region:

- Providing diploma, undergraduate, and graduate programs of study in the major fields of tropical agriculture – programs that prepare graduates for significant roles in the agriculture and food systems of countries across the South Pacific.
- Undertaking, and disseminating the results of research relating to tropical agricultural production, farm business management, extension systems, and other elements of agriculture and food systems of relevance to the South Pacific.
- Training secondary school teachers of agriculture.

Each of the case studies compiled for this project explored how an institution used ODL methods to address fundamental needs and aspirations of rural people.

The work of MANAGE is grounded in the recognition that a majority of the Indian population live in rural areas, and that most of these people derive their livelihoods from farming or providing labor to agricultural and related enterprises. MANAGE works to strengthen the agricultural extension system across India, thereby fostering the provision of information, training, and other inputs to facilitate the sustainable development of agriculture and related rural activities.

The case study about the AIOU focused on the programs and services of the Institute of Mass Education (IME). The work of IME is based on the premise that basic and secondary education is fundamental to the ability of rural people to achieve sustainable increases to their incomes and quality of life. The IME provides basic, secondary, and functional education for rural people across Pakistan. Some programs are directed specifically to rural women, in recognition of the cultural and political-economic constraints to the provision of conventional education to women in rural Pakistan.

Behind OPAPA is the convergence of three concepts: eExtension, Distance Learning, and eCommerce. It was envisioned to employ ICT to organize and deliver information to the farms. It makes available online content, learning, interactivity, and advisory services. Lastly, it enables farmers to access information and connect to markets.

A majority of countries in the South Pacific have a substantial proportion of their populations engaged in work directly related to agriculture. Further, many farmers and other rural people throughout the region have inadequate levels of income, food security, and productivity. The root causes of low incomes and food insecurity in the region are diverse, ranging from geographic issues (physical isolation, distance to international markets, vulnerability to natural disasters), demographic issues (small populations and domestic markets, high rates of population growth), and institutional issues (land tenure systems, underdeveloped capital markets).

Education and training issues are also central to agricultural development and rural poverty reduction in the South Pacific. These issues include:

- Low levels of basic education and agricultural education among farmers.
- Inadequate initial training and continuing education for agricultural professionals and technicians.
- Relatively weak extension services in some countries.
- Shortage of skilled laborers to take up positions of a technical, professional, managerial, administrative, or entrepreneurial nature.

SAFT does not directly reach the rural poor. The primary target audiences of SAFT are current and prospective employees of ministries of agriculture, agricultural businesses, and non-governmental organizations in the agricultural sector. In order to have an impact on agricultural development and rural poverty reduction, SAFT relies on making strategic linkages with those responsible for providing the programs, services, policy decisions, and advice that enable farmers to enhance their productivity, and that enable farmers and other rural citizens to obtain and sustain increased levels of income and food security.

STOU is dedicated to addressing the inequality of educational opportunity. In Thailand as in other countries, only a minority of people have the chance to study above the legally-required minimum level. The higher up educational ladder one goes, the fewer are the opportunities for further study. STOU is an "open" institution, both in the sense of having an open admissions policy and in the sense of being accessible at a distance. This openness provides particular advantages for rural people, who are less likely to possess educational qualifications, and who are less able to attend residential institutions based in urban areas. STOU also has an affordable tuition structure, enabling even those with relatively low incomes to improve their access to opportunities in society.

From these five case studies, it can be concluded that successful innovation and best practice in ODL for rural poverty reduction

and agricultural development needs to take place at the point where institutional missions and community needs intersect. The institutional mission is important, because without institutional commitment and resources, ODL initiatives cannot be sustained. The needs of the community are important because ODL initiatives not grounded in a firm understanding of such needs are likely to either fail or to produce outcomes that are of limited benefit.

Being sensitive to context

There is no universally appropriate model for designing and delivering distance education initiatives. The potential target audiences for ODL initiatives for agricultural development and rural poverty reduction is very broad indeed, ranging from farmers and marginalized rural populations, to relatively privileged urban professionals such as policy makers and information managers. It is essential that the form of ODL selected be appropriate to the particular context in which it is being applied.

ODL models and practices must be adapted to the social, cultural, economic and political circumstances of learners and their environment. In practical terms, the need for sensitivity to context means accepting the fact that "one size" does not "fit all." In working with various groups of learners and various programmatic and learning objectives, it is necessary to develop the capacity to use more than one set of instructional methods, more than one delivery strategy, more than one learner support strategy, and so forth.

The starting point for being sensitive to context is knowledge of the learners who are the targets for ODL initiatives. Understanding the characteristics of the learners, and the environment in which the learners live and work, is essential for planning and delivering successful ODL programs. In the five cases explored for this project, sensitivity to context can be perceived in the choice of ODL delivery methods. There is a logical connection between the goals of a program, the characteristics of the target learners, and the ODL delivery methods used. As an obvious example, one cannot use online learning for learners without access to the Internet.

Table 1 summarizes the programs, learners, and ODL delivery methods that were the focus of the case studies in this project.

Table 1: Programs, Learners, and Methods

Institution and Program	Target Learners	ODL Delivery Methods
MANAGE In-service training and consultancy	Agricultural extension workers, senior policy makers, government officials, grassroots-level workers	Two-way video conferencing (ISDN)
Diploma in Agricultural Extension Services for Input Dealers (one-year)	Private sector input dealers and unemployed graduates of agricultural programs	Face-to-face instruction on Sundays at regional collaborating institutions
AIOU – IME Basic Functional Education Program	Rural illiterates and others with low levels of education.	Face-to-face learning groups in villages, using centrally prepared lesson plans, cassettes, flip charts, radio, television, and handouts
Women's Basic Education Program (two-years)	Illiterate women over the age of 12	Modular-based correspondence packages for independent study

Women's Secondary Education Program	Women having completed grade 8 but not having completed high school	Correspondence packages in combination with weekly face-to-face tutorials
STOU Undergraduate and graduate programs in areas such as Management, Education, Law, Health Sciences, Social Sciences, Liberal Arts, Agricultural Extension, and Home Economics	University students at undergraduate and graduate levels	Combination of correspondence packages, radio and television broadcasts (some live with telephone interaction), CAI, online learning, professional experience activities, and tutorials
In-service training , HRD programs, and consultancy	Local Administrative Bureaus and other organizations	Face-to-face learning groups, and project-based activities
OPAPA K-Agrinet	Agricultural extension workers and farmers	World Wide Web
Farmers' Call Center	Agricultural extension workers and farmers	SMS, Cellular telephony
Radio + Internet + SMS	Agricultural extension workers and farmers	Radio, Internet and SMS Interface Telephony over IP
Last Mile Connectivity	Local government units and farmers' organizations	Internet

OPAPA VCLASS eLearning platform	Agricultural extension workers and farmers	Web-based Learning Management System
Rice Cyber Clinic	Agricultural extension workers and farmers	Videoconferencing over IP
SAFT Diploma, undergraduate, and graduate programs in agriculture	University students aspiring to public and private sector employment	Correspondence packages, audio-conferencing, e-mail contact with tutors
Undergraduate programs in education (in collaboration with the School of Humanities)	University students aspiring to teach agricultural subjects at high school.	Correspondence packages, audio-conferencing, e-mail contact with tutors

As can be seen from Table 1, the choice of appropriate delivery methods is tied to the nature of the learners and their learning objectives. With government officials, the use of high-end video conferencing facilities is quite appropriate. With illiterate villagers, face-to-face community learning groups is suitable, but so are methods such as the use of SMS and cellular phone technology by the OPAPA Farmers' Call Center.

