INFORMATION TECHNOLOGY USE IN DEVELOPING COUNTRIES

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Chapter I: Introduction

Our world is undergoing through a dramatic phase characterized by rapid changes and developments. Phenomenal advances in information and communication technologies have led to the emergence of a new global communication environment. The rapid movement of information across local, national and international borders is contributing to revolutionary changes in various dimensions of our life and activity. Information technology (IT) is now embedded in various sectors, including agriculture, commerce, education, health, mining, banking and transportation, and many other activities such as these are becoming increasingly fast, flexible and information-intensive. In other words, even though modest at the macro level, IT is transforming the economy, the nature of growth, occupations and how people use their time, according to a report published recently by the OECD (2000).

Our times are, one must admit, quite challenging in every way, indeed. Connectivity has assumed the status of a new buzzword in the global village where readiness for development depends considerably on network infrastructure, technology diffusion and skills. This simply means that development, the OECD report indicates, can not be possible in places where there is no strong growth in information infrastructure and in Internet use. Electronic commerce, for example, can not be promoted or fostered without strong growth of infrastructure, including narrow and broadband access, and the accompanying growth of Internet usage. The OECD report says:

> As firms in all sectors continue to invest massively in IT, the impact is likely to begin to appear at economy-wide level. The rapid diffusion of IT in individual firms has transformed the organisation of value-added chains, affecting all business aspects from design to distribution and resulting in more efficient production and sales processes. Information and telecommunication networks have become essential tools in global business.

However, there is no guarantee that information's value and benefits we derive from information technology use will be equitably shared or allocated in society. New IT is, in fact, as various indications suggest, exacerbating income disparities between rich and poor nations and rich and poor people. One clear indication of this growing disparity can be noticed in the structure of available investment and skills in many developing countries. It is true that many developing nations are worried, more than ever, about lack of investment and shortage of skills in the IT sector. Confronting inequity in the global "*Information*

Marketplace" [1] is now a highly formidable task for a large number of countries, particularly those that are least developed. Michael Dertouzos (1997) describes this situation succinctly:

> This inequity of information's value for rich and poor gives rise to an unfortunate instability. With the productivity gains made possible by all the information and information tools at their disposal, the rich nations and rich people of the world will improve and expand their economic service, thereby getting richer. As they get richer they leverage the Information Marketplace even further, thereby experiencing exponentially escalating economic growth. The poor nations and poor people, by contrast, can't even get started. They will tend to underuse information resources, because they can't afford them. They will gain no such leverage. There will be no rising spiral. They will stand still, which in relative terms means falling exponentially further behind the rich.
>
> The painful conclusion is that, *left to its own devices, the Information Marketplace will increase the gap between rich and poor countries and between rich and poor people.* (p-241)

In the race to lay claim to knowledge, "the global gap between haves and have-nots, between knows and know-nots, is widening" warns the Human Development Report 1999 (UN development Programme) published a year ago. Writing computer programs and revealing genetic codes have replaced the search for gold, the conquest of land and the command of machinery as the path to economic power, says the Report. The Internet is "the fastest-growing tool of communication ever," with the number of users expected to grow from 150 million today to more than 700 million in 2001. What will the scenario be like in 2001 and after?

Despite great strides in information and communications technology, many of those who most need access cannot, unfortunately, obtain it. An invisible barrier has emerged on the scene that, "true to its name, is like a world wide web, embracing the connected and silently, almost imperceptibly, excluding the rest, and everywhere", the Report points out. In the same vein, the Report further states that Internet access divides educated from illiterate, men from women, rich from poor (a computer, for example, costs the average Bangladeshi more than eight years' income, compared with one month's wages for the average American), young from old and urban from rural. The literally well connected have an unfair and overpowering

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[1] The term "*Information Marketplace"* was first used by Michael Dertouzos when information revolution was beginning to emerge. Describing the term in 1981, he said:

> By *Information Marketplace* I mean the collection of people, computers, communications, software and services that will be engaged in the intra-organizational and inter-personal informational transaction of the future. These transactions will involve the processing and communication of information under the same economic motives that drive today's traditional marketplace for material goods and services. The Information Marketplace already exists in embryonic form. I expect it to grow at a rapid rate and to affect us as importantly as have the products and processes of the industrial revolution.

advantage over the unconnected poor, who are, in most cases, illiterate and whose voices, needs and concerns are being left out of the global dialogue and conversation.

Only a year ago, the UN Commission for Science and Technology for Development (UNCSTD, 1998) clearly indicated that failure to give priority to the measures needed to address the emerging Global Information Society will exacerbate the gap between the "haves" and the "have-nots". Lanvin (1996) also warns that failure to make connections feasible for all could conceivably result in a dangerous situation in which only a critical mass of developing countries would upgrade to the global information economy, excluding entire regions and subcontinents (including most of Africa) from its benefits. Such a failure would cause immeasurable harm to the standards of living, health, and environment of these regions. Consequently, abject poverty, coupled with heightened isolation, may also exacerbate underground political movements, corruption and illegal traffic of all kinds. "For the North, further performance divergence among poorer countries would thus translate into additional threats to free trade, health, the global environment, and governance", says Lanvin.

Optimistically, information and communications technology are, the UNDP Report notes, tremendous tools for development and can open a fast track to knowledge-based growth, a track followed, for example, by India's software programming, Ireland's computing services and the Caribbean's data processing.

We are well aware that of all the many technologies of our time, IT's influence has been the greatest on the global economy, "making it possible to collect, process, and transmit information at breathtaking speed and declining cost, thereby increasing productivity and improving quality in all types of industries and services." (Hanna, Guy, Arnold, 1990:7). Considered in economic terms, IT has become one of the most important single factors in development in many developing nations, and it can address some of the mounting challenges confronting poor countries, notably, "fighting poverty; reducing the isolation of rural areas; educating more people and supporting lifelong learning; making government more efficient, accountable and transparent; increasing the effectiveness of economic reforms; monitoring and protecting the environment; promoting small and medium-sized enterprises; and participating in global trade", according to Talero (1997:290).

IT can, in a number of ways, facilitate transfer of work from developed countries to developing countries. For example a few countries, mainly in the Caribbean and the Philippines, are helping to meet the data processing needs of the U.S. and Canadian banking, insurance and airline industries over telecommunications links -- a system that some call "teleporting." It is estimated that the total value of these transactions has reached $30- $40 billion annually, according to a UN Development Programme study.

Citing an example of the impact of internationalization of services on developing countries, Braga (1996) says:

> Progress in IT is making it possible to unbundle the production and consumption of information-intensive service activities. These activities--e.g. research and development (R&D), computing, inventory management, quality control, accounting, personnel, secretarial, marketing, advertising, distribution, and legal services--play a fundamental role not only in service industries but also in manufacturing and primary industries. In the United States, for example, as much as 65-75 percent of employment in manufacturing may be associated with service activities. With progress in IT, outsourcing--supply by an external entity of a service previously provided in-house--has become feasible. And, as communication costs continue to fall, the potential for international outsourcing grows.

Literature review indicates that guarded optimism about IT's role in the development process, as well as awareness of its negative, unintended impacts are shared by many authors and writers from different countries and regions of the world. Among Information Revolution's many (potential) benefits include widened potential for citizens to be interconnected to one another and to their government (Toffler, 1980); cautious optimism and awareness of IT's world-transforming power (Dertouzos, 1997); IT's great positive impact (Gilder, 1989); and Information Revolution's greater and qualitatively different impact than any other previous phenomenon (Kahin and Nesson, 1997) are points worth considering.

Impressed by IT's positive features, several other authors note that IT can be instrumental in: promoting speedy economic development (Schware, 1991; Moussa and Schware, 1992; and Pool, 1987), spurring growth in a number of other areas as a result of the introduction of new IT tools and appliances (Lesser ad Osberg, 1981; Hudson, 1984); enhancing greater degree of mobility (Cherry, 1977); and reducing time and distance barriers, thereby making commerce from distant and remote areas more economical (Robinson, 1996).

1.1. Scope and Methodology

The attempt here is not to try to unravel how information technologies or technology systems are adopted and with what social impacts. Instead, the objective is to present a picture, drawing upon the large and growing literature, available in print and on the Web, on information technology use in developing countries. IT use is reflected by various projects/practices and initiatives, both operating and being planned or shortly underway, particularly in least developed and low-income countries. There are altogether 61 low-income countries or economies grouped by Gross National Product (GNP) per capita of US$785 or less and they comprise all the least-developed plus a few other countries. It is not intended to be a broad review or summary account of hundreds, if not thousands, of such activities and initiatives. Rather, it is only a small sampling of projects, programs and practices, some of which are sketchy and a few, even anecdotal, occurring in various developing country settings. The aim is to provide a general sense or cursory view of

how IT and associated technologies are put to use. The report would, hopefully, provide some ready references for our on-going discussions.

Information and data for the report were assembled from a variety of sources, including published (and some unpublished) references that were available, World Wide Web Pages, (author's) personal communication via e-mail, telephone and fax with various people in different places. On the whole, this report is an effort to portray a glimpse of IT activities in developing countries within the bounds set by time and resources.

Chapter II: Information Infrastructure in Developing Countries

In developing countries most information infrastructure initiatives are traditionally concerned with the development of facilities-based telecommunications and, to a limited context, computing. Issues concerning strategies for privatizing, deregulating, or encouraging competition for voice carriers are now beginning to surface. However, many other challenging issues such as technology policy, trade policy and general economic liberalization that are driving telecommunications reform are, it seems, not taken into serious consideration. Also, many developing countries are lagging behind in envisioning the increasingly digital nature of new information infrastructure as a result of a series of new developments in information technology and networking. In fact, to-day's information infrastructure requires a high level of coordination of vision, policy, and strategy across sectoral and institutional boundaries. Securing appropriate infrastructure for education, health, environment, and government operations is another vital task in this process.

