Information and Communications Technologies (ICTs) for Poverty Reduction: When, Where and How?

Background Paper : Discussion, Research, Collaboration

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An earlier draft of this paper, *ICTs, the Internet, Development and Poverty Reduction*, was completed in April 2003 and posted on http://www.mimap.org. This second draft has *different* and more focused introductory and concluding chapters, and adds much case material (eg OECD, Brazil/India/Mexico/Turkey, Philippines, Vietnam, gender, multipurpose access, new technologies amenable to poverty reduction, education, software industry development, and smaller additions in the other areas of chapter IV), along with perspectives from reviewers and recent global fora.

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[1] The Development Gateway (http://www.developmentgateway.org/node/133831/?) is one prominent example, posting materials daily under a long list of headings listed at the end of this paper.

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Executive Summary

Framework and evidence

Information and Communications Technologies (ICTs), including the Internet, are generating changes in markets, private and public sectors and economies in the more and less developed world. Some 'sectoral' changes are very large (business services, education) while others are to date small. But they are present and advancing in every area of economic, social and political activity. This paper starts with economic perspectives on poverty and poverty reduction - on the one hand - and on ICTs as technologies, and the very special characteristics of these technologies which shape their impact on development and poverty reduction. For example, including the networking possibilities they enable, ICTs (massively) reduce transactions costs, change the structure of markets and of public services and institutions, integrate global and local markets, untrap human resources, and immediately increase the potential values of human capital. They further embody enormous knowledge and can serve to empower (and manipulate) people at community and national levels.

There has been a large wave of investment over the past decade in ICT for development (ICT4D), and some significant part of this has been aimed at poor people (ICT4P) - both in terms of bringing ICT access poor communities, and in using ICTs in many other ways which support poverty reduction. There have been ***many*** successes, lessons learned and experience documented. This paper draws on experience from developed and developing countries to survey cases material pertaining to ICT4D and ICT4P, and draw out some analysis and conclusions, for purposes of discussion.

Along these lines, the experiences of groups of countries are surveyed, using a wide base of material from the Internet and online journal access. For the OECD and rapidly changing developing countries - principally Korea, Taiwan, Hong Kong, Singapore, Malaysia, Brazil, India, Mexico, Turkey - country cases are profiled. For an intermediate group - Mongolia, Philippines, South Africa, China, Vietnam - there is also enough material to profile country experiences. (Some also are promoting software industries with success - Bangladesh, Indonesia, Ukraine, Iran, Vietnam, China, Philippines, Russia). For less advanced developing countries, lacking concerted overall ICT game plans, material is abundant, but it is mostly sector and application specific, and so is surveyed at length under these 9 headings:

1. multipurpose community access;
2. access technologies amenable to poverty reduction;
3. gender equality;
4. education and human resource development;
5. science, high-tech and ICT-sector growth;
6. business and livelihoods development and support:
7. public sector, services & poverty management
8. environmental and natural resource management;
9. transparency, accountability, empowerment

This experience offers a lot of insight and value, though it is difficult to consistently maintain focus on poverty, and separate poverty reduction from broader economic development insights. In this context, based on introductory chapters on ICTs and poverty, and current development thinking, this paper takes the view that growth and development are necessary but not sufficient for poverty reduction, and that pro-poor strategies and investments are as important for ICT and knowledge-economy strategy as for other connected areas of social and economic development.

Observations: OECD and rapidly changing developing countries

Successes generally occurred in productivity, growth and poverty reduction, with ICTs contributing strongly. Liberalization and opening of ICT sectors was important in almost all cases. Strategic government intervention and support were also both generally essential and culturally/politically/socially specific. Countries whose

'vision' included social as well as commercial development have often generated a dramatic growth **and** equity dynamic. Poverty levels in most of these countries were low initially, and poverty reduction an explicit component of ICT strategy for only a few, but broad social inclusion and 'buy-in' has characterized many. Culturally and politically specific factors were central to the intensity and form of the strategy, with some real trade-off between economic competition (liberalization) and political control. Education and technical skills were either preconditions or strong co-investment areas for these countries, which are mostly cases of major economic/social reform and restructuring. Both a national ICT/knowledge economy game plan and intensive ICT infrastructure investment were essential, and there are valuable insights in each case on how different approaches and institutions were used for social development and poverty reduction. It is also worth noting that, as with other major technology revolutions (steam, electricity, combustion.. biotech..), initial effects were also disruptive, and created a major change in the structure of economies. Structural adjustment included initial negative impacts, like labour displacement, and differential initial access to ICTs (digital divide) contributed often to some initial decline in distributional equity. As access spread in business, public services and households, the positive economic potential of ICTs prevailed in terms of GDP, but results for equity and poverty reduction depended on the nature and extent of socio-economic policy and action in each country.