In addition to delivery methods, the five case studies all highlight the importance of cultural and linguistic sensitivity in teaching methods and learner support services.

In the case of OPAPA, cellular phone technology, specifically SMS has been used extensively in almost all of its programs since this technology is already part and parcel of mainstream Philippine culture. The Philippines has been called the texting capital of the world. In one specific example, OPAPA has fostered an initiative that blends several technologies to take advantage of the unique

context of the rural Philippines. In one educational program, a radio announcer gets information from the Internet, which s/he broadcasts in his/her regular program. Farmers then text message their feedback or queries to the announcer, who in turn e-mails experts for appropriate answers. Once these answers are received, the an***nouncer broadcasts these to the farmers.***

At AIOU, instruction is in Urdu but English is also used as a medium of instruction in certain courses and for most of the postgraduate programs. IME, for one, is now planning to raise for further discussion gender issues in their bi-annual magazine. This implies that the program does not only cater primarily to women but making the materials gender sensitive as well. Since 1986, AIOU has developed a program called (WSEP) or the secondary level education program for "Purdah Observing Families" as well as housewives in the village where they offer practical and skill-oriented courses. "Purdah" is a stage in one's woman's life to hide their faces in public especially in the eyes of men.

The SAFT case study demonstrates that careful curriculum development and course design are essential to making ODL appropriate to the learners. SAFT courses are delivered to twelve countries across the Pacific Islands. English is the language of instruction, but the substantive content of the courses is developed in a manner that is suited to the cultural and institutional characteristics of the region. As one example, some SAFT courses involve experiential learning activities supervised by local staff members with ministries of agriculture or education.

From these five case studies, it can be concluded that successful innovation and best practice in ODL for rural poverty reduction and agricultural development needs to be sensitive to context. Institutions must understand the target groups of learners, and know the characteristics of those learners. Programs must be developed that are appealing to such learners, in terms of the overall goals of the programs, the delivery methods used, and the pedagogical approaches taken.

Using sustainable infrastructure and budgets

Infrastructure is important to ODL initiatives. On the one hand, infrastructure involves technologies such as telephone lines, broadcasting facilities, and Internet connectivity. On the other hand, infrastructure involves the organizational capacity to manage and administer learning at a distance. Technological infrastructure for ODL is closely related to the delivery strategies through which instructional and learner support services are provided. Educational institutions are rarely able to sustain independent systems of communication for the delivery of ODL initiatives. Rather, delivery strategies for ODL initiatives should be developed according to the communications infrastructure that is currently available, reliable and affordable to the learners who will take part in the initiative. Often, entertainment and commercial sectors create such infrastructure, and educational institutions can make use of it.

Just as infrastructure is important, so is money. It is essential that ODL initiatives be organized in a manner that the ongoing full costs of delivering and sustaining the initiatives will be matched or exceeded by the revenues that the initiatives will attract. There are essentially three sources of revenue for ODL initiatives: tuition or other fees paid by learners themselves; tuition or other fees paid by the parents or the employers of the learners; and indirect support to the learners paid by governments, corporate sponsors, or donor agencies. Through some combination of these sources, ODL initiatives must generate sufficient revenues to sustain themselves over time.

Each of the five case studies demonstrates unique approaches to establishing the organizational, technical, and financial foundations for sustaining ODL initiatives in the field of rural poverty reduction and agricultural development.

The MANAGE case study shows a blending of organizational networking, government funding, and tuition-based (cost-recovery) funding in its ODL work. Core expenses are minimized by employing a very small number of full-time faculty members. To carry out its large number of training programs and consultancies, MANAGE has built a network of over 100 visiting faculty members called

"Facilitators" across the country. These facilitators are regular faculty members of State Agricultural Universities or Scientists of Indian Council of Agricultural Research or senior or middle level officers of Agriculture or allied department in one of the state governments. MANAGE invests on their capacity building on regular basis and utilizes their expertise on Project basis on mutually agreed terms (in consultation with their employers). This arrangement brings the advantage of concrete field experience and huge outreach of these officers to compliment MANAGE's core resources, while working on any project. The performance of Facilitators is under constant review and some of the Facilitators have even joined MANAGE at very high positions. The MANAGE facilitators enjoy the status of national-level resource person in their respective departments.

One of the key features of MANAGE training and teaching delivery is its strong linkages with State Agricultural Universities and other training and teaching institutions like-ICAR research institutes and NGOs all across the country. MANAGE has signed MOUs with all these institutions to launch collaborative educational programs. For example, in one training scheme MANAGE signed MOUs with 69 institutions in the country to organize the two-month long highly technical program for the un-employed agriculture graduates. The course framework and the content is designed by MANAGE and the same is delivered at the designate institutions, under the agreement. MANAGE. Similarly under its Diploma in Agricultural Extension Services for Input-Dealers program, MANAGE provides the course framework, content (in English), to the collaborating institutes and institutes conduct the program as per agreed guidelines. The certificates in all cases are given by MANAGE.

In general, the costs for in-service training provided by MANAGE are absorbed by the Government of India, while the costs of the Diploma in Agricultural Extension Services for Input-Dealers program are covered by fees charged to participating students. In this program, MANAGE is concentrating on the states where the reach and presence of private Input Dealers is very strong. The course fee has been worked out on the basis of "cost+ accounting" system. Only a marginal service charge is charged over and above the expenses and consumables. Hence the program is self-sustainable and also not overly costly for the clients. The annual fee for 52-week program

(classes on Sundays every week) including course material, field visits and working lunch is Indian Rupees 27000 (US$ 600 approx.). MANAGE out-sources the Faculty and premises in other districts in A.P. and works on franchisee arrangements in other states.

The AIOU case study demonstrates that organizational infrastructure is needed on a national, regional, and local level. AIOU has a main campus in Islamabad, thirty-seven regional campuses, 1,350 study centers, and about 730 examination centers. Within the IME unit, a two-pronged strategy has been adopted; a head office and a network of 32 regional offices. The Head office supports activities related to:

- Nationwide publicity; admission, registration, mailing of study package, holding of examination, advisory service from academics, monitoring and evaluation of course materials and issuance of certificates.
- Finalizing the admission of students.
- Providing training to part-time tutors and field coordinator and all kinds of backup support need in the field.