Unfortunately, many developing countries seriously lack appropriate mechanisms to deal with an expanding range of technologies, product applications and services that support the transmission of information on a nation-wide and worldwide basis. Developing countries differ from one another in terms of, among others, stages of development, regulations and policy frame work, varying degrees of political centralization vs. decentralization, differences in gross domestic product, market structure, and differing national research and development strategies. As an example of two different situations in Latin America, telephone penetration and the privatization of post, telephone and telegraph (PTT) somehow proceeded successfully further in Chile than in Brazil.

2.1. Growth of Global Information Infrastructure

As far as the profile and growth of the global information infrastructure. (GII) are concerned, they are not evenly distributed across its various information and communications components, according to Petrazzini and Haridranath (1997). They note that older, mature technologies such as broadcast television and telephone have a large worldwide installed base, but their growth rates have slowed as markets with high purchasing power have become fairly saturated. New technologies and services such as the Internet and cellular phones have, as the latest trend in telecommunications indicates, a small installed base but a steep growth curve. The use of some elements of the global information infrastructure such as satellite TV,

cellular phone and the Internet has increased phenomenally (ITU, 1995), compared to the plain old telephones, broadcast TV and cable TV.

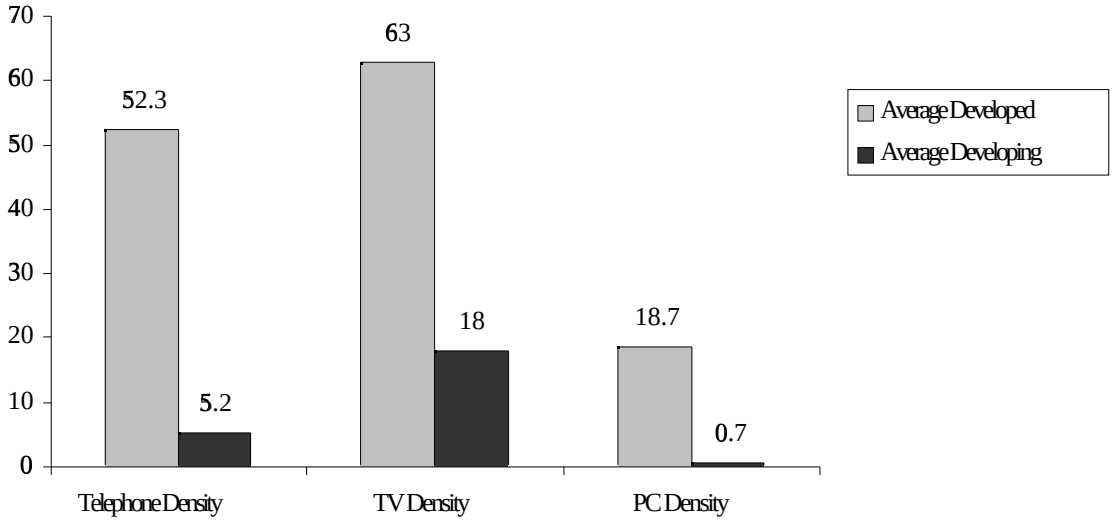

Figure 1. Information Infrastructure in Developed and Developing Countries
(Based on ITU, 1994)

While advanced nations, according to Petrazzini and Harindranath (1997), have a well-developed information Infrastructure in place, in developing countries the National Information Infrastructure (NII) is still, as Figure 1 shows, far from being a reality. In all three categories--telephone density, TV density and PC density--the average developed countries are way ahead of average developing countries. Developed countries had almost 19 times (18.7%) more PCs than developing countries (0.7 %) in 1994.

2.2. Some Improvement in Physical Telecommunications Infrastructure

By 1994, countries that had restructured their telecommunications sector (mainly through privatization and/or liberalization), such as Chile, Malaysia, and Argentina, showed, as Table 1 displays, considerable improvement in the development of their physical telecommunications infrastructure. In the comparison, Malaysia achieved the highest improvement while India, the lowest.

Table 1. Number of Main Telephone Lines per 100 Inhabitants

Countries	1990	1991	1992	1993	1994
Argentina	9.55	9.78	11.12	12.22	14.14
Chile	6.53	7.89	9.43	11.01	11.00
Malaysia	8.93	9.99	11.24	12.62	14.69
China	0.60	0.74	0.99	1.47	2.29
India	0.60	0.67	0.77	0.89	1.07

Source: ITU

2.3. Rate of Increase of Telephone Lines

The rate of increase of Telephone lines between 1983-1993 varies greatly, with Angola, as Table 2 displays, showing only 1.5% growth rate compared with China's 21.3% in a decade.

Table 2. Rate of Increase of Telephone Lines in Selected Economies, 1983-1993

Growth of Telephone Lines	(%)
Angola	1.5
Ghana	2.7
United States	2.9
Japan	3.1
Russia	6.3
Brazil	6.3
Hungary	8.3
Mexico	8.6
India	11.7
Indonesia	13.0
Chile	13.3
Egypt	15.1
China	21.3

Source: The World Bank (1995)

2.4. Internet Connectivity

Internet connectivity at the end of 1995 indicates, as Table 3 shows, that the 21 countries out of 55 that are not connected belong to the Low Income Group [2] and only 7 countries out of 40 that belonged to the Upper Middle Income Group are not connected to the Internet.

Table 3. Internet Connectivity in Developing Countries

	Connected	Not Connected	Total
Low Income	34	21	55
Lower Middle Income	61	9	70
Upper Middle Income	33	7	40
Total	128	37	165

Source: Lawrence H. Landweber and the Internet Society, 1995

2.5. The Least Telecommunications - Developed Economies

There is a very wide gap between the telecommunication facilities of developed countries and those of the least developed countries (LDCs), according to the International Telecommunication Union (ITU). The level of teledensity (i.e. telephone lines per 100 inhabitants) in LDCs has risen over the last decade from 0.19 to 0.29. As an example of huge disparity between countries in the developing world, the availability of telephones ranges from 378 per 1,000 persons in Singapore to 2 per 1,000 in Bangladesh.

There is an even more staggering gap between urban and rural areas, according to d'Orville (1996). In some least developed countries (LDCs) the rural main line is 1 per 1000, with large areas or territories without any telephones. Among the least telecommunications-developed countries, Cambodia is, as Table 4 shows, at the bottom with only 0.06 per 100 inhabitants and Papa New Guinea has the highest teledensity of 0.96 per 100 inhabitants.

[2] Economies are grouped by United States dollar (US$) income levels: Low = Gross National Product (GNP) per capita of US$ 785 or less, Lower-middle = US$ 786-3,125, Upper-middle = US$ 3,126-9,655; and High = US$ 9,656or more.

Table 4. The Least Telecommunications - Developed Economies
(with teledensity of less than one, 1993)

	Economy		Population (000s)	Main Lines (000s)	Teledensity
1	Cambodia	*	9, 633	5.9	0.06
2	Chad	*	6, 131	4.6	0.07
3	Zaire	*	40, 997	*36.0*	*0.09*
4	Uganda	*	18, 026	20.8	0.12
5	Niger	*	8, 440	10.5	0.12
6	Afghanistan	*	22, 190	*29.0*	*0.13*
7	Mali	*	9, 234	13.8	0.15
8	Rwanda	*	7, 320	*11.8*	*0.16*
9	Somalia	*	8, 543	*15.0*	*0.18*
10	Guinea	*	6, 269	11.6	0.18
11	Liberia	*	2, 373	*4.5*	*0.19*
12	Lao PDR	*	4, 511	8.6	0.19
13	Cen. Afr. Rep.	*	3, 249	6.7	0.21
14	Burkina Faso	*	9, 830	21.9	0.22
15	Bangladesh	*	116, 702	268.4	0.23
16	Sudan	*	27, 255	*64.0*	*0.23*
17	Ethiopia	*	53, 297	132.5	0.25
18	Bhutan	*	1, 532	3.8	0.25
19	Myanmar	*	44, 704	119.3	0.27
20	Burundi	*	5, 974	15.6	0.26
21	Madagascar	*	12, 728	34.8	0.27
22	Equatorial Guinea	*	437	*1.3*	*0.30*
23	Ghana		16, 261	48.7	0.30
24	Tanzania	*	26, 743	85.0	0.32
25	Sierra Leone	*	4, 468	14.5	0.32
26	Nigeria		104, 893	342.3	0.33
27	Malawi	*	9, 303	32.8	0.35
28	Nepal	*	20, 390	72.0	0.35
29	Mauritania	*	2, 137	7.6	0.35
30	Viet Nam		70, 881	260.0	0.37
31	Mozambique	*	16, 916	62,1	0.37
32	Benin	*	5, 194	20.4	0.39
33	Togo	*	4, 026	17.3	0.43
34	Cameroon		12, 611	57.2	0.45
35	Angola	*	10, 020	53.3	0.53
36	Eritrea	*	3, 393	*20.0*	*0.59*
37	Lesotho	*	1, 899	*12.2*	*0.64*
38	Haiti	*	6, 839	*45.0*	*0.66*
39	Cote d'lvoire		13, 358	93.9	0.70
40	Comoros	*	580	4.0	0.76
41	Congo		2, 508	19.2	0.76
42	Senegal		8, 054	64.1	0.80
43	Guinea Bissau	*	1, 043	64.1	0.82
44	Kenya		25, 376	214.8	0.85
45	India		900,543	8,037.4	0.89
46	Sri Lanka		17, 622	157.8	0.90
47	Zambia	*	8, 527	78.0	0.91
48	Papa New Guinea		4, 148	39.8	0.96

Note: * Classified by the United Nations as a Least Developed Country. Figures in Italics are estimates.
Source: ITU World Telecommunication Indicators Database.