Observations: less advanced developing countries

Diffusion of ICTs directly to (poorer) communities has been happening intensively for about a decade, mostly via hundreds going on thousands of specific initiatives, led by communities, development, donor and business organizations. In addition, and particularly in the past 5 years, ICTs have been applied to systemic improvements important to poverty reduction (eg, from the list above, education, health and social services delivery, broader government transparency and accountability, and helping empower citizens and build social organization around rights and gender equality). Evidence on both pro-poor ICT access and use (bottom up) and systemic (top down) approaches is mostly in the form of a flood of case material - surveyed in this paper - and thus inevitably interpretative for drawing conclusions. Subject to this caution…

Pro-poor access and utilization

There is a lot of very positive experience in connectivity and use in poorer communities. Effective usage includes e-commerce and market information services, education, health/health-education, gender empowerment, social and political empowerment, and combinations of these in multi-purpose community access investments. Poor communities in most of the world are increasingly aware of the potential of ICTs and, with some help, keen to adopt ICTs and help other communities do so. Clearly, poverty will not be eradicated *by* ICTs - and for many poor populations, more basic needs may take precedence. But equally, poverty will not be eradicated without these technologies, and failure to maximize their potential for poverty reduction, in this PRSP/MDG era, would be incongruous. The positive dynamic often created by ICTs and the commitment of their beneficiaries and supporting groups, appear highly valuable to global poverty reduction objectives, and it is hard to see poverty reduction succeeding if a large part of humanity is excluded from the knowledge shared by everyone else. What is done today for ICT4P will also be critical for newer technology revolutions, notably biotechnology, whose essence is linked inextricably with informatics, and whose and management and benefits will be highly intensive in knowledge, networking and widespread ICT literacy.

The challenges of pro-poor ICT access and utilization are as substantial as their potential. Diffusion is very intensive in effort and local knowledge, literacy and skills development etc, as well as technical capability and effort. Broad approaches, like that of Grameen (large-scale microfinance first, ICTs in combination), are very appealing in their scale, early/quick financial viability, social development dimensions, scope and vision. More familiar in less advanced developing countries are many individual pro-poor access pilots in the context of fairly erratic development of markets, national and local governments, public services, ICT infrastructure, telematics sectors, micro finance, community development capacity etc. 'Scaling up' pro-poor access and utilization faces challenges in all of the following areas:

- *technology*.. Land lines and computers, the 'desktop model', has been prevalent in multipurpose community access (telecenters, schools..) but is typically slow and/or expensive to extend to poor communities. And - although there are many examples of rapid financial sustainability - these investments often require

extended subsidy. There are cases for subsidy (below) but clearly, ongoing development of low-cost technologies will be one key to ICT4P. Currently, Wi-Fi (broadband Internet, by radio frequency) is showing success for low-cost broadband 'last mile' connectivity in densely populated areas. And wireless mobile/PDA text messaging is spreading in a range of countries and commercial and public service uses. Research, development and piloting of low-cost technologies amenable to poor communities needs ongoing support, particularly via ICT4D social and commercial entrepreneurs

- *community development capacity*.. Widespread ICT diffusion in poor communities will need in most countries a large scaling up of community development people and organizations which are ICT-smart and connected with technical support. Expansion of community development training in educational and on-the-job programs would appear a key investment for poverty-reduction generally, in most countries, including pro-poor ICT access and utilization.

- *national policy and infrastructure*[2].. Pro-poor access initiatives can move ahead of, and create demand for, the many components of national ICT infrastructure, but widespread pro-poor access over time is dependent in many ways on these components, as elaborated below.

Systemic changes contributing to poverty reduction
Experience with the more top down approaches to ICT4P has also been mostly very positive - for example in general e-government applications (improving basic functioning, transparency and accountability of governments), in distance education applications, in health system management and responsive to needs, in economic management, in poverty monitoring and reduction programs, in environment and natural resource management etc. etc. Priorities in each country depend basically on what are the most binding constraints to development and poverty reduction. Experience of more and less advanced countries underlines the importance of attention to ICT infrastructure, and more specifically..

- *game plan, policy and regulatory regime*.. Countries need ICT and knowledge economy game plans, however basic, and these need to be integrated with overall socio-economic development strategies and with poverty reduction strategies. Policy and regulatory regimes which support the development of both market and social ICT investment are key. Liberalization and private market expansion have been central to successful countries, but so have public support and investment. Social inclusion, equity and poverty reduction have been important components of most successful ICT/knowledge economy strategies. Knowledge and technical assistance in ICT policy and regulation is plentiful, but there is a need to further synthesize and make easily available the central models and features of ICT4D policy/regulation, and the special elements most important to ICT4P.