The regional offices:

- Conduct publicity in the field. The unique feature of this approach is to ask female field coordinators to do the needs assessment along with the male regional directors. They visit the field and approach the females, their parents and do the publicity, motivation and counseling throughout the study period.
- Arrange the study groups and allocate the study centers, appoint the part-time tutors and all this information is dispatched to the students and the part-time tutors.
- Once the weekly tutorial starts, where the students get the opportunity to benefit from their tutors and interact with fellow students, the field coordinator supervises and monitors the study centre activities at least once a month. Even sitting at their offices they get to know the performance of study centers because weekly attendance sheets and cumulative assessment of assignments are sent to the regional offices by the tutors.

- Provide career counseling, through which students are made aware of possible job opportunities available and besides the stereotype roles of teachers and nurses they are advised of taking up jobs as telephone operators, office secretaries, health visitors or workers, small entrepreneurs etc. The students are provided with guidance, counseling and advisory service through a very well established system. In informing students, information materials are disseminated like a newsletter, instructional posters, interaction through direct correspondence with students, telephone, and personal contacts are used to make the system effective.
- Facilitate student placement by referring them to related agencies i.e.; First Women bank, Lady police stations, Social welfare dept., NGOs dealing with domestic violence etc. Since there is a very well-established monitoring and evaluation system, problems are identified and solved properly.

This national and regional system of offices is organized in a cost-effective manner. While tuition fees are very low (given the nature of the IME target audiences), the government of Pakistan contributes only 11% of the budget of AIOU. Economies of scale and cost control enable AIOU to generate the remaining 89% through tuition and related revenues.

In the case of OPAPA, it has been able to attract a significant amount of funding by networking with two other major agricultural networks in its K-Agri Net initiative. This knowledge network, funded by the Commission on Information and Communication Technology (CICT), has consolidated the ICT4D initiatives of three line agencies and is directed at servicing enterprising agricultural communities. The CICT approved a P191 million grant under its eGovernment program on September 2004 for this purpose. Under the arrangement, the PCARRD e-Farm/e-Consortia was granted P83 million, OPAPA was awarded P60 million, while e-Agrikultura received P24 million.

With regard to sustainable infrastructure, OPAPA's Farmers' Call Center is SMS. It started operations in 2004 using one cellular phone. By sending text messages to 0920 911 1398 one can avail of free expert consultation services on agricultural technology.

The objectives of the Call Center are: to link experts, agricultural extension workers, and farmers through the use of SMS; to inform extension workers and farmers on technology updates; to cater to queries of extension workers and farmers, particularly on rice production technology; and to link farmers to markets through text messaging.

The procedure to set-up the Call Center required: the standardization of content; acquisition of hardware and software; the development of procedures/ workflow; management of a database; and the development of frequently asked questions (FAQs) service. The service is purely text-based and messages can be routed to experts, services, or query databases. It makes use of the GSM Data Terminal and an open source program.

To further broaden the scope of the Farmers' Call Center a link-up was arranged with several provincial radio stations. The procedure entails the participation of an announcer who gets information from the Internet which s/he broadcasts in his/her regular program. Farmers then text their feedback or queries to the announcer who in turn emails experts for appropriate answers. Once these answers are received, the announcer broadcasts these to the farmers. In other words, the announcer acts as the intermediary between the Internet and the farmers.

The Academy likewise offers extension offices, research agencies and Community eCenters with connectivity and bandwidth problems, access to low-cost high speed Internet through the use of standard to fabricated antennas and low-cost transmitters (2.4 Ghz 11 mbps 802.11 b/g). Through this intermediate technologies, local government units, research agencies, farmers' cooperatives, barangays, and even individuals, are able to connect to the Internet with the help of network backbones and access points.

Furthermore, the Academy's partnership with SMART Communications, one of the major cellular telephone service providers in the country, has provided last mile connectivity to sixteen local government units and farmers' organizations in areas not

reached by conventional landline ISPs. In this regard, the Academy took advantage of the omnipresence of cellular telephony in the Philippines, interfaced this with Internet services and made the latter available to almost any point in the country. Through its partnership with SMART Communications, areas unreachable by electricity and telephone lines can avail of low cost, broadband Internet services through a laptop with a PCMI slot where the SMART wireless card is inserted. OPAPA has walked the extra mile by providing laptops equipped with the SMART card to fifteen local government units and farmers' organizations previously without access to Internet services.

SAFT uses two basic ODL delivery methods: correspondence packages and audio-conferencing. The postage system throughout the Pacific Islands is well-established, and despite some delays in the exchange of course materials and assignments, the system works reasonably well considering the vast distances and small populations served by SAFT. The audio-conferencing system makes use of the "USP-Net" satellite service that has been established to provide service to all twelve countries within the umbrella of the University of the South Pacific.

STOU has taken a number of steps to ensure the sustainability of the infrastructure it uses for ODL purposes, including:

- Partnering with public libraries and high school libraries to share resources and ensure an STOU presence throughout the country.
- Establishing STOU study centers based on locally-donated resources.
- Promoting partnerships with external agencies through the exchange of in-kind services and various financial incentives.
- Outsourcing of expertise for processes such as the production of curricula and texts.

Further, STOU has implemented a "performance-based" budgeting system, in order to manage its operations largely from revenue-generating activities, with only modest subsidies from government.

Engaging stakeholders

The need for participatory and empowering educational practice was identified by FAO (1999) in a guide entitled *Participatory Curriculum Development in Agricultural Education*. The guide categorizes general groups of stakeholders in curriculum development processes as the "insiders" (leaders with training organizations, teachers, students, producers of educational materials), and the "outsiders" (policy-makers, politicians, educational administrators, educational experts, employers, professional bodies, clients, funding agencies, parents, past students and interest groups). Early in the analysis of a potential ODL intervention, it is important to identify the stakeholders, understand those stakeholders' diverse interests, and develop a process through which such stakeholders will be represented in the planning, implementation and evaluation of the intervention. The process of identifying, understanding and involving stakeholders helps to ensure that distance education initiatives are undertaken for the right reasons, are sensitive to the contexts of learners and their environments, and are sustainable.

Training Needs Assessment (TNA) is one of the core competency areas of MANAGE. Human Resources Development (HRD) faculty members map the skills and knowledge levels required for each job category of clients, and then the course content is carefully planned to include all the core and ancillary subjects in the curriculum. Prospective participants and their heads of departments are always involved in carrying out the TNA exercise. The involvement of clientele is not limited to TNA; innovative farmers and agri-preneurs are regular guest faculty members at MANAGE and its collaborating institutions. These people are called to share their experiences including the process of their progress and are requested to explain the key features of their achievements. Participants in MANAGE training are also taken to innovative farmers' fields for on-site demonstration and sharing of lessons. Thus, clients including farmers are an integral part of the MANAGE design and delivery of training.