2.6. Internet Proliferation in Different Regions

In matters related to the Internet and computers, there is a huge disparity between and among regions of the world. One way of estimating the spread of IT, according to ITU (1999), is to look at access to information technology in terms of the total number of Internet hosts and users. These two--total number of hosts and users--, in addition to some others, serve as fairly (usable) indicators of IT development. Africa with a little over 157 thousand Internet hosts, as Table 5 shows, represents a very small segment of the total Internet host population of the world (over 43 million) in 1998, according to data released by ITU in 1999.

Table 5. Internet Proliferation in Different Regions of the World in 1998

Regions	**Total Hosts**	**Hosts per** (10,000 people)	**Users in *(k)***	**Users per** (10,000 people
Oceania	890,224	302.69	3,614.5	1,236.46
Europe	7,728,825	96.88	39,008.8	488.5
Asia	2,610,386	7.38	29,689.3	87.2
Americas	32,099,287	401.29	70,843.4	886.74
Africa	157,309	2.07	1,636.1	21.75
World	43,486,022	73.43	144,801.0	250.32

In percentage terms, Africa had in 1998, as Figure 2 shows, only 0.3% of the Internet hosts, compared to 74% in Americas. This serves as another clear example of gap in access to information technology.

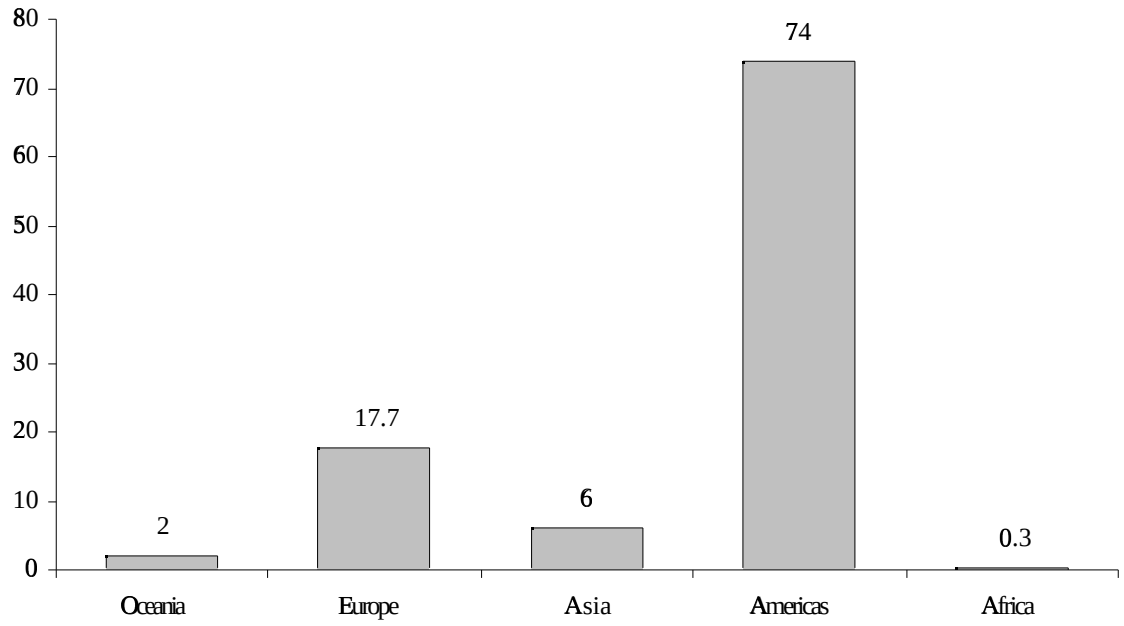

Figure 2. Distribution of Internet Hosts among Regions (Based on ITU, 1999)

Similarly, only 1% of the Internet users were African and nearly a half (49%) of the Internet users resided in Americas, as Figure 3 presents. The difference is huge by all accounts, indeed.

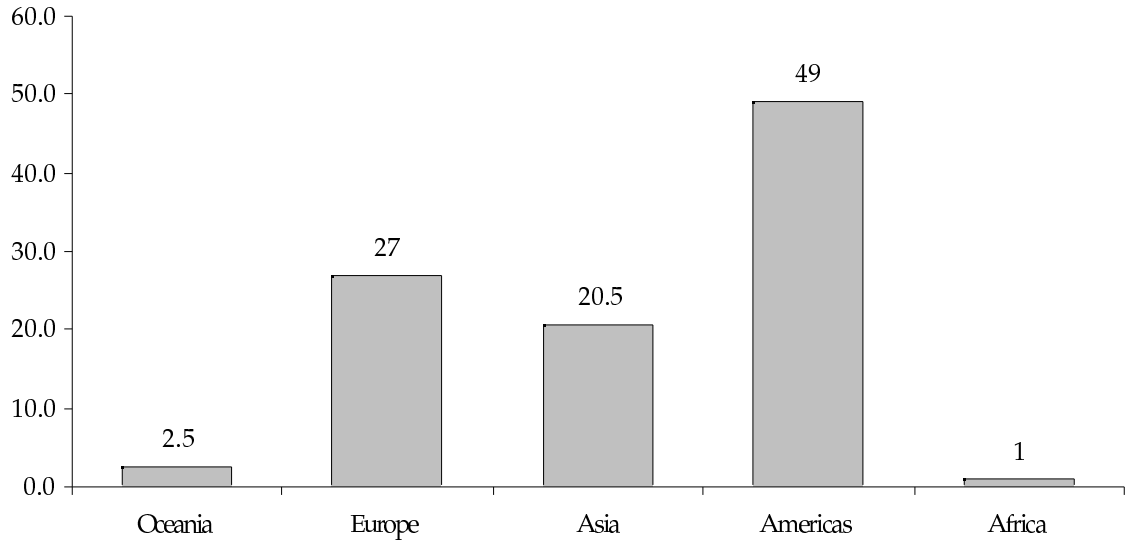

Figure 3. Distribution of Internet Users among Regions (Based on ITU, 1999)

Estimation of computers (PCs)--another indicator of IT--reflects a similar situation. Here again, it is estimated that Africa has, as Table 6 displays, the lowest number of PCs (over four million in total for the whole continent) and less than even one computer per 100 people or inhabitants. The region representing Americas, thus, once again scores highest with nearly 149 million computers, according to ITU (1999). In the year 2000, this gap may have, one can assume, widened further.

Table 6. Proliferation of (Estimated) PCs in Different Regions of the World (1998)

Regions	Total in *(k)*	per 100 people
Oceania	8,802	38.4
Europe	106,528	13.89
Asia	69,532	2.17
Americas	148,506	20.79
Africa	4,461	0.81
World	337,828	6.43

In percentage terms, Africa has only slightly over 1% PCs, compared to 44% of PCs in Europe and Americas. Europe, which ranks next to Americas, has 32%of the world's PCs (ITU, 1999), as Figure 4 presents.

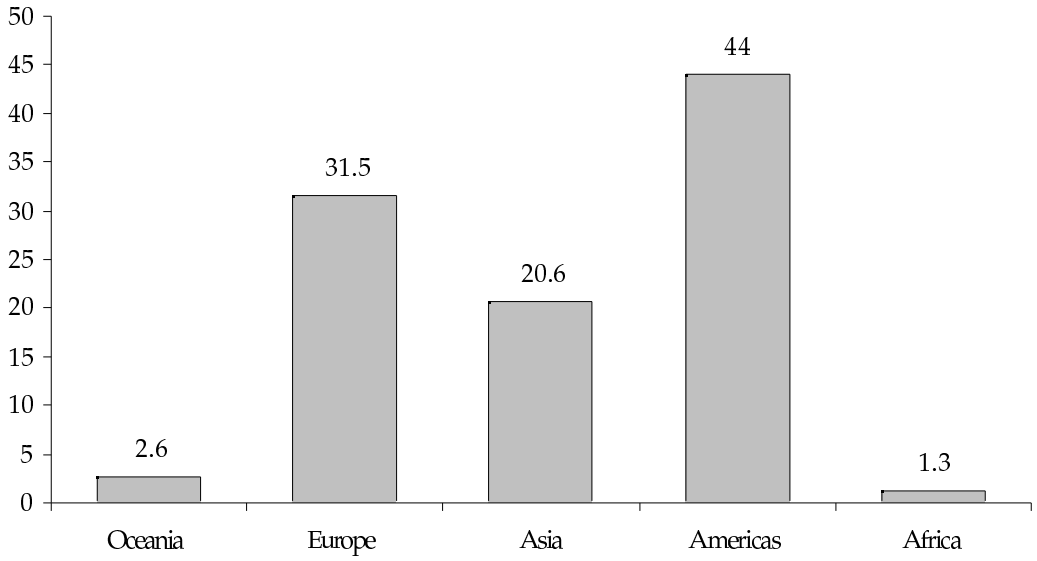

Figure 4. Distribution of PCs (Estimated) among Regions (Based on ITU, 1999)

To sum up, information infrastructure in many developing countries is inadequate and, in some places, even non-existent. Lack of such an infrastructure seems to hit Africa the hardest in every way. In terms of the waiting period for a telephone line, for example, people had to wait for ten years in Nepal and Zambia, according to records available in 1993 (ITU, 1996). This shows how some state monopolies have failed to meet the telecommunications needs of their potential customers. Progress in information infrastructure-building depends on telecommunications policy reforms not yet implemented and many other factors that are still unexplored. Having provided, at least, some idea about the state of information infrastructure in developing countries, this report now touches on a newly emerging phenomenon called the *telecenter* movement.