- *telecommunications and connectivity infrastructure*.. Government investment support for ICT infrastructure (but generally not managing it) has been an essential ingredient in developed and rapidly advancing ICT-oriented developing countries. A primary case for this is that of collective consumption (public goods elements of connectivity infrastructure), and thus of economic efficiency. Regardless of the case for public support, however, poorest country governments lack a sufficient revenue base for investment - even though experience indicates that, with competition and reasonable public management, connectivity costs can decline quite rapidly. International development cooperation, currently focused so much on poverty reduction, could valuably take up the government-to-government task of ICT infrastructure development - on both efficiency and equity (poverty reduction) grounds - and further building of effective country and sector approaches needs global and country-by-country attention. The pro-poor areas of connectivity infrastructure, like Wi-Fi and wireless/mobile/PDA, increasingly need specialized attention from governments and bilateral donors in ICT and poverty reduction strategies.

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[2] Both 'physical/technical' infrastructure:
- policy/regulatory regimes, technical supplier/provider industries, hardware and software/applications
and knowledge and networking infrastructure
- content providers and content, knowledge networks/networking, attitudes and technical capacity of users - ICT literacy

- *application and content..* Aside from international content of the Internet, an enormous resource, the application and content for all domestic ICT applications comes from a full range of institutions in a country - government, educational, private (telematics sector), NGO, gender, development and community organizations etc - and the engagement of each needs building and investment as part of national strategies and donor support. In many countries, improvements in public sector functioning are key, and there are many e-government platforms available internationally at low cost, and with support for adapting and implementing. ICT and e-government supported improvements in economic and budget management, government accountability, social services (especially health and education) targetting and delivery, poverty monitoring etc are well developed and merit concerted attention and investment, given the cost of public sector weaknesses or failures.

Suggestions

Accelerated pro-poor access and utilization

A next step for the ICT4D community, (operating responsively and largely outside developing country governments, supported by multilateral and bilateral donors outside bilateral government-to-government channels), would be to consolidate the successful experience and lessons of the past decade of 'research venture capital', and intensify efforts to bring ICT access and beneficial uses to poor communities. More specifically, with the focus of donor support on poverty reduction, it is suggested that global ICT4D fora, including the forthcoming World Summit on the Information Society (WSIS) develop an explicit ICT4P platform which includes concerted efforts on:

- support for low-cost technology development and application, aimed at poor-community access;
- support for improvement and scaling up of key applications and services for poor communities - within countries and internationally:
  - bringing together essential partners, eg organizations specialized in development and community organization, gender equality, education, economic development and poverty reduction..
  - funding well conceived initiatives at a scale much larger than current ICT4D pro-poor access initiatives;
- support for some leading-edge ICT-pro-poor initiatives in areas of global focus re poverty reduction, eg girl's primary education (aimed at girls but not excluding boys), where there are active global consortia.

Systemic poverty reduction improvements

At the same time, the effectiveness of governments and bilateral government-to-government cooperation in ICT4P investment could evidently be improved by co-ordinated country initiatives, for poorer/poorest developing countries, which included:

- elaboration of ICT and knowledge economy game plans, integrated with overall development and poverty reduction strategies, and the policy and regulatory regimes needed;
- elaboration of ICT application in government services strategies, notably education, health, macroeconomic and budget management, gender equality and poverty monitoring;
- support for the implementation of these strategies, once elaborated, including long-term support for the public goods component of ICT infrastructure development

ICT4P Research Support Program

Both of the initiatives above would need research support including:

- more, more frequent and better synthesis of technical knowledge, and lessons/good practices, including country by country ICT4D/ICT4P reviews across sector and issue areas;
- research support for connecting and building coalitions among ICT, community development, gender, livelihoods, education, health etc oriented organizations internationally and within countries;
- more synthesis of experience on the integration of ICT and knowledge-economy strategies with poverty reduction and overall development strategies;
- microeconomic analysis and evidence on the main ICT-centred and supported applications which are central to both the private and the public-services sectors important to poverty reduction.

I   Introduction

Information and communications technologies (ICTs), including the Internet, are generating changes in markets, sectors and economies in the more and less developed world. Some 'sectoral' changes are very large (business services, education) while others are to date small. But they are present and advancing in every area of economic, social and political activity. It appears that the ICT/Internet revolution is rolling out much earlier and faster in developed countries, and many 'rapidly changing' or advanced developing countries, so that changes and improvements are more studied and better understood.[3]

In almost all of these countries, expectations of people and markets got way ahead of economic reality, and currently are a long way toward absorbing the bursting of the bubble and the moving on more realistically. But another part of that economic reality is that the majority of people in the world are not yet included in 'the Information Economy.' In this perspective, the developing world is part of the solution, rather than a problem, for both slowdown and volatility in the tech-sector. Few doubt the power of ICTs and connected technologies, which are still in early stages of diffusion globally, nor their essential part in realizing the economic, social and quality-of-life benefits from more knowledge/networking/innovation oriented economies and societies.