As far as AIOU is concerned, participation and cooperation occurs at the managerial and operational levels. Meetings with districts at the village level are conducted to get their cooperation and

participation. As result, AIOU gets to use the formal school buildings and their facilities; they were likewise able to identify places and local teachers at the village level for the centers. As well, Village Education Committees have been organized to manage and arrange to supervise the centers. Each committee is composed of three influential males, and three females. They are responsible to meet the requirements/problems relating to the centers, its teachers, and students. They assess activities on a regular basis. In effect, implementation becomes participatory at the community level giving the community a hand in its growth and development.

The depth and breadth of OPAPA's networking and partnership with agencies within and outside the agricultural sector, within and outside of the Philippines, is unparalleled. It is linked with: offices within the Department of Agriculture; other line agencies such as the Department of Science and Technology and the Department of Agrarian Reform; the academe, exemplified by the UP Open University, the Development Academy of the Philippines, and provincial state colleges of agriculture; the CGIAR; and the private sector, specifically, SMART Communications and Internet Cafe establishments. Given this structure, we may conclude that the institutional, virtual and social networking arrangements of OPAPA present a culture of information and knowledge sharing.

STOU engages a wide range of stakeholders in the development and delivery of its courses and programs. At the level of policy development, STOU networks with relevant agencies such as the Ministry of Education (especially the Non-Formal Education Department and the Institute of Distance Education), the Ministry of ICT, the Ministry of Interior, the Ministry of Labor, and the Ministry of Agriculture and Co-operatives. At the level of program and content development, STOU networks with other universities and other knowledge-based institutions in Thailand and elsewhere, with a goal of managing and sharing knowledge for the benefit of all partners. At the level of implementation, STOU works with local governments, schools, colleges, and other agencies in order to mobilize local knowledge and other resources. As one example, the delivery of an "HRD Empowerment Curriculum" has been facilitate through working with some 7,000 Local Administrative Bureaus across Thailand. Also

at the level of implementation, STOU partners with various agencies responsible for maintaining and administering the media through which STOU courses and programs are delivered (e.g., satellite broadcasting). Perhaps most importantly, STOU makes use of an extensive outsourcing network, drawing in expertise from other post-secondary institutions, government agencies, and private businesses.

The work of SAFT depends fundamentally upon the engagement of regional stakeholders, as its ODL courses are delivered to twelve different countries. Collaborating partners such as Ministries of Agriculture, Ministries of Education, and NGOs contribute significantly through the provision of facilities, staffing support, and research inputs. Regional agricultural departments of South Pacific Island countries have greatly contributed to the practical needs of students taking ODL course through SAFT. In some departments, there is a special training unit established to accommodate the practical needs of tertiary students studying locally or abroad. For example, in Solomon Islands, the training unit of the Department of Agriculture and Livestock takes care of practical training needs for tertiary students.

Local tertiary and secondary institutes also provide assistance to SAFT ODL students. With collaborative dialogue between centre directors, institutional heads and educational authorities, ODL students are given the opportunity to undertake research work in the facilities such as libraries, laboratories, trials and school farms and classrooms. For one example, in Solomon Islands, students taking agriculture courses through SAFT are free to do research in the Solomon Islands College of Higher Education Library, laboratory and School farms and its trial units. Agriculture Science Teachers undertake their teaching practicum through local high schools.

The wide range of specialized expertise and scientific publications from regional bodies such as the South Pacific Commission (SPC) and the Food and the Agriculture Organization (FAO) of the United Nations have considerably contributed toward the academic advancement of students taking ODL courses through SAFT. The SPC and FAO had provided literature which ODL students have been using in their studies. SPC provides free agricultural and nutritional publications to SAFT.

Using sound pedagogical and administrative models

There has been a substantial number and range of ODL experiences over the past several decades in developing countries. While ideal models and practices have yet to be developed, practitioners and scholars have done much to critically examine ODL and make its application more appropriate to diverse circumstances around the world. Over the past decade, the practice of ODL in both developed and developing countries has evolved substantially. Box 1 outlines some of the practices that have been found to be useful in the delivery and administration of ODL.

Box 1: Best practices in ODL

Establish a purpose and engage the stakeholders
- the purpose of the distance education initiative is grounded in a significant issue or problem
- stakeholders to the initiative are identified, understood, and effectively represented in processes of analysis, planning, implementation and evaluation
- programmatic objectives are defined, and the place of distance education strategies in the accomplishment of these objectives is identified

Analyze instructional possibilities and define learning objectives
- the characteristics of the target populations of learners are understood, and the main features of their learning environments are known
- the substantive content (subject matter) of the initiative is well-understood, and desired learning outcomes (changes in knowledge, skills and attitudes) are stated
- concrete learning objectives are defined

Identify resource requirements and marketing strategies
- fixed and variable costs are assessed and budgeted
- adequate resources are mobilized to support the initiative
- marketing, recruitment and selection strategies are devised to ensure that an adequate number of appropriate learners take part in the initiative

Design instructional content and process
- a course development team is assembled to ensure adequate expertise in the subject matter, the instructional design process, and the media of communication to be used
- substantive content is organized into short and focused modules
- the teaching and learning process is designed to involve a range of instructional methods (e.g. presentation, discussion, tutorials, drill and practice, simulations, group problem solving)

Design delivery strategies and materials
- potential delivery strategies are identified (print, audio and videotapes, radio and television, teleconferencing, computer-based instruction and computer conferencing)
- the mix of media for the initiative is determined based upon nature of the learners, learning objectives and instructional methods, in the context of the economic and logistical feasibility of different options
- educational materials and processes must be designed for each delivery strategy

Administer teaching and learning at a distance
- educational materials are produced or purchased, stored and distributed
- systems to enable communication between instructors and learners, and between learners and other learners, are developed and maintained
- instructors are given orientation, training and support in their role as distance educators
- learners are oriented to distance learning, and integrated in student support and record-keeping systems

Facilitate learning
- learners enroll and learning materials are delivered to them
- learners work toward learning objectives through independent study, and through interaction with instructors and other learners

Assess learning
- learner outcomes (satisfaction, learning, behavior change, impact) are evaluated
- in formally accredited initiatives, learning is assessed through much the same processes as in conventional education (e.g. examinations, essays, projects, evaluations of practical experience, etc.)

Evaluate the initiative
- pre-testing and formative evaluation of educational materials and processes is undertaken regularly
- summative evaluation processes lead to improved planning and implementation activities, and inform the ongoing analysis of the purpose of the initiative itself

AIOU has a well-structured, systematic, and organized teaching-learning process using the distance learning mode. The notion of providing access to education via distance education strategies was anchored on the fact that education is expensive, increasing population, women are marginalized culturally, geographically difficult for students to go to the schools, and foremost would perhaps be many are poor. On that basis, programs are developed to address all levels of learners from pre-literacy to post-graduate education. All sectors are likewise taken into account to include programs in teacher education, economics, agriculture, rural development, community health and nutrition, forestry education, business administration, environmental design, and many more. Courses that were developed in close coordination with agencies needing these competencies.