Chapter III: Proliferation of Telecenters

The establishment and operation of hundreds of telecenters and communication centers indicate a new level and flow of interest in IT use in various places, including those where it was almost non-existent until only recently. The information provided here draws upon an account presented by Colle and Roman (1999), other publications as well as some sources available on the Web.

Telecenters or communication centers are on the rise in a number of developing countries. These centers draw especially from efforts to establish what is now commonly known as 'telecottages' in Scandinavia and Canada. Various labels/terms have been used to describe this phenomenon, now spreading in various geographical locations of Asia, Africa and Latin America. Some of the common labels used to describe these activities, include telecenters, telecottages, community technology centers (CTC), community communication shops, networked learning centers, multipurpose community telecenters (MCT), digital clubhouses, community communication centers (CCC), technology access centers etc. The term 'telecenter' or 'communication center' used interchangeably here also refers to terms used in connection with various other similar practices. Generally speaking, a telecenter may have just one or more telephone line(s) or a variety of combinations of telephone lines, copy machine, fax, e-mail and/or Internet access facilities.

One common characteristic of these centers is a shared place/facility that provides access to some form or combination of information and communication technologies for various purposes. In some rural areas, as in Bangladesh for example, a telecenter contains only one telephone line, and not much else. Different centers may differ from one another in the way they are funded, organized, owned and operated/administered. Telecenters may be publicly funded or privately funded, commercial (fee-based) or free, urban or rural, narrowly focused or multi-purpose, independent or networked or grouped, stand alone or attached (with some other facilities or activities), and community-based or government or business organization-based. In most cases they are guided by the concept and spirit of universal service in telecommunication. Now that the difficulty in providing each Third World home with telecommunications services in the foreseeable future has been fully realized, these centers are being increasingly promoted as a method of providing some form of basic access to information and communication technologies (ICTs) for all people, particularly those who live in rural areas. Also, IT is now being increasingly considered, at least in some policy-making circles, an agent of transformation of various dimensions of human life and activities in the knowledge-based society of the 21st century.

In 1996, so concerned was the the World Bank with the generally deteriorating situation in Africa that it issued a dire warning:

> If African countries cannot take advantage of the information revolution and surf this great wave of technological change, they may be crushed by it. In that case they are likely to be even more marginalized and economically stagnant than they are today.

Responding to the crisis outlined by the World Bank and similar assessments such as this made by others, a few international agencies and western donor governments have initiated various measures to increase universal access, Internet connectivity and community telecenters. Partnership for information and communications technologies in Africa (PICTA) is a forum set up just to achieve such an end. This partnership is working to establish better collaboration of donor and executing agencies acting within the framework of Africa's Information Society Initiative (AISI). Four organizations with well-designed programs have been especially active in the developments related to communication centers in Africa. These include the International Development and Research Centre's (IDRC) special program known as Acacia, International Telecommunication Union's Multipurpose Community Telecentres, USAID's Leland and LearnLink programs, and the United Service Agency's (of South Africa) various initiatives. More about these organizations and their activities will follow later.

3.1. A Few Examples of Telecenter or Telecenter-type Activities/Initiatives

Telecenters of one type or another have been established in many towns, cities, and villages in developing countries. Recently, their number has increased significantly. The examples below provide a sense and glimpse, not a substantial picture, of these and related activities. These examples (or cases) are cited primarily to serve as a reference to the current movement and inform our on-going discussions and deliberations on this topic. The examples are placed in alphabetical (following country or region names), not in any priority, order.

Telephone Service Enterprises in Bangladesh

Information technology is a new opportunity for small business enterprises in Bangladesh. Thousands of small entrepreneurs, some with hardly more than a telephone receiver and a small shelter, have actually set up businesses for selling very basic telephone services. The Grameen (village) Bank system has provided cellular phone technology, allowing, particularly the low-income women to start their own telephone service enterprises usually in the communities where they live. In some cases, these small information and communication technology (ICT) enterprises serve as the forerunners of some more comprehensive communication centers, and they introduce communities, some of which are desperately poor and

marginalized, to the benefits of using information and communication technologies. This situation has become feasible because of, among others, the enormous developments in communication hardware and falling product prices, particularly in the last decade, coupled with the interest of the government in privatization of at least some telecommunication services in the country. The telephone service enterprises are helping alleviate rural poverty. Visit www.cerfnet.com for more information.

Community Learning Center in Benin

Under the USAID's LearnLink program, a community learning center (CLC) has been established in a place assigned for agricultural training in Benin. Interestingly, this center is sustained, in part, by the profits of a restaurant that is associated with the training center. Two additional sites will be established in the country in near future.

School-Based Community Networks in China

The International Telecomputing Consortium (ITC), a non-profit organization based in Washington, DC, helps particularly schools use new technologies. This organization concentrates, particularly on rural schools and schools in developing countries. Among its current ICT-related projects are "school-based community networks" in Southwest China and in Capital, Beijing. It also conducts Internet workshops annually in China for schools. The primary goal is to help Internet access centers become school-run enterprises. This greatly helps divert some of the revenue earned back into the schools. Under the program schools are provided with the facility to use the computer equipment and Internet access during the daytime, making them available to parents and other members of the community after school hours. The enterprise component of the model is appropriate for China where schools are expected to raise funds to support themselves. The Consortium has used a similar approach in Vietnam as well. It is also experimenting with *selling handicrafts on the World Wide Web*.

Technology Access Community Centres (TACC) in Egypt

In March 1999, the United Nations Development Programme (UNDP) opened three technology access community centres (TACC) in the Governorate of Sharkeya, Egypt. This is the first in a series of pilot digital projects by UNDP in Egypt and other countries in the Arab States, Africa, Asia, and the Latin America and Caribbean regions. The TACCs - often also referred to as telecentres - represent a unique platform to provide community access to the Internet and through it to a panoply of electronic information and knowledge. TACCs will also serve as training centres for civil society groups, the private sector, low-income groups and individuals to familiarize them with information technologies (IT) and to use IT for various development applications. Such applications may encompass long-distance education, telemedicine, electronic commerce, assistance to small-businesses, new mechanisms for popular participation, environmental management and women and youth empowerment. In addition, TACCs are

also designed as hubs for electronic content creation, especially in Arabic, responding to community needs and interests.

Each TACC will be equipped with a server and some 10 Pentium PCs, backed up by the use of additional training computers in each location. Dedicated local Internet connectivity will be provided for each TACC. Beyond such connectivity, systematic training and skills development will be a key feature of TACC activities. The programmes will focus on computer literacy, e-mail operations, web page creation, desktop publishing, PC applications, maintenance and technical support. See http://www.undp.org/info21 for more details.

Wireless Local-Access Networks in Haiti

The belief, that part of the barrier to the spread of information technology is political and closely tied to monopolies in the telecommunications industry, is gaining momentum. In Haiti, for example, ISPs are skirting the country's telecom monopoly by building wireless local-access networks and using satellite and microwave technologies. Haitian Internet providers are also servicing a largely rural population by opening small telecenters -- central points where users pay small charges for short periods of access to do things such as download and send e-mail. Fortunately, this is a model that may be imitated elsewhere [3]. This clearly shows that, if developing countries can remove the political and economic barriers to the growth of the Internet, the economic opportunities for growth is likely to be huge (Mueller, 1999). See <http://www.techweb.com/wire/story/> for more details.

Telecentres in Mexico

In his paper entitled "Telecentres in Mexico: Learning the hard way", presented at a conference in Canada, Robinson (1998) describes the telecentre syndrome emerging in many lands where citizen and government initiatives, separately and in tandem, are creating a dynamic web of local public access to the digital technologies. But, unfortunately, not so in Mexico. The two sets of Telecentre programs that were launched have, in effect, crashed, according to Robinson. He says:

"To date, two sets of pilot Telecentre programs have been launched and have, in effect, crashed. In 1997, the Ministry of the Environment, Natural Resources and Fisheries, SEMARNAP, initiated a two stage pilot program to create Telecentres. My public university, the Metropolitana, was invited to coordinate the fieldwork, training and HTML data file creation, and I was asked to coordinate this contract project. Seven Telecentres were installed in as many small towns or villages at the edge of Mexico City (where a series of 54 small communities ring the city—formerly rural places now absorbed by newcomers moving in). Criteria for selecting where to install a modem equipped PC, offer a basic training (plus a prepaid ISP account), included a politically neutral institution—a public library or cultural center, for example, with a

[3] This description is based on statement made by the Syracuse University Professor Milton Mueller in 1999.

secure facility and a local authority or citizen's group willing and able to assume responsibility for the equipment and the user training and support program. Employing similar criteria, a second set of 16 Telecentres were installed in as many municipal seats, cabeceras municipales, in three regions of the state of Michoacán, west of the nation's capital."

Robinson reports that of the 23 Telecentres set up in Mexico during 1997, only five are currently functioning. He argues that the "observable restraints are more political and cultural than economic, and hence, new initiatives should consider these parameters and impediments if another series of inoperative pilot endeavors is to be avoided." He observes that these lessons may be applicable to other nations and local situations as well.

Telecenters in Mozambique

The International Development Research Center (IDRC) is involved in the planning and development of information technology in Mozambique. Recently, opportunities have been identified to: a) establish telecenters, to develop demonstration projects in schools, and b) to work with the government and the private sector on local content creation. Other agencies have also expressed interest in cooperating with IDRC to extend connectivity beyond the centre of Maputo, the Capital. The first two years of activity in Mozambique would see an extension of connectivity through long distance wireless data networks from areas within support distance of Maputo to 4 of the 10 provinces, and the establishment of telecenters in support of education, local government, and management of natural resources. Additional effort would go into creating community content in the priority areas of health, education, and natural resources, either through the university or in cooperation with other private or public sector information providers (http://www.idrc.ca.acacia/).