There is a considerable body of literature on the socio-economic impacts of major new waves of technology.

Technological Revolutions and Opportunities for Development as a Moving Target[4]
"Abstract: World development is not simply cumulative progress. It is rather a jagged process, marked by major changes in direction, advances and setbacks, in relation with successive technological revolutions. Countries in the periphery face successive windows of opportunity determined by the phases in the deployment of these great surges of technological transformation. The nature of these spaces of possibility varies; some windows are narrower some wider, some only sufficient for initiating development processes others allowing significant leaps forward. Countries advance when they consciously or intuitively take advantage of each consecutive opportunity; they fall back when they continue applying the previous recipes when the context that had made them effective has ceased to exist. Understanding the origin of these changing conditions helps comprehend the unequal results of past policies and provides criteria for designing adequate strategies in the future."

The impacts of ICT/Internet, and their roles in development and poverty reduction, have been understandably receiving quickly growing recent attention from academics, researchers, NGOs, governments and donors. Sections III and IV attempt to survey some reasonable part of this experience, with respect to a number of interesting countries, and a range of areas of economic/social/political activity. Some initial observations, by way of introduction, would include:

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[3] For perspectives on the roll-out of ICTs and the Internet, comparisons with earlier technologies, and perspectives on economic development implications; Michael Spence, Keynote address at the meetings of the MIMAP Network, June 2002, at Université Laval: www.pep-net.org (under "meetings and workshops", "MIMAP network")

[4] Perez, Carlota, Technological Revolutions and Opportunities for Development as a Moving Target, from Amilcar Herrera Annual Public Lectures: http://www.intech.unu.edu/events/herrera-lectures/2001-perez.htm.
See also:
   Perez, Carlota, Technological revolutions and financial capital : the dynamics of bubbles and golden ages, Edward Elgar, Northampton, MA, 2003.
   Castells, Manuel, The Information Age: Economy, Society, and Culture (three volumes), Oxford: Blackwell, 1996-1998; 2nd edition, 2000,
Volume 1: The Rise of the Network Society, Blackwell Publishers (Oxford, and Malden, MA), 1996.
Volume 2: The Power of Identity, Blackwell Publishers (Oxford, and Malden, MA), 1997.
Volume 3: End of Millennium, Blackwell Publishers (Oxford, and Malden, MA), 1998.
   Mansell, Robin (ed.). Inside the Communication Revolution: Evolving Patterns of Social and Technical Interaction. Oxford University Press, 2002.
   Hall, Bronwyn H. and Khan, Beethika, Adoption of New Technologies, NBER Working Paper No. W9730: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=410656

The 'rapidly changing country' cases are very important in themselves and for other countries who may 'go for it' with a combination of ICT, other high tech, and all of the physical and knowledge infrastructure that goes with it. Many of these cases (eg India and China) appear particularly interesting for less advanced developing countries, as their ICT/tech sectors are strong, but don't dominate in economies with relatively large rural and poor populations. Mongolia is an interesting intermediate case among many in Asia, and Uganda, Mozambique and Senegal in Africa, with Senegal becoming a 'technopole' in West Africa.[5]

In the less advanced developing countries, where much of the world's poverty resides, the picture is different. ICTs are expanding in all 'walks of life,' but sporadically - depending less on concerted vision and more on 'initial conditions' (particularly education and skill levels), national regulation and policy capability and governance, and the range of different commercial and development organizations and interests investing in ICT expansion and diffusion. There is a wide variety of country situations, from very weak, in terms of 'e-readiness' to 'working hard and getting there'. Most countries have or are preparing e-readiness plans, with many supported by country-donors and IFIs.

> These plans ought to be very valuable, and to achieve this, need to be integrated with social and economic development strategies (and institutionally among information, science, education, health, economic/finance, rural development etc. ministries). These national development strategies, particularly in most of the poorest countries, are currently strongly oriented toward poverty reduction. ICT strategies, consequently, need to seriously address poverty reduction, equity and social development.

> There are many good examples of exactly this, from rapidly advancing OECD and developing countries. Some relied mostly on liberalization and growth, but most in fact sought wide national inclusion and buy-in, and gave a lot of attention and support to poverty, equity and social development objectives. Most are succeeding.

> To a considerable extent, this paper is oriented to national strategies, policies and budgets of less advanced developing countries, some of whose economic/finance ministries I have worked in, and accepts the view that (growth and) development is a necessary - but not sufficient - condition for poverty reduction. There are many successes in pro-poor and equitable growth, from economy-wide to community level, and most are convincing in terms of both economic performance and the quality of life which emerges.