In general, the university uses multi-media techniques which includes learning packages (course books/reading material, assignments, tutorial schedule, radio/TV schedule, general student course guide, assignment forms); radio and television broadcasts, especially prepared for distance learners; course assignments as an instrument both of teaching and continuous assessment; and tutorial instruction

through face-to-face learning at study centers, or correspondence and workshops when necessary.

Materials undergo pre-testing prior to mass production and distribution. A design section for each college, institute or department is put in place. At IME for instance, the Design Section has developed science books, Urdu book, English books, Women basic education, charts, graphs, magazine, brochures, and any other printed material. AIOU works collaboratively with the Pakistan Broadcasting Corporation and Pakistan Television for broadcast materials. A separate Institute of Educational Technology was established to produce audiovisual materials to promote and support the distance teaching courses of the university. Pakistan has also launched the 2nd TV Channel for Education with assistance from Japan that covers 75 percent of the population.

In term of assessment, each full credit has four assignments and a half credit course has two assignments. Students are required to complete and send to their tutors for assessment. The assignments are given to enable a student to have one's performance assessed by tutors regularly, to enable tutor to give instruction to students through comments and corrections on the assignments; and to act as a pacing device for students during their period of study. The marks or grades of students are sent to the Controller of Examinations for the preparation of results. They also have final examination at the end of the semester. The overall result is based on a combination of continuous assessment and final examination. There are workshops and practical examination conducted if required as part of the overall assessment. The process is quite tedious and highly controlled that would ensure quality of graduates. Feedbacks from VECs form part of continuously upgrading materials and performance.

1. Summary of the case studies

The body of this report has provided a synthesis of five case studies according to five principles of ODL for agriculture and rural development in low-income countries. According to these principles, ODL should:

11. Be undertaken for the right reasons;
12. Be sensitive to the context in which it is being applied;
13. Make use of existing infrastructure, with sustainable cost structures;
14. Engage stakeholders in participatory processes; and
15. Use sound pedagogical and administrative models.

Rather than repeat this framework, the summary to this report will describe each of the five case studies individually. The complete case studies are available for review at [http: - web URL here later]. Each case study was included in this project due to some level of innovation or best practice from which others could learn. While none of the institutions described in this project would claim to be perfect, they each have one or more innovative features.

MANAGE is a national government institution dedicated to serving and strengthening the agricultural extension system throughout India. The innovative features of this case study focus on:

- **Collaboration**: a high level of networking with state agricultural universities, non-governmental organizations, research institutions, international agencies, and public and private sector organizations.
- **Efficiency**: an organizational structure based on modest base budgeted staff and resources, blended with the extensive use of consultants and contractual arrangements.
- **Effective use of technology for learning**: making best use of state-of-the-art ICTs, including video conferencing networks, a mobile VSAT van, and information kiosks using Wireless-in-Local Loop (WILL) technology.

AIOU is an ODL institution dedicated to providing basic, secondary, and post-secondary education to people throughout Pakistan and elsewhere. The innovative features of AIOU at the heart of this case study are:

- **Gender sensitivity**: AIOU has achieved substantial success in promoting the education of Pakistani women.

- **Basic education**: AIOU has successfully developed and delivered courses and programs to illiterate and semi-literate people in rural areas.
- **Geographic reach**: AIOU courses and programs are made available to rural and remote villages, despite the considerable challenges of a mountainous geography.
- **Sustainability**: AIOU generates nearly 90% of its budget through sources other than government support.

OPAPA is a network of institutions dedicated to providing education, training, and extension services in support of farmers and others engaged in agriculture and agri-business in the Philippines. The innovative features of the OPAPA case study are:

- **Networking**: OPAPA has brought together an unprecedented network of government agencies, academic institutions, and corporate businesses.
- **Public / private sector partnerships**: OPAPA has partnered with SMART (mobile phone provider), and numerous Internet Cafés to serve as a sustainable and practical venue for training extension workers.
- **Last mile linkages**: OPAPA has successfully used a remarkable blend of communications technologies (from radio to cellular telephony) to reach even remote farmers.

STOU is the only state-supported ODL institution dedicated to providing university-level educational opportunities to people throughout Thailand. The best practices of this case study relate to the following key features of the institution:

- **Networking and partnerships**: STOU engages in partnerships with a broad range of organizations and individuals.
- **Practicality of learning:** STOU courses and programs are focused on the practical needs of the learners.
- **Accessibility:** STOU courses and programs are accessible to various kinds of learners scattering around the country, making the institution known as the "People's University."

- **Acceptability:** STOU courses and programs are appropriate to the skills and lifestyles of participating students.
- **Validity of content:** STOU courses and programs have high quality subject-matter content, such that graduates are recognized by Thai society.
- **Economics:** STOU makes its courses and programs available at an affordable price, to serve its mission of "to open opportunities for all".

SAFT is dedicated to teaching, research, and service related to agriculture across a dozen Pacific Island countries. The innovative features of SAFT outlined in this case study are:

- **Collaboration**: SAFT works closely with government departments, other secondary and post-secondary educational institutions, non-governmental organizations, and regional agencies to support the ODL experiences of students.
- **Geographic reach**: SAFT uses correspondence and audio-conferencing systems to make courses available across twelve countries and massive distances.
- **Practicality of learning**: SAFT courses and programs are focused on preparing professionals and technicians to undertake key roles with public and private sector employers in agriculture and food systems across the Pacific.

III. RECOMMENDATIONS AND CONCLUSIONS

2. Recommendations from each case study

The authors of each of the case studies independently developed recommendations based upon the ODL experiences of the specific institution under review. These conclusions are summarized here, under the pertinent sub-headers.

National Institute of Agricultural Extension Management

MANAGE was established in 1987, and has worked since that time to build the capacity of the agricultural extension system in India. The key lessons emerging from the MANAGE case study can be summarized as follows:

- ICTs provide an excellent opportunity and low-cost options to the existing institutions to increase their outreach manifold. The Video Conferencing network can be used effectively to provide a highly effective open and distance-learning environment.
- There is no need to have all the experts on your rolls. You can use their services on need basis, using ICTs and also having flexible contractual arrangements.
- All the technical resources need not be at one place. You can use the best of the technical inputs from wherever these exist. You only need to network with the best institutions and individuals.
- A mix of technological options should be used to provide optimal learning materials to the learner. The evaluation can also be done using web-based services.

The MANAGE case study concluded that ODL is one of the key facilitators for providing quality education in extension sector and one of the driving forces for successful implementation of rural education goals. The authors of the study observed that successful integration of ICT with rural education depends on the following strategies.