PanAsia Research and Development Grant Program

The International Development Research Center's PanAsia Research and Development (R&D) Grant Program provides grants for original and innovative networking solutions to specific development problems in Asia. During its first two years, countries benefiting from support included Bangladesh, Bhutan, Cambodia, Laos, Maldives, Mongolia, Nepal, the Philippines, Sri Lanka and Vietnam. Where Internet access was not available (most of the above), the program assisted in setting up a national Internet Service Provider (ISP). Support is directed also towards regional Internet information hosts, www services and authoring, and networking applications. PanAsia has also been active in supporting national groups, particularly NGOs, in Latin America in establishing telecenter projects (http://www.panasia.org.sg/).

Community Learning Centers (CLCs) in Paraguay

Under the USAID's LearnLink program, the Municipality of Asunción in Paraguay, is seeking to provide basic education and communication and information services to less advantaged citizens through 12 community learning centers (CLCs) housed in public buildings and Municipal Centers throughout the city. Built on the idea of simple business centers which offer a variety of electronic and communication services, the CLCs emphasize the educational and civic development benefits of computers and communication technology, and, more specifically, their ability to increase access to basic education resources, life-long learning opportunities, and information and services from municipal sources. All of the CLCs are expected to be open and fully operational by September 1999 (USAID, 1996).

USAID's LearnLink Projects in Paraguay, Ghana and Benin

LearnLink activities focus on various applications of the World Wide Web for education. LearnLink is establishing Community Learning Centers (CLCs) in three countries: Ghana, Paraguay, and Benin. Each CLC will be equipped with a local area network and shared high-speed access to the Internet. Each CLC will also contain a library of printed materials and a room for the public to improve computer literacy and learn about information resources available on the Internet. LearnLink "uses culturally appropriate communication and educational technologies to strengthen learning systems essential for sustainable development. This includes using technologies to link individuals, groups and organizations, and to build the capacity of people to access the resources they need to meet their learning needs, particularly those associated with basic education" (USAID, 1996).

Public Phone Shops in Senegal

Senegal has a relatively huge network of skills and organizational capacity (public, semi-public and private) in managing information resources. Significant efforts will be focused on upgrading these networks to make use of the new information and communication technologies (ICTs). Recently in Senegal, private telecenters have experienced exponential growth and it now serves as a vital link in any strategy for disseminating and using ICTs at the community level in the country. They have also helped reduce unemployment, particularly among young people with minimal education. The system of public phone shops is another example of telecenter activity in Senegal. The country is trying to catch up with the recent trend of setting up public phone shops being run by various local entrepreneurs in different parts of Africa. In Senegal alone, there are currently more than 7000 public phone shops, many of which have added fax and computer-based services such as word processing, and some of which have also added Internet access.

Telecenters in South Africa

The establishment of the Universal Service Agency (USA) in South Africa reflects that a telecommunications policy reform process has already begun in the country. One of its outcomes was the creation of a system intended to define the meaning of universal access in South African terms and to initiate pilot community access projects. The Agency intends to create in total 1,500 telecenters in various low-income communities of the country in the next 10years.

Suriname Multipurpose Community Telecenter (MCT)

The Suriname Multipurpose Community Telecenter (MCT) pilot project included two basic telecentres, each comprising public phones, a fax and a computer. The centers were established in 1996 and 1997, respectively in the interior of Suriname where there were no communication facilities, nor any continuos electrical power supply before the establishment of the telecentres and the associated infrastructure. The telecom technology used is an inexpensive fixed cellular communication system, linked to the national network by a digital microwave link built by the project. The equipment is solar powered, with batteries and a generator, which works during evening hours or in case of cloudy weather.

The Brownsweg MCT is located in a rural community of scattered villages in the jungle in the Brokopondo district at a distance of some 160 Km. from the capital, Paramaribo. The center shares space with other local government offices, in particular a primary health center on the first floor. The Gujaba MCT is located in the heart of a Bushnegro community in the upper Suriname River, some 240 Km. from Paramaribo. Access to the village of Gujaba is by river, only by canoes or small motorboats, since there are no roads. The surface of Gujaba MCT is slightly bigger than the Brownsweg MCT but it has only one telephone line to serve the facilities which is often out of order due to power problems (fuel for the diesel does not always come in time). Also some individual subscribers (village chiefs, etc.) in both regions have been provided with cell-phones using the same cellsites.

Unfortunately, the Project failed to achieve its objectives due to: a) lack of marketing, lack of awareness building and shortage of user training, b) raise of tariffs in 1998 (the tariffs more than doubled to rebalance reduction in international tariffs, forced by competition), c) competition from individual subscribers who resell communication services at lower price, d) technical problems and limitations, e.g. the inexpensive fixed cellular technology used is not suitable for applications, requiring higher bandwidth than 9.6 kbs, e) the solar panels did not generate enough power as cloudy periods were more than predicted, f) equipment was out of order due mainly to maintenance problems and/or lack of power, etc., and finally g) congestion at the Internet gateway in Paramaribo (adversely affecting access to emailing and Internet in the MCTs).

3.2. Organizations, Agencies and Institutions Involved in Telecenter Development

Telecenters in developing countries are usually the result of various national, regional and international initiatives, cooperation and efforts. A few of them have even sprung up locally with very little support from outside. In most cases, several major international organizations are involved in telecenter development. The modality of cooperation and involvement, based on local conditions, may be different in different places. In some, telecenter operation is somehow guided by their national and regional information and communication technology (ICT) strategies that have been put in place, while in others, telecenters have turned out to be a locally organized affair. In addition to some of the major organizations engaged in such activities such as the International Telecommunications Union (ITU), Canada's International Development Research Centre (IDRC), the U.S. Agency for International Development (USAID), The United Nations Development Programme (UNDP), and the World Bank, there are many other organizations and/or institutional mechanisms to support various telecenter initiatives.

A fairly summarized account of the role and involvement of various international organizations (or national organizations with international affiliation) active in telecenter development, include the following (arranged in alphabetical order):

The Association for Progressive Communications (APC)

APC is an association of 22 non-profit computer networks around the world. It is working with IDRC to implement, operate and evaluate two community networking pilot projects in Latin America--Ecuanex in Ecuador and Colnodo in Colombia. APC will help telecenters projects establish network access points in community telecommunications centers.

Bellanet

The Bellanet includes IDRC (where Bellanet Secretariat is based), UNDP, SIDA, CIDA, Rockefeller Foundation, and the MacArthur Foundation. The consortium facilitates the sharing of information about telecenters. In addition to other activities, the Bellanet hosts websites, maintains databases, and email discussion lists.

The Canadian International Development Agency (CIDA)

The Canadian International Development Agency supports Internet connectivity and content creation capacity building in a few African countries, and supports IT industry development, particularly in South Africa.

Futureworks

Futureworks is a consulting firm based in Newfoundland. It has helped set up a few telecenters in developing countries, including Indonesia.

The International Development Research Centre (IDRC)

The IDRC is another major organizer of, and contributor to, telecenter development. IDRC's program called Acacia concentrates on Africa, and another program, PanAsia concentrates on Asia and Latin America. IDRC also has a connectivity project called Unganisha that will link IDRC program offices with local project partners mainly through the Internet. IDRC's community telecentre is a location, which facilitates the provision of a wide variety of public and private goods and services. Such services might include basic communication such as voice, fax, e-mail, Internet access, etc.; public and quasi-public sector services such as tele-medicine, distance education, municipal governance services, etc.; and private sector services like news distribution, tele-commuting services, training, information on markets, crops and weather conditions, and more.

International Fund for Agricultural Development (IFAD)

Established in 1977, International Fund for Agricultural Development (IFAD) is a specialized agency of the UN to combat rural poverty and hunger in developing nations. IFAD has financed 489 projects, including some telecenters, in over 111 countries since its establishment in 1977. FIDAMERICA is a project under IFAD in Latin America and the Caribbean focused on information exchange among IFAD-financed projects. There are several IFAD-sponsored programs in Asia and the Pacific. The arrival of telecenters in Asia will be assisted by the relatively strong telecommunications network that is either in place, or soon to be in place in the Asia and the Pacific region (with the exception of China). A number of initiatives are focused on networking NGOs and international organizations in order to increase communication of best practices and reduce redundancy.

International Telecommunication Union (ITU)

As a major leader in the telecenter movement, the ITU has helped and encouraged many international development agencies to initiate and get involved in the establishment and development of telecenter in developing countries. It is setting up Multipurpose Community Telecenters (MCTs) in different parts of Africa, Asia and Latin America to provide access to modern telecommunication facilities and information services, particularly to people in rural and remote areas. Multipurpose Community Telecenters pilot projects are currently being negotiated and implemented in Benin, Bhutan, Honduras, India, Mali, Mozambique, Suriname, Tanzania, Uganda, and Vietnam. Lately, the ITU is also studying the feasibility of MCT projects in Haiti, the Maldives, Romania and Senegal.

The Peruvian Scientific Network (RCP)

An NGO in Peru, the Peruvian Scientific Network fosters the development of a network of approximately 190 telecenters (some are operating and some are just being developed) called Cabinas Públicas in various parts of the country.