> It is worth noting, for later reference, that a different kind of model is seen in major initiatives/phenomena like that of the Grameen Bank in Bangladesh, which first built up micro credit provision for millions of people in poor communities, and then adopted ICTs for its operations, and for access and use (livelihoods, education etc) largely for the poor.

With respect to poverty reduction, the most prominent ICT-development (ICT4D) activity of the past decade has been the host (hundreds going on thousands) of very applied research/pilots - many in poor communities or with organizations working directly with the poor. These have focussed on livelihoods, education, health, human and community development… and span a wide and innovative range. Most of this very applied research and application has been supported from the perspective of ICT specialists and practitioners, who understood or predicted the large potential impact of ICTs earlier than most, and were in a position to connect with progressive partners and also carry out core technical parts of projects and investments.

> This experience has been quite well documented. Generally it has been good, with problems and constraints in virtually every case, a fair share of failures, but with commitment and very often

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[5] Several of the intervention-specific cases surveyed in chapter IV are for these countries, but it remains to collect and synthesize cases which provide overall country perspectives.

successful outcomes. Lessons have been learned. It is probably fair to say that a vast majority of poor communities world-wide would like ICT access, and that domestic institutions in most countries are in various stages of getting experienced at this, often with external support.

Constraints appear to lie particularly in basic education and literacy, and in the time it takes to grow capacity in technical and intervening (public, NGO, civil) institutions. Also, while initiatives often produce positive results quickly, they can take years to become financially self-sustaining - more so when aimed at important public services (education and health) rather than livelihood development and support. And concessional financing (public, donor, voluntary) is ultimately limited and has other priorities to consider in relation to poverty reduction.

It is important to note the many ICT4D investments which *have* become quickly self-financing, even with weak national ICT infrastructure, and in both commercial and public services applications. Recently, many have used mobile phone and PDA technologies, and many applications (eg transmitting market prices to farmers, squeezing margins of middle men), have sprung up very quickly, successfully and sustainably in many countries.

It would appear, not surprisingly, that the ICT technology mix would be different in poorer societies, and less (quickly) oriented around land lines and desk-tops. It is also clear by this point in ICT diffusion experience that the development of technology mixes oriented to poorer users will be one key to success in poverty reduction. As elaborated below, combinations of satellite, Wi-Fi and wireless (mobile, PDA) technologies are being developed and piloted in poor communities by many ICT entrepreneurs.

Another large and related wave of ICT4D initiatives has aimed at various sectors or parts of national or local systems that are important for development and poverty reduction, from ICT infrastructure and policy, to health and education services, to natural resource management, to public sector management and governance, to local engagement and empowerment. Experience is similar - many successes, overcoming obstacles, but ultimately facing the same constraints of skills and institutions, and in many areas, long-term concessional financing.

The decade long boom in ICT4D investment appears to be both cresting a wave and undergoing a process of assessment and change. Major global initiatives and fora, including the forthcoming World Summit on the Information Society (WSIS) are adding in a big way to resources and attention. There are very good reasons and evidence to continue 'investing in everything', particularly access and beneficial access/support for (poorer) communities, and all it takes to achieve this.

At the same time, there are competing demands for scarce internal and foreign (private, donor) resources and the ICT priorities of each country are different, because of both circumstances (eg extent of conflict, poor governance) and cultures. As experience develops, it raises questions of scaling up, and whether more could be done for development and poverty reduction through different forms or configurations of ICT expansion and diffusion.

Depending on a country's circumstances, where do ICT-related investments have highest returns? Where are returns so high or important that domestic or donor resources should be shifted from other development and poverty reduction activities?

This brings the focus back to national development perspectives and strategies - including their governance and local development dimensions. But a second main orientation of this paper remains that of the WSIS and global fora, the importance of their adopting more explicit poverty reduction objectives and agendas, the importance of their taking on board more specialized knowledge about poverty, gender, social and economic development, and the importance of integrating ICT strategies

with development and poverty reduction strategies within countries and donor organizations. In short, work is needed on the **rationale and content of an ICT4D poverty platform.. ICT4P.**

Issues of ICT impacts on poverty had also emerged from the twelve-year experience of an IDRC program (MIMAP or the micro impacts of macroeconomic and adjustment policies) which supports research in the South on the way macro, sectoral/regional and local levels of economies interact. In this perspective, ICTs can be looked at as technologies - like others, but with some very special and unique features - which draw them broadly and rapidly into (all) other production/market/consumption technologies. How, how much and how fast they would be expected to impact on (poor) households and communities - and by what specific 'channels' - is a very interesting and challenging question, amenable to these macro-micro and global supply chain approaches, but needing a detailed survey and knowledge of actual experiences (country by country, across all 'sectors') to be realistic.