Strong Policy Support

The creation of a conducive policy environment for the introduction of ICT in rural education is essential. Key decision makers and stakeholders need to make informed decisions about which ICT are most appropriate for their contexts and needs. The link between ICT and many developmental challenges is not always intuitively obvious, especially for countries with high levels of illiteracy, low level of basic

tele-communication infrastructure and high levels of debt. Integrating ICT in rural education is a complex multicultural endeavor, requiring analysis, political will and concerted action across a wide spectrum of sectors and actors. The policy makers at all levels require "enabling" policy support to make rural education as a main political agenda.

Capacity Building

The most critical factor in the successful integration of ICT into rural education is the extent to which the teacher educators have the knowledge and skills for modeling the use of ICT in their own teaching practices. A well-conceived and sustained program of professional development is, therefore, required to enable the teacher educators to develop these skills. The professional development of a teacher may follow the cascade model where the core resource team will train a group of national level master trainers and educators. Organizing training program for master trainers in pedagogy-ICT integration is one of the key strategies for implementing ICT in rural education successfully. As the master trainers progress through the training program, they have the opportunities to collaborate, share and exchange information and knowledge about successful approaches, models and good practices in pedagogy-ICT integration in nationally, regionally and locally specific contexts. The program should place teachers at the centre of capacity building process and activate them to play key roles in integrating ICT for improved teaching and learning.

Appropriate use of ICT

ICT means different technologies in different national/local contexts. Appropriate models for the effective use of ICT remain to be developed to suit learning needs in the varied contexts of the Asia & Pacific region. Different learning environments need different ICT and, as such, a comprehensive approach needs to be taken prior to selecting technologies. However, the common characteristics of ICT need to be simple, user friendly, sustainable and vernacular based. In rural setting, design of proper user-friendly interface is a critical

parameter for successful implementation of any technology-based solution. Care has to be taken to design attractive, user friendly, simple graphical user interface system with touch screen and other innovative methods to suit the particular needs of the rural people.

Community Participation & Local Content

Successful effort to integrate ICT with rural education needs community participation. Stakeholders' participation is a vital ingredient for the success of rural development efforts. Individuals and communities affected by development activities should be involved in decision making from the design stage. Experiences show that projects that employ participatory approaches have a much higher rate of success, because stakeholders have ownership and the control of the development process. The participatory approach is a complex and long drawn process, involving various agencies, rules and regulations and technical aspect. But the core of the participatory approach is people, particularly empowered people. Special effort has to be undertaken to place people at the center stage of development. The use of ICT could assist in identifying community concerns and help to facilitate the communication process between communities and other stakeholders. In addition there is an urgent need to develop local content for greater community participation in the developmental program.

Allama Iqbal Open University

AIOU was established in 1974. The university had used ODL methods to address the geographical, political-economic, and cultural barriers to educational access and equity in Pakistan. The scope of AIOU is impressive: of a national population of 162 million, some 23 million have taken part in AIOU courses and programs. The author of the AIOU case study identified the following lessons learned:

- Economies of scale (AIOU's enrollment in 2004-2005 is more than 1.5 million) can be combined with low tuition fees and organizational efficiency to make basic, secondary, and post-secondary education programs self-sustaining.

- ODL can respect cultural traditions while helping to alleviate poverty and solve gender inequalities in education.
- The full support of government is important, and at AIOU this is ensured by having the President and the Minister of Education serve in leadership roles within the institution.
- ODL for rural poverty reduction needs to focus on practical and applied course offerings (instead of the traditional subjects), and be delivered through "hands-on" teaching methods.
- The continuous upgrading of staff and faculty is essential to sustaining the quality of ODL courses and programs.
- Religious and gender issues are complex, with women being on the one hand disadvantaged in the conventional educational system, while on the other hand being encouraged to have a strong role in educating children.
- Nation-wide regional study centers and coordinating offices ensures a physical presence, and gives credibility to AIOU.
- A mixed package of materials enhances the teaching-learning process although the choice of media must be appropriate to the learners involved.

IV. Open Academy for Philippine Agriculture

The major lesson in OPAPA is the importance of partnerships and networking. Perhaps the most popular IT adage is found in Moore's Law, which states that, technology-wise, computing power doubles every eighteen months. A lesser known IT principle is the Network Effect. Otherwise known as Metcalf's Law, after the head of the Ethernet development team, the Network Effect states that the total value of a network where each node can reach every other node grows with the square of the number of nodes. Perhaps the major achievements of OPAPA during its first two years of operations validate Metcalf's Law. Surely, this network has generated synergies greater than what conventional organizations can muster.

On the other hand, systems theorists submit that networks, be they institutional, social or electronic, are organic living systems that are subject to the same principles of life, entropy and decay as other

living organisms. It has been argued that knowledge networks have three prerequisites. Firstly, one needs a good IT infrastructure with respectable bandwidth to accommodate the functionalities and applications associated with the storage, sharing and reuse of digitized or captured knowledge. Secondly, one requires an appropriate workflow or process for knowledge sharing and reuse. Lastly, the organizational environment or culture for knowledge sharing and reuse is an absolute imperative. These prerequisites hold true in the development sector as well, with one main difference. The goal of knowledge management in the rural development context is not limited to the sharing and reuse of knowledge to increase the bottom line but covers a much more complicated set of outcomes, which we refer to as the Millennium Development Goals. The third prerequisite – a conducive organizational environment or organizational culture for knowledge sharing – seems to be the factor that has generally been neglected in Web-based rural information systems and has been adequately addressed in the Open Academy for Philippine Agriculture. What constitutes this conducive organizational environment should be the focus of a further study.

Sukhothai Thammathirat Open University

STOU has been in operation since 1978. Through flexible design, the university has been able to extend educational opportunities to people in all walks of life, especially those in remote areas, and those studying on a part-time basis. The authors of the STOU case study identified the following lessons learned:

- Learners in the distance education system need a flexible curriculum structure. STOU has provided both degree and non-degree programs. Short courses, such as those provided in Certificate programs, the Certificate of Achievement program and the Associate Student programs, are offered in order to meet the demands of individuals and agencies for personal and professional development.

- Adult learners need flexible learning schedules. The multi-media approach helps to meet these needs. Tutorials are optional and help on Saturdays and Sundays. Examinations are also organized on weekends at local study centers. These arrangements are necessary for successful teaching at a distance.

- Existing facilities and resources are necessary for distance education. As students are spread throughout the country, existing local facilities and resources have to be utilized for the benefit of students. STOU has maximized the use of these facilities, such as the secondary schools, teachers' college, hospitals, health centers, agricultural stations, and public libraries. Human resources, such as businessmen, lawyers, bankers, and nurses, are recruited as part-time tutors.