The Specialized Telecenters Of Professional Education (ProjectSCOPE),

ProjectSCOPE, an NGO based in Boston, Massachusetts, is a non-profit developer of community-based telecenters focusing especially on underserved populations, particularly women, children and the disabled. It works with local communities to establish telecenters with the intent of providing universal access to education, training, community "redevelopment," public health and economic development programs via "appropriate technology." A unique feature of Project SCOPE's approach is the interconnection of SCOPE telecenters to other "globally-accessible" resources for the sharing and exchange of information. Project SCOPE is involved in economies-of-scale purchasing plans for its constituent communities, community educational activities related to information and communication technologies (including distance learning), on-going training for telecenter staff and users, and securing funding for community telecenters.

United States Agency for International Development (USAID)

The USAID has two major efforts that deal directly with telecenters. These are: The Global Information Infrastructure Gateway Project (The Leland Initiative) and the LearnLink project. The Leland Initiative (www.info.usaid.gov/regions/afr/leland), a five-year program designed to bring the benefits of the global information revolution to people in Africa was approved by the U. S. Congress in 1995. While the project includes global information infrastructure (GII) technologies, it especially focuses on extending Internet connectivity to 20 or more African countries. This program is aimed at: a) improving Internet connectivity within Africa, b) increasing access of Africans to other people via networking and information for sustainable development, c) enhancing African ability to find solutions to African problems, and d) making African-produced information available to the outside world.

The initiative has three strategic objectives: a) create an enabling policy environment in project countries to facilitate electronic networking and access to information technologies, b) strengthen the local telecommunications infrastructure to facilitate Internet access and support a local Internet Service Provider (ISP) industry to ensure the local availability of reliable, accessible, and cost-effective Internet access, and c) achieve broadbased use of information and global information technologies among USAID's partners to promote sustainable development.

The USAID program consists of substantial advocacy for the Internet, facilitating the creation of private sector enterprises related to the Internet, and training personnel who can further the interests of Internet diffusion and applications on the continent. The project works on the supply side (creating the Internet capacity) and the demand side (promoting awareness of uses for the Internet). USAID encourages the development of affordable, public Internet awareness and access centers to promote Internet use. Such centers could provide such services as: free, public demonstrations; fee-based Internet accounts and Internet workstations for those without access to home or office computers; fee-based end-user training; fee-based web page development and training; free institutional information and communication strategy consulting; fee-based publishing consulting services and training; and free proposal

development consulting for Internet-related activities. The Leland Initiative is also promoting associations of Internet service providers and users — in some cases national chapters of the Internet Society.

A substantial amount of the USAID effort involves identifying organizations in a country that have the potential to use the Internet system in their work. This includes examining their readiness for effective use of the Internet and assessing the barriers (policies, infrastructure, awareness etc.) to sustainable and effective use. An initial step in the USAID work in a country is conducting an Internet for Development: Applications and Training Workshop to brief both USAID Mission personnel and help their development partners navigate through applications and resources related to the Internet and the Leland Initiative. This Initiative and other USAID country programs assist with infrastructure building and encourage and support the development of Internet pilot projects and other activities that help increase the awareness and use of the Internet. The nations, identified as participants in the Leland Initiative are: Benin, Ghana, Malawi, South Africa, Botswana, Guinea-Bissau, Mozambique, Tanzania, Côte d'Ivoire, Guinea-Conakry, Namibia, Uganda, Eritrea, Kenya, Rwanda, Zambia, Ethiopia, Madagascar, Senegal, and Zimbabwe. LearnLink is an activity of the USAID Human Capacity Development Center.

Universal Service Agency (USA)

Universal Service Agency, an agency of the South African Government, is mandated to foster universal access to telecommunications throughout South Africa. The Agency is supporting telecenters as pilot projects in providing universal access in disadvantaged areas, particularly rural communities. It works with schools, libraries, churches, and existing community centers in various parts of the country.

The UN Development Programme (UNDP)

Among its development efforts, UNDP has at least two ways of working with the communication center movement. The most direct way is through partnerships with other organizations through its Sustainable Development Networking Programme (SNDP). For example, UNDP/SNDP is an international partner in ITU's MCT projects in Benin and Honduras. It is also involved in connectivity aspects of ICT. UNDP/SNDP supports the creation of national non-profit electronic networks for sustainable development information in about 30 countries. China, India, Indonesia, Republic of Korea, Pakistan and the Philippines, as well as parts of the South Pacific are already, thanks to UNDP efforts, at different stages of network development.

The UN Educational, Scientific, and Cultural Organization (UNESCO)

The UNESCO is a partner in communication center projects led by IDRC and ITU. It is a partner with ITU in Mozambique, Tanzania Uganda, Honduras, Suriname, Bhutan, India and Vietnam. UNESCO also sponsors workshops associated with various operational aspects of communication centers such as telecentre business planning, product and service development, and evaluation.

The World Bank

The Bank is involved with rural communications activities in more than 15 countries, focusing on policy, revenue and tariff arrangements and infrastructure development for rural telecommunications. Central to the Bank's policy work is access to communications by the poorest, most of whom live in rural areas. The Bank has established the multi-donor *info*Dev Fund which has supported various IT-related activities, including promotion and operation of telecenters or communication centers and major distance education facilities in Ethiopia, Kenya, Uganda, Tanzania, Zimbabwe and Ghana. The Bank's *info*Dev is a program designed to provide developing nations' governments with policy advice and "best practices" information on the economic development potential of communications and information systems.

The World Health Organization (WHO) and Food and Agriculture Organization (FAO)

The WHO is a collaborating partner with ITU in various pilot MCT projects. Similarly, the Food and Agriculture Organization (FAO) contributes to funding for some ITU-MCT pilot projects, and collaborates in other ways in some of them. FAO has been quite active in studying and publishing about Internet in relation to rural development

Chapter IV: A Few General and Country or Region-Specific Examples of IT Use

While presenting these examples and activities associated with the development and experiences of information technology in developing countries, it is recognized that IT need and demand naturally vary greatly from country to country, and region to region even within a country. Much depends, among others, on local conditions, regulatory environment, stages of economic development, education, trade and, political leadership of a particular country. It is, therefore, logical to assume that a best practice in one place may be a worst or unfit practice in another place. In addition, there are very few national studies carried out rigorously to guide new or on-going IT practices and programs. Despite this, lessons can certainly be learnt and valuable experiences gained from various IT practices and examples in developing countries. Keeping this in view, an attempt is made in this section to turn to a variety of other examples as snapshots related to IT use in settings of the developing world. They are placed in alphabetical order.

Village Pay-Phones in Bangladesh

Village Pay-Phones can alleviate rural poverty. Mobile cellular phones have their own significant contribution to uplifting the lives of the rural poor. This was the conclusion of a field study completed by the Centre for Development Research (ZEF) of the University of Bonn in Germany on the impact of mobile cellular phones called Village Pay Phones (VPPs) on a rural community in Bangladesh. The study covered specifically the beneficiaries of the VPP project of the Grameen (village) Bank and indicates socio-economic benefits of VPPs as an alternative and cheaper medium of communication to the villagers, especially the poor ones. VPPs reduce fares and time spent on road transport, with a user saving as much as Tk55-or more than the cost of six kilos of rice-from one phone call. They provide poor producers and traders an easy and fast way to check prices of their commodities, thus helping increase the villagers' bargaining power. The poor segment of rural population, implying more frequent phone use made one-fourth of the total phone calls. The study also shows that women make 35 percent of all calls made.

Modular Information Centers in Costa Rica

In an effort to bring information technology to developing countries, the Costa Rica Foundation for Sustainable Development and MIT have begun a project to develop modular information centers to be

deployed around the world, reports Fletcher (1999). The central idea of this project is to create small deployable structures, which contain essential functions in health, education and commerce. Professor Sandy Pentland of the MIT Media Lab and MIT Architecture Dept. are participating in the project, along with the Industrial Design Department of the Costa Rica Technical Institute.

The project features a working high-bandwidth satellite link, a space for telemedicine, environmental monitoring, a computer lab, and a walk-up information booth. By using the modular structure made from industrial shipping containers as the hub of a network, new lower-cost wireless local loop technologies provided by Motorola and other potential sponsors, would enable voice over IP, data, and Internet access to be integrated more seamlessly into the surrounding buildings of a remote community, says the report.

Electronic Commerce for Developing Countries (EC-DC)

Electronic Commerce for Developing Countries (EC-DC) is an ITU special development initiative with a global scope. The following account is based on information available at http://www.itu.int/ECDC. EC-DC was launched at the ITU World Telecommunication Development Conference 1998 in Valletta, Malta. EC-DC is a concrete example of a thesis the ITU has long promoted: *Telecommunication development fosters economic development*. EC-DC uses a geographically distributed architecture that separates the components for building an electronic commerce system, so that developing countries can implement those components that use their current infrastructure; these interface with other components running elsewhere. In a typical scenario, as Figure 5 shows, a business presents goods or services on an online catalogue (located in a developing or least developed country). A consumer or business partner can select desired items from the business site and confirm purchase. When the purchase is confirmed, control is passed to the commerce server which transparently and securely processes the payment in real time. The commerce server performs all the necessary security, authentication and encryption procedures and informs the business to deliver the goods or services if the payment is valid. The funds for the transaction are transferred to the local bank account of the merchant or business. The commerce server would be shared by multiple independent businesses located in the region.