Poverty reduction, over time, also of course relies on economic development and growth stemming from sources other than technological advance. So the ways in which ICTs create or contribute to private sector growth, globally and locally, and to public sector effectiveness, are a big part of the essential background for understanding ICT-poverty connections and possibilities. Data is a problem here, though knowledge on ICT-productivity relationships is fair for advanced countries, and there is interesting case-study evidence surveyed below of ICT impacts on governments and governance in both developed and developing countries.

ICTs are very special in several economic perspectives sketched below, but it appears that there is relatively little synthesis of research on the economic (let alone poverty reduction) impacts of their diffusion, relatively little underlying theory, and relatively few individuals whose experience tends naturally to combine perspectives of IC technology, economics, poverty reduction, gender equality and social development. This picture is changing, and many recent studies are referenced below. Some have grown out of the impact assessment approaches developed for ICT project interventions, and some are coming from sociology, economic, gender and political science perspectives.

On the political side, the implications and control of ICTs are addressed, monitored and widely debated by activists, and the dangers of privacy invasion and political repression seem clear.[6] But there appear to be few strong economic analyses and perspectives, let alone 'frameworks' which help clarify the channels, and the short and longer-term development and poverty impacts, of ICTs and the Internet.

At the level of individual ICT initiatives, I had hoped to find some fairly hard microeconomic evidence on relative returns of investments in community access, livelihoods development/support, education, health, e-government etc., but was not very surprised to find little. Many factors make these investments difficult, for example, for benefit-cost calculations, including:
- the relatively short life of the investment boom so far;
- the familiar problems quantifying health, education and other (part) public-goods benefits;
- the cumulative effect of investments in a new-technology wave (national railways would not have been built on at-the-time realistic benefit-cost calculations);
- the rapid changes in technologies (broadly defined, elaborated below), which make today's micro analysis not very applicable to tomorrow's investments.

Better microeconomic evidence would be one suggested priority for further research, but given the difficulties, and lacking this at present, decisions by public and private investors go on, and are helped by the best evidence available. Some comes from scholarly studies, but most it seems, from project/initiative, issue/sector and country case studies. A good part of the motivation for this paper, having started, was to collect as much study and case-study evidence and references as possible / reasonable.

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[6] For an interesting overview, *The Economist, Survey of the Internet Society*, January 25th-31st edition, 2003.

At the same time, organizing experience in a way useful for judgements about ICT investment strategies and priorities - with a continuous focus on poverty reduction - needed some conceptual or organizing framework. And the one adopted and adapted here, and sketched in II below, is admittedly quite economic in nature, aiming to help ***clarify, across some range of countries and initiatives:***

- ***shorter- and longer-term economic and social implications of ICTs expansion - theory and knowledge, from micro to macro, and from local to global;***
- ***which are presently and potentially more and most significant for (i) development and (ii) poverty reduction efforts (including the negative);***
- ***factors that determine, and policy or interventions that influence, the most important ICT-development and poverty-reduction linkages.***

A final and in the end primary motivation for this paper is to provide a backgrounder for a meeting of specialists, scheduled for September 19-20, 2003, bringing together specialists in ICTs, economics, gender, social development and other perspectives, and aiming to help develop clearer views of ICT-poverty connections. This is a very experienced group of people, and IDRC hopes that their discussion and views will influence and benefit ICT and development strategists and investors, domestic and donor, public and private. To the extent that action or research priorities also emerge, IDRC would envisage supporting both substantive and coalition-building research and activity.

It is good to keep in mind the caution of both technology and social science specialists, that the impacts of ICTs are very much dependent on what else is happening in the economy and society, and that these technologies themselves are presently changing fast enough that anyone saying they understand much should be regarded with some suspicion. In this connection, it also appears important to keep an eye on how (fast) ICT ***and related*** technologies will change over the next years and decades.

> This goes far beyond the rollout of currently familiar technologies (eg universal broadband Internet and all that goes with it) into very much enhanced silicon technology, molecular electronics, and the development of both smart and organically organized computers and systems.

> It is not now outside the arena of sane predictions by scientists and commentators to anticipate that biotechnologies - and their inorganic molecular engineering equivalents - will generate over the next few decades the knowledge and methods to eliminate disease, hunger, poverty, economic scarcity and environmental degradation, along with similarly dramatic challenges and dangers [7]

> The solutions, of course, will do no better than present ones if social and political development does not accompany scientific and technological advance. Enough is produced and known today to largely eradicate hunger and poverty. So it is right, for poverty reduction, to emphasize and give priority to approaches that build peace, governance, rights/freedoms and distributive equity nationally and globally - and provide resources and opportunities for the poor.