- Flexible learning systems of distance education require efficient management systems. The management of distance education at STOU is conceptualized as consisting of different integrated systems: admission and registration, production, delivery, instruction, examination, and administration. Each system requires sound planning, communication, co-ordination, and co-operation. It also needs appropriate infrastructure.

- From STOU experiences, the cost of providing distance education seems to be less expensive than in restricted-admission universities. The economy of scale helps to reduce the average institutional cost. Costs to society are also less: taxpayers contribute only about 20 percent of the total institutional costs. Also, students themselves are adult workers and do not, therefore, forego their income. Costs to the students themselves are less as they study at home.

- STOU might be called as the "University for those with Less Opportunities in Thailand." Rural people or rural communities in Thailand are among those with less opportunities in Thai society. It could be said that STOU is the only state university in Thailand that uses the strategies to empower rural communities through both direct and indirect methods.

University of the South Pacific, School of Agriculture and Food Technology

SAFT was established in 1977 in order to promote agricultural education and training in the Pacific Island countries. SAFT offers programs at the diploma, undergraduate, and graduate levels, and it provides ODL courses in Agricultural Economics, Agriculture Systems in the Pacific Island Economies, Applied Statistics for Agriculture and Biology, Soil Science, Soil, Water and Structure Engineering, Agricultural Biology Animal and Human Nutrition, Farm Management Principles, Methods of Materials of Teaching Agricultural Extension, Crop Production, Animal Physiology, Teaching Agricultural Science, and Pest and Disease Management. In the past four years, SAFT has had an average of 490 students per year enrolled in ODL agricultural courses.

The author of the SAFT case study offered the following key lessons learned:

- A multi-media mode of delivery is suitable for a diverse cultural and regional learning environment.
- A reliable and cost-effective mailing system is needed for an ODL system in countries separated by mass of sea water.
- Practical-based courses require necessary resources and national government support in order to provide effective learning.
- ODL programs should be adapted to regional needs, and be culturally sensitive.
- DFL programs can only be effective in well-established network and infrastructure.
- Operational cost for DFL programs must be sustainable.
- DFL programs need innovative pedagogical and administrative practices.

Overall Recommendations and Conclusions

Results of the study gave rise to the following recommendations and conclusions:

1. It is important that ODL initiatives aimed at rural poverty reduction and agricultural development follow the five principles defined in this paper. ODL should:

   16. Be undertaken for the right reasons;
   17. Be sensitive to the context in which it is being applied;
   18. Make use of existing infrastructure, with sustainable cost structures;
   19. Engage stakeholders in participatory processes; and
   20. Use sound pedagogical and administrative models.

   It is recommended that COL and other stakeholders to this project should promote widespread commitment to these basic principles of ODL in initiatives related to rural poverty reduction and agricultural development.

2. The five case studies developed for this project clearly indicate that successful innovations and best practices have been achieved by a number of institutions in Asia and the Pacific. The keywords that run through this synthesis report are: collaboration, networking, public/private partnerships, efficiency, effective use of technology for learning, practicality of learning, accessibility, acceptability, validity of content, economics, gender sensitivity, basic education, geographic reach, and sustainability. Such keywords, in the context of the basic ODL principles, provide important guidance to those seeking strategies to address the challenges of rural poverty reduction and agricultural development. It is recommend that COL and other stakeholders to this project work to develop further understanding of innovation and best practice related to ODL for rural poverty reduction and agricultural development around the world.

3. Knowledge about such successful innovations and best practices could be usefully and economically disseminated throughout the world. There are a range of options for the dissemination of such knowledge, including:

- The website to be developed as part of the project itself (with the synthesis paper and the complete case studies).
- Print-based publication of project documents.
- Publication of a summary paper in a scholarly or professional journal.
- Presentation at conferences where leaders and professionals from pertinent organizations are in the audience.
- Invitational workshops for specific stakeholders.
- The establishment of an on-line community of practice, with members drawn from various institutions from across Asia and the Pacific. This community of practice could play a catalytic role of sharing and disseminating best practices adopted by the national institutions on a regular basis. It could also act as a think tank for the Asian national policy makers in ODL policy and practice. The community of practice could be initiated as a list-serve to which appropriate individuals are invited to participate. If such a community were to flourish, then an interactive website could be developed, and possibilities for face-to-face meetings around established regional events could be developed. It is recommended that COL and other stakeholders to this project explore and pursue these options for the dissemination of knowledge regarding successful innovation and best practice in ODL for rural poverty reduction and agricultural development.

4. Dissemination would contribute to capacity-building efforts, and ultimately to a stronger role for ODL strategies in the pursuit of agricultural development and rural poverty reduction in developing countries. To replicate or adapt what has been demonstrated by these five case studies would require other institutions to engage in strategic planning and capacity-building exercises. Strategic planning would be important in order to determine how some of the innovations and best practices described in this report would fit different institutional missions, environments, and cultures. Adopting such innovations and best practices would require the investment of resources, and a strategic planning process would help institutions organize for the mobilization, monitoring, and evaluation of such investments.

Beyond strategic planning, capacity development will be required in order to ensure that the institution and its staff members are prepared to successfully adopt such innovations and best practices. By institutional capacity building we refer to developing the knowledge, skills, and attitudes of leaders and staff members, as well as to facilitating organizational development such that an institution is better able to support the work of its staff and partners. It is recommended that COL and other stakeholders to this project promote holistic and integrated processes of strategic planning and capacity building among institutions having a mandate to apply ODL methods to the challenges of rural poverty reduction and agricultural development.

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APPENDIX. INSTITUTIONS STUDIED

The **National Institute of Agricultural Extension Management (MANAGE)**, is a premier national institution of the Indian Ministry of Agriculture. The mandate of the Institute is to develop, test and implement innovative extension systems and models in India. In the last five years, MANAGE has tested the innovative use of ICTs to enhance the communication capacity of the agricultural extension system in the country. MANAGE has installed and used a videoconferencing system connecting 40 national centers of excellence in the areas of agriculture and agricultural extension and training. MANAGE has also piloted the use of mobile videoconferencing to directly link farmers with researchers and policy makers. With costs falling for these technologies, such innovations present a huge opportunity for improving the communication capacity of agricultural extension systems. The innovation keywords of the MANAGE case study are collaboration, efficiency, and the effective use of technology.

The **Allama Iqbal Open University** (AIOU), established in 1974, was the first distance education post-secondary institution in Asia and Africa. It is Pakistan's response to filling the gaps left by the conventional system and taking education to areas and groups unable to benefit from that system of education. AIOU has received the UNESCO NOMA and Raja Roy Sing awards, recognizing their achievements especially developing a teacher training program and more than 400 courses for illiterates and semi-literates. Program offerings range from secondary to PhD levels consisting of 1000 courses to choose from. Since it started, cumulative enrolment now stands at more than 23 million students. The Pakistan experience has shown how a poor country can take advantage of distance education as an alternative mode of developing the capacities of its people for greater productivity. Inasmuch as traditions greatly impede women from enjoying equal rights with men, distance education has explicitly been utilized to address those inequities. Given its topography, and its increasing population living in mountainous areas

where educational facilities and access to information is scarce, distance education is of great benefit. The innovation keywords of the AIOU case study are gender sensitivity, basic education, geographic reach, and sustainability.