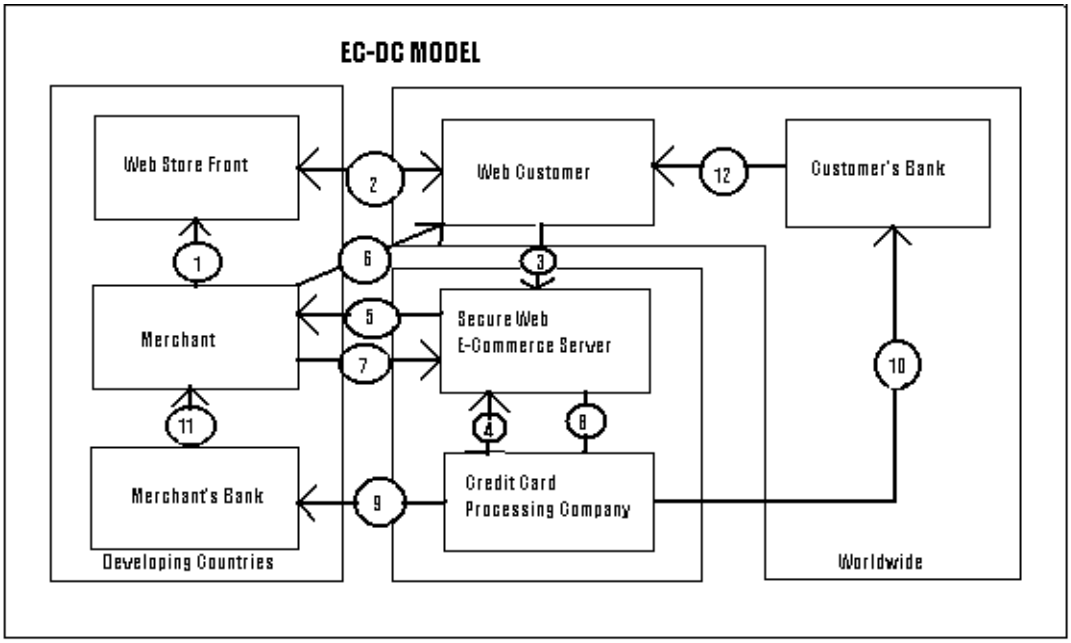

Figure 5. Electronic Commerce for Developing Countries (Based on ITU, 1998)

1 Merchant posts products info. (catalog) on the Web Store Front
2 Customer uses Internet Web Browser to select product
3 Customer uses a secured link to enter the credit card information
4 which is validated in real time
5 Merchant is informed to ship
6 Merchant ships product …
7 …and sends shipping number to commerce server
8 ...which requests the credit card company
9 ...to transfer payment to the merchant's bank account
10 ...and to debit the customer's bank account
11 The merchant's bank sends statement to merchant
12 The customer's bank sends statement to customer

It is assumed that EC-DC projects will enable micro and small businesses and other groups to begin trading at internationally acceptable price levels and bypass the system of exploitation of their products for minimal return. Some items currently being bought from rural artists in many developing and least developed countries for $5.00 are fetching $50.00 or more in the international marketplace.

ITU has completed an electronic commerce service for the International Labor Office (ILO) based on the experience acquired in EC-DC and has received requests from other UN organizations (both in Geneva and New York). Discussions for carrying out EC-DC activities are being held with Brazil, Cameroon, Chile, Ecuador, Egypt and India. (for more information, http://www.itu.int/ECDC/)

The Humanity Libraries Project

The Humanity Libraries Project, a basic needs library on a CD, is an example of project developed to help people in low-income countries. It offers a model for an information resource developed at low cost and made available to all for free or very low cost. An example of items available in this project includes a low cost vaccination campaign to combat the lack of knowledge similar to a universal polio vaccination. This source taps a huge "base" of essential knowledge that has already been gathered and produced by the United Nations, the World Bank, and other publicly funded agencies at subsidized cost. This project helps disseminate and combine vital information and knowledge for individuals in Third World countries (http://www.oneworld.org/globalprojects/humcdrom).

Various IT Initiatives in India

India, like many other countries with a large population, is concerned with numerous challenging problems associated with development. As a result, one can witness a number of projects/initiatives or activities in the country.

Changing Face of TV and Radio: Beginning with the launch of satellite TV in the form of Star TV in the early 1990s, India has seen a boom in electronic media. Yet, surprisingly enough, millions of people still continue to have no access to clean water or basic education. However, access to TV and radio has increased dramatically. This, coupled with the transition to a market economy, has fueled a consumerist, entertainment-driven media culture in the country. Development agencies, once dependent on state-controlled radio and TV, now have to define their own space in a media environment that is competitive, relatively free and market-driven (http://www.comminit.com/review_indianmedia.html).

Pilot Community Radio Project Recently, a pilot community radio project, was conducted in Chitradurga district, Karnataka, India, to assess the possibilities for local participation and program content. A monthly 30-minute radio program was produced and aired on the local FM station of All India Radio in 1998. The project involved participation of local individuals and groups. Themes included watershed management, girls' education, women's health, women's self-help income-generation schemes and the impact of adult literacy programs on rural life. Encouraged by this, experimental broadcasts using a portable briefcase-size radio station from UNESCO are planned in near future.

Software Package for Farmers in Maharashtra The State government plans to link 40,000 villages in the State of Maharashtra with a specially developed software package for farmers. The unique package -- Agronet -- aimed at providing the farmers with the latest information on agriculture, including cropping pattern. The scheme will be given final shape within a month (http://www.indian-express.com/ie/daily/19990508/ige08014.html).

Multimedia for Villagers Under the aegis of Project Vidya, Intel India, in association with the National Science Centre, has launched the first mobile computer awareness program, 'Computers for you', for rural India. Under this program, a van equipped with multimedia computers, software and a trainer will cover 60 villages in 12 months, reaching out to over 4,000 children per village. Bhimtal, Uttar Pradesh, will be the first halt for the van. Intel has already set up 'Cyberskools' at the National Science Center in Bombay and New Delhi. Over 50,000 children and 5,000 teachers are given exposure to computers annually through the Cyberskools. The Cyberskool even organizes a weekend parent training program (http://www.rediff.com/computer/1999/jun/08intel.htm).

Telemedicine in Gujarat According to a report, a civil hospital and an institute of cardiology and research center, located in two different districts, are linked with an Online Telemedicine System. Under the system, doctors at the civil hospital can 'refer' (virtually) an emergency case to the institute of cardiology and research center. The civil hospital doctors, in a recent experiment, successfully recorded a patient's ECG using an Event Recorder, a small electronic equipment resembling a TV remote control. This device can record live the ECG data within a minute and transmit it over the telephone (http://www.the-week.com/99jun13/life2.htm).

Email-Software Madras-based Lastech Systems Private Ltd. has launched its e-mail Software - "IndoMail", which facilitates sending e-mails in 12 Indian Languages. The languages covered by IndoMail are Assamesse, Bengali, Gujarati, Hindi, Kannada, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil and Telugu. IndoMail, priced at Rs 400, ensures that any Email client software like Netscape Mail, Microsoft Outlook, Eudora can be used to read the Indian language mail. The range of products offered by the company include Indoword, Indovision, Indobase, Indoweb and Exact. All the products are available in 10 Indian languages including Tamil (http://www.lastech.com/).

Other Initiatives Expanding the telecom network in India substantially at the prevalent level of per-line investment is not viable. However, recent system based new technological advances in wireless, fiber-based access technology, open interface standards, high-speed digital transmissions on the copper loop, and Internet remote access switches have made some significant cost reduction feasible, according to JhunJhunwala, Ramamurthi and Gonsalves (1998). Consequently, a new network with significant rural penetration can be installed today at under $450/line, they pointed out. Many of the systems, such as network manager system (NMS) software and customer care/billing software, that are key to the operation of a complex network with dispersed intelligent nodes, have been developed in India.

The Limited (A Woman's Clothing Company) in China

A woman's clothing company called "The Limited" gathers copious data at its point-of-sale terminals which are analyzed almost continuously at its central office. Based on these analyses, the firm predicts when it must reorder a particular item. The transaction order is then automatically generated and, once approved, is transmitted electronically to China or wherever that item is fabricated. When the order is received, it is filled and the garments are shipped by air back to drop points in the U.S. Thus within days of the order, the goods are in the Limited's retail outlets.

Electronic Kiosks in the Philippines

Since many government employees are today involved in providing information or assistance to citizens, information technology can increase productivity and deliver information more effectively and widely, especially in rural areas. A key tool is the electronic kiosk, which can deliver many types of government services, including job information, health care information, and education. Information kiosks provide interactive information through easy-to-use touch screens with verbal and written instructions in multiple languages. Information is provided in a combination of text, pictures, audio and video formats. Kiosks provide the convenience of "one-stop" shopping and 24-hour access in many public places. The Philippines is establishing a Government Information Sharing Technology Network, linking government offices down to the community level. In addition to providing services, it will also be used to collect public opinion and economic planning data.

Internet Radio in Sri Lanka

The Internet is increasingly used for broadcasting radio programs. The Kothmale Internet Community radio project in Sri Lanka is an example. The project uses community radio as an interface between the Internet and rural communities. The official opening took place recently (1998) after three months of trial period during which a Web site database was developed and community volunteers were trained to handle various elements of the project. For many of them it was the first exposure to computers and the Internet.

This project combines new information technologies with conventional radio medium. It includes a radio program to "Radio Browse" the Internet. Information is interpreted in the local language, with community broadcasters interpreting information from selective Internet sites. This makes the Internet accessible to those who do not understand English. Community radio also functions as a mini Internet Service Provider to the community with free Internet access. Besides its own Internet Café, the community radio has provided two free Internet access points at Gampola and Nawalapitiya community libraries. This radio also develops its own computer database deriving information, which are often requested by community members, from the Internet. Much of the information in this Web site is, thus. Availableto the local people.