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[7] There is of course a huge amount of literature and Internet discussion here. Some useful overviews include:

The Economist Magazine, Biotech Survey, March 27, 2003

Cynthia Roth-Robbins, *From Alchemy to IPO: the Business of Biotechnology*, Perseus Publishing, Cambridge Mass, 2000, (an insider's documentary of the sciences/technologies, firms and sectors in human health, agriculture, environmental management, oceans and space...)

Davy, Brian, Dufour, Paul, Lafond, Renald, Leppan, Wardie, Spence, Randy and Woo, Jean, *Survey: Biotechnology and GMOs*, IDRC, work in progress.

Brockman, John (Editor), *The Next Fifty Years: Science in the First Half of the Twenty-first Century*, Weidenfeld and Nicolson, Great Britain, 2002.

Grace, Eric S., *Biotechnology Unzipped,* Trifolium Books, Toronto Canada, 1997.

Charles, Daniel, *Lords of the Harvest*, Biotech*, Big Money and the Future of Food*, Perseus Publishing, USA, 2001.

Crandall, B. C. (Editor), *Nanotechnology: Molecular Speculations on Global Abundance*, The MIT Press, 2000

At the same time, the new ICT and 'molecular' technologies provide huge upside potential, and they are inextricably integrated in their science, development and global utilization. Biotech literacy will be as important as ICT literacy for the South, and what is done now about influencing ICT expansion in directions of equitable development and poverty reduction will have major benefits for the subsequent technological revolution(s) currently bursting onto the scene.

The Social Implications Of Information & Communication Technologies[8]

"If there is a sentence that would capture the essence of the current empirical record on the social implications of new ICTs it probably would be that there is a dramatic gap between our technological over development and our social underdevelopment. Because of the power of new technologies, trends which are rooted in the organization of societies become extraordinarily amplified, so that, overall, we seem to be heading towards social and economic crises of unprecedented magnitude, instead of collecting the harvest of human creativity. Some of these trends are related to the new brand of de-regulated, global capitalism that emerged triumphant from its historic confrontation with statism – only to be faced by its own contradictions and systemic flaws. But capitalist greed is not the whole story. Deep-seated sources of discrimination and social exclusion, such as racism, patriarchal sexism, xenophobia, religious fanaticism, extreme nationalism, are also contributing to the deviation of the power of technology towards enhancing the technology of power. Furthermore, institutional weakness of political systems, and the widespread crisis of ethical values in most of the world, may be inducing an even more dramatic confrontation between the products of human ingenuity and human life. The revolution in genetic engineering, an information technology after all, is putting in our hand the power of alter, manipulate, and ultimately create life. As regulatory institutions and ethical controls break down in most realms of activity, we should not expect much enforceable restraint in the conduct of this new technological adventure. The extraordinary potential of the biological revolution to cure illness, and feed an still starving world, may go hand in hand with the dark side of the Information Age: after conquering the power of life and death over our own species, we may well follow our death wish."

Finally, by way of introduction, and without going into any great detail, some brief underlying definitions or views of ICTs, poverty and poverty reduction, are as follows.

A very expansive definition of ICTs is adopted initially. From a recent ICT-poverty literature review done by Dr. Catherine Nyaki Adeya for IDRC (Annex A)[9], "**ICTs include** electronic networks – embodying complex hardware and software - linked by a vast array of technical protocols. (Mansell and Silverstone, 1996). ICTs are embedded in networks and services that affect the local and global accumulation and flows of public and private knowledge. According to the United Nations Economic Commission for Africa, ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities (ECA, 1999)."

At the same time, a more economic and functional definition would be useful. Section II explores economic characteristics of ICTs which are more concrete and familiar - eg information and communications volume, time, distance, error, access, search , cost etc.

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[8] Castells, Manuel, *The Social Implications Of Information & Communication Technologies*, (Conclusion section), Report prepared for UNESCO's World Social Science Report, 1999: http://www.chet.org.za/oldsite/castells/socialicts.html
[9] C. Nyaki Adeya, *ICTs and Poverty, a Literature review*:
http://network.idrc.ca/ev.php?URL_ID=24718&URL_DO=DO_TOPIC&URL_SECTION

While there are volumes of perspectives on poverty and poverty reduction, one might risk flagging the following[10]… **Poverty** is generally thought of as deprivation in respect of things necessary for life - food, water, health, shelter - and others fundamental to life - education, security… opportunity… freedoms[11]…

- Poverty is associated with lack of rights, freedoms and empowerment, at both household and higher levels of social organization.
- Poverty is associated with lack of many kinds of capital - physical/economic ('plant and equipment,' market institutions), human (education, knowledge), political and social/community institutions etc.; all take time to build and accumulate
- Poverty is often associated with and worsened by war, natural disasters and major epidemics (HIV/AIDS).

Poverty is **measured** in several ways: the ones used widely are household income and expenditure. Multi-indicator measures and surveys are becoming frequent today; and participatory and community based monitoring mechanisms are spreading. Numbers and percentages of absolute and relative poverty are typically measured against a national poverty (income) line, but with better information (nutrition, health, education etc), understanding of household and individual poverty is gradually becoming clearer and more current in most countries.

There are many different **kinds** of poverty, and some distinctions are suggested as particularly important. Chronically and transient poor, as one important example, have different needs - the latter are in particular need of protection or social security in the face of crises - the former of more fundamental support. Implications for ICT impacts and priorities are very different - eg more in economic stabilization/ management and safety nets for transitory poverty, and more in basic relief, nutrition, health, livelihoods, education for chronic poverty. In this context, 'poverty dynamics' is important to understand in each country, and is a priority for collection of consistent information about poor households over time, and understanding it well. [12]

Chronic and Transitory Poverty in Recent Panel Data Studies[13]

country	dates	observations	chronic poor	transitory poor*	never poor
S. Africa	1993-98	2	22.7	31.5	45.8
Ethiopia	1994-95	2	24.8	30.1	45.1
India	1968-71	3	33.3	36.7	30.0
India	1975-84	9	21.8	**65.8**	12.4
China	1985-90	6	6.2	**47.8**	46.0
Pakistan	1986-91	5	3.0	**55.3**	41.7
Russia	1992-93	2	12.6	30.2	57.2
Chile	1967, 85	2	**54.1**	31.5	14.4
Zimbabwe	1992-95	4	10.6	**59.6**	29.8

Similarly, poverty with violence and insecurity has different (additional) features and requirements. More women are poor than men, but in spite of much focus on this issue, information on poverty of males and females within households is just now becoming adequate to quantify this inequality at all precisely. It is

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[10] These views come principally from the experience of the MIMAP (Micro Impacts of Macroeconomic and Adjustment Policies) program supported by IDRC, particularly the 'poverty measurement, monitoring and analysis' and 'community based monitoring systems' elements; see www.mimap.org for further information.

[11] Amartya Sen, *Development as Freedom*, Oxford University Press, 1999

[12] For many countries, 'panel data' - same data, from same household sample, for two or more points of time (years) - are becoming available and should continue, indicating in particular which households have been moving in and out of poverty, and a lot about their economic and social characteristics.

[13] Paul Shaffer, *New Thinking on Poverty Dynamics, Implications for Policy*: http://www.un.org/esa/socdev/poverty/paper_shaffer.pdf. *Chronic poverty is defined as those who are poor in all years of the panel, while transitory poverty consists of the 'sometimes' poor.

important in each country to have a current profile of the poor according to several policy and intervention oriented dimensions - employment/income, consumption, nutrition, education, health, security etc. Currently, only with the more specific measures - eg nutrition and education, do within-household poverty differences (eg male/female) emerge.

Poverty reduction and broader long term development are closely linked. This is not the place to tackle definitions of development, but human development (capabilities, freedoms) is clearly central to poverty reduction, and a balanced accumulation of human, political/social/community and physical assets is seen as central to economic and social development.

There is much debate about whether growth causes - or is necessary to - poverty reduction; it appears that little poverty reduction occurs without growth, and growth is associated with different degrees of poverty reduction - from almost nil to very positive (E Asia, China). Give or take a bit, growth is a necessary but not sufficient condition. In this context, *all* measures contributing to growth and development - from good (economic) governance and management to improved infrastructure - are key for poverty reduction.

It is useful to consider some broad approaches to poverty reduction, each influencing strategies, policies, programs, and projects or interventions in certain directions, eg direct transfer approach , human capital approach, production function approach, governance approach, sustainable livelihood approach.[14]

There is a lot of evidence that poverty reduction and gender equality are closely related. In this context, elements of pro-poor and pro-women growth are reasonably well explored. More is said below.

Precisely targeted programs have proven difficult for national and provincial/state-level governments to do efficiently, though there are successes and lessons from experience. In this context, communities and local governments have much potential, and some/growing success, in being able to support the poor and reduce poverty; community-level information and development mechanisms are expanding with decentralization and devolution of government in many developing countries.

Section II explores some conceptual approaches to how ICTs impact on development and poverty reduction, followed by III and IV on experiences of the more and less advanced countries.

II   How ICT/Internet Expansion Impacts on Development and Poverty Reduction

ICTs in an Economic Perspective

Economists and technology specialists often look at 'technologies' in different ways, so a quick look at economic perspectives is ventured here. Economists will find this simplistic at best, but it offers some possible framework and insight into the many ways ICTs and the Internet have impacts on economic and social activity.

Economics, in one prominent