The **Open Academy for Philippine Agriculture** (OPAPA) is a network of institutions providing education, training and extension in agriculture, specifically to researchers, extension workers, farmers, and support service providers. It is an alliance of national, local, and international organizations that will utilize and tap existing network infrastructures, their content and information databases, in an open environment using ICT and distance learning. It links policymakers, researchers, service providers, markets, business organizations, and farm communities. The Philippine Rice Research Institute serves as the lead agency assisted by several partners representing government line agencies, the academe, international agricultural research agencies, and the private sector.

Sukhothai Thammathirat Open University (STOU) was formally established in 1978 as the first university in Southeast Asia to use open and distance learning. The STOU system is the eleventh state university of Thailand, and has a mandate to serve life-long education, to improve the quality of life of the population, to upgrade the educational and professional qualifications of working people and to expand educational opportunities at all levels. STOU uses the following open and distance learning strategies: self-learning package, radio programs, television programs, satellite programs, CAI, audio and video on demand, online learning, professional experience activities, and tutorials. In addition, face-to-face educational services are provided at study centers, regional distance education centers, provincial study centers, and the “STOU corners” in main public and high school libraries across Thailand. STOU services are provided all over the country, to ensure access to quality education to all Thai people. The innovation keywords of the STOU case study are practicality, accessibility, acceptability, validity, and economics.

The **University of the South Pacific, School of Agriculture and Food Technology** (USP – SAFT) in Samoa is a premier regional institution for providing tertiary education in agriculture to 12 Pacific Island countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. As one of the Schools of the University, its mission is to maintain, advance and disseminate knowledge through teaching, consultancy and research and otherwise, the provision at appropriate levels of education and training responsive to the well-being and needs of the communities of the South Pacific. The School of Agriculture and Food Technology, through its distance and flexible learning (DFL) initiatives, has provided agriculture degree courses to potential technical agriculture staff, extension staff, agricultural science teachers, and many others who come from agriculture related areas. DFL courses are currently offered through print-based materials and supplemented by audio-visual materials, satellite tutorials, and audio-conferencing. In the near future, SAFT will start offering its courses on-line.

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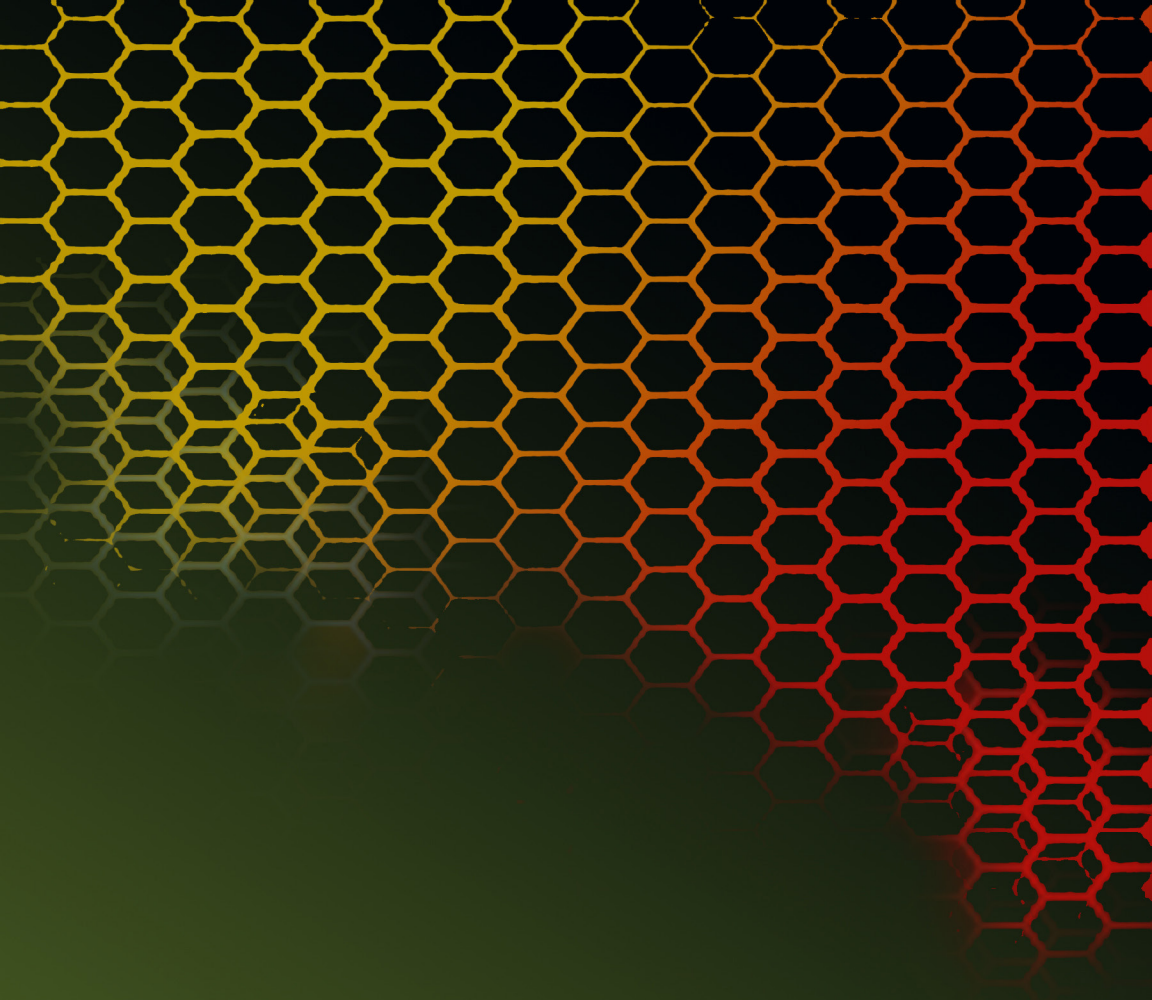

ABOUT THE BOOK

This volume was originally compiled in 2008 as required reading in MMS 130 (ICT4D. Information and Communication Technology for Development) offered under the Bachelor of Arts in Multimedia Studies (BAMS) Program of the UP Open University. It was a product of field experience, a collection of grey literature and fugitive materials produced in our consulting sorties in Asian countries. Before the BAMS program, there were no formal courses on the subject nor were there any texts. With the highlighting of best practice and lessons learned, the restructuring of the text, and the inclusion of learning objectives and self-assessment questions, the compilations were transformed into what we feel, is a comprehensive textbook on information and communication technology for development.

A.G. Flor and B.G. Flor