New Technology in Tanzania

Volunteers in Technical Assistance (VITA), the world's first private voluntary organization to apply advanced microelectronics and space technology to the dissemination of technical information for development and humanitarian purposes, is playing a vital role in Tanzania. The communications technologies used by VITA includes a low-earth orbiting satellite, a series of independent short-wave packet radio systems, and an electronic message delivery system that uses existing telephone networks (http://www.vita.org).

A story goes like this:

> Because road conditions and high-fuel costs make overland travel in Tanzania difficult, flying is cheaper than driving. Bill (who works for VITA) recently ordered an assemble-it-yourself-Zodiac two-seat propeller plane over the Internet. He relied on his wireless Net connection to stay in touch with the manufacturer, Zenith Aircraft Company of Mexico, Missouri, whenever he encountered construction problems. Now the finished airplane allows Kibidula doctors to fly into Tanzania bush twice a week to visit remote clinics.
>
> The Internet has also allowed Bill to stay in touch with people he cares about. "You cannot imagine how dramatically the ability to communicate has changed our lives," he exclaims. "By being reachable through the Internet, I have seen a surge of support from family and friends scattered around the globe. People who only sent Christmas cards at best are now in touch every week. We feel as close as if we were living in the next country. It is truly amazing!"

Technical and E-Commerce Training via Internet

In an effort to demystify the technology to people with limited exposure to computer applications, PEOPLink has developed an on the spot training and modules published on the Internet. PEOPLink usually begins by traveling to the country and doing a series of demonstrations. At that time they also review the technical capability of the Partner Organizations (PO) in terms of their computer hardware and the knowledge of their staff. Then they make recommendations on the training and equipment and planning requests for funds.

Once the PO has the necessary equipment, a PEOPLink specialist visits the PO for a one to two week basic training on capturing digital images and then editing them for storage in a format suitable for transmission by e-mail. With that basic capability, PEOPLink staff back in Maryland provides continuous support on a variety of topics via e-mail. Technical workshops on specific areas, such as design, are coordinated with follow up visits by staff and consultant specialists. Moreover, the Web pages of PEOPLink contain a section with training modules that make it easy for POs to work on their technical

skills on their own. Most of these modules are intended to be printed so they can be studied carefully without monopolizing a computer, phone line and Internet connection.

The information and communication technologies (ICT) resources employed include a) a personal computer (PC) that runs Windows (either 3.1 or 95) and has at least 8 MBs of memory and a modem, b) an account with a local Internet Service Provider (ISP) able to send e-mail with attachments, and c) a browser software (either Netscape Navigator or Microsoft Internet Explorer). As far as the future of the project is concerned, as individual staff in the POs become adept at specific aspects, PEOPLink promotes their training other individuals in other POs via the Internet (an example of "South-South" technical assistance). The goal here is to have the POs able to design and maintain their own Web pages in a couple of years, if not sooner (http://www.peoplink.org). PEOPLink is also involved in marketing of the finished products produced in several developing countries.

Technology at a Price in Togo

Togo is a West African nation that is trying hard to catch up to the West, but where issues such as modem speeds and bandwidth are secondary to finding a phone at all; where power tends to fluctuate (except in the villages, where it is nonexistent); and where the water—at least in Lome, the capital—is turned on for only a few hours in the middle of the night. The oft-cited gap between the Western standard of living and that of emerging countries is enormous and, yes, it is growing. There is a desire to progress and a perception among people at the highest levels that technology will help the country do this.

But there is also a need to match the technology to the existing infrastructure as well as to the social and economic climate. In 1997, computers are entering Togo, but the typical computer that costs $2,000 in America cost about $3,000 in Togo. CD-ROM drives and other multimedia peripherals cost extra, software not included. Add the Microsoft Office business-software suite for nearly $1,000, a power supply filter for $650 and a color ink-jet printer for $800 and the real cost equation begins to emerge. On top of all this, the primary supplier in town has to charge a 50 percent to 100 percent premium to support the costs of doing business and the lack of market size. The cost of a single E-mail account with unlimited Internet access (as it emerges) was $100 per month, with the first year payable in advance. There was also a new local access number for America Online, but it carried out a premium charge of $24 per hour of use. In fact, not much has changed since then.

The good news about the technology gap is that the research and development and technology risks have been absorbed by the front-running nations. Third World countries can benefit from their trailblazing. For

example, many emerging nations may skip right over investing in wired telephony and jump straight to cellular, PCs or satellite communications. And their first computer need not be a 286 (Miller, 1997) [4].

Computer Center in Zambia

In a mining area in Zambia, industry has a requirement for qualified computer-applications operators and programmers. To address this need, in October 1994, the Zambia National Correspondence College, in collaboration with the Open University of Sri Lanka, established a computer center with facilities and expertise to offer the needed training using distance education techniques. This approach is viewed as a key strategy to develop a skilled and employable work force and also as an opportunity to train women to participate in the Information Society on an equal basis with men. A year after its opening, the program had graduated 187 students and was already making a significant contribution to human resource and economic development in the region.

[4] This description is based on a report (1997) by Rockley Miller.

Chapter V: Lessons and Conclusions

Lessons Learned: Presented below is an account of some of the lessons learned:

Emphasis on information technology use should better be preceded by a close understanding and look at the nature and shape of information technology itself. One must be aware that information technology is not just limited to activities such as creating innovations for traditional hardware, and manufacturing-based industries. Information technology is very much different from all other technologies we have come across so far in that it "involves not just inventions and mechanical things, but also ideas, property rights, information and software. It has values and value conflicts strewn throughout it. This whole subject is one that pervades government, the private sector, academics as well as electoral and legal concerns" (Branscomb, 1998). Use, application and development of information technology involve both human and technological dimensions and the intimate relationship between these two vital forces should not be underestimated in the global Information Marketplace (Dertouzos, 1997).

Regulations and tariffs that serve as a major component of IT use, still remain formidable barriers and constraints to low cost networking activities both within and between many developing countries. Broadly speaking, each of, what is sometimes referred to, the 3 Ps—Pipes, Policy and People—should receive consideration that is due. The term 'Pipes' refers to technologies and their selection and appropriateness in a given environment. Policy refers to the participation of the private sector, regulatory environment, and free flow of information. Finally, the idea of people will involve education and training. Also, planning and management, including routine monitoring and evaluation of progress and operation are important tools that are closely related to people, and all these components should be highly considered in the technological development process. Many least developed countries seem to be losing battle on all these fronts. They desperately need all the help and support from developed and industrialized nations that can be mustered.

Proper way must be found to increase access to IT, not just for a few, but for many people and communities in both urban and rural areas. It is heartening to see that with the help of dedicated entrepreneurs, the Internet is making an appearance in developing countries. However, more than 98% of all the computer hosts on the Net are, according to Zgodzinski (1999), still located in countries in North America, Western Europe, Japan, and Australia—countries that together have only 15 percent of the world's

population. The continents of Africa, Asia, and South America are tiny islands in cyberspace. Information technology revolution has yet to touch the lives of a large majority of these people living in widely dispersed geographical locations in developing countries.

Besides, access to information technologies and other technologies associated with them alone will not do. Technologies are, in the final analysis, only tools or means with which to achieve certain ends or objectives. They can be rightly used, unused or misused. Bowie (2000) rightly sums up what the poor, low-income nations need most today.

> Even if everyone in the world could have a free personal computer, and free Internet access via reliable information infrastructures, that would not be enough. The technology could not empower those individuals who were illiterate and lacked know-how. Literacy itself is of strategic importance to individuals, regions and nations in the information society.

Finally, “three elements are necessary—the right tools, the right rules, and the right people" says Zgodzinski. And developing these elements in unison with one another requires serious efforts on the part of governments, other institutions and various national and international bodies responsible for policy making. Connecting billions of people in developing countries to the Net is a monumental task, indeed. Such a vital task requires considerable resources, consistent and determined efforts, and a number of fairly pro-active steps.

Conclusion: The general conclusion is that although Internet’s impact on people, government and organizations is generally limited, business is increasing particularly in areas where, at least, some form of information infrastructure already exists. Information infrastructure, no matter how complex and difficult it is to build, holds key to progress in developing countries. IBM (1999) reports (http://www.ibm.com/ibm/publicaffairs/global):

> It will not be easy for many developing countries to build their national information infrastructures. However, these infrastructures are essential for achieving sustainable economic development in the networked world. Information technology holds the promise of generating the economic efficiencies required to attract the investments that are the engine of growth around the world. At the same time, information technology can also provide the means to reach, mobilize and empower citizens and to reduce income as well as information disparities through adoption of a "pro-poor" agenda that will integrate rural and urban poor communities into economic life.”

Developing countries should take steps necessary to provide a policy that will attract investment—both external and internal. The emphasis for policy in least developed countries (LDCs) therefore "must be on the

use of information and organizational change, on skills and learning opportunities, and on the links between ICT applications and development priorities" (UNCSTD, 1997:8). Incorporating IT into a developing country setting will fail to produce positive, desired results unless it is strategically and efficiently introduced, and carefully led and nurtured through training, re-training, proper regulatory environment and organizational changes.

Provision of telecommunications and IT facilities is not a goal in itself. To have a real impact on economic and social development such facilities and services must be introduced as an integral part of the objective of a cross-sectoral effort that involves, not just information and communication technologies, but also other sectors such as business, commerce and education.

Telecenters are presently being introduced on a large scale in a few developing countries, but their feasibility has yet to be demonstrated. In some places such as Mexico and Suriname they have in a way failed to achieve their objectives, but in others, they seem to be working and producing encouraging results. Proper assessment and evaluation of such efforts should be carried out to provide a solid basis for further investment in these and other settings in future. Telecenters of various types and configurations can play an important role in providing new impetus to IT use and application in developing countries.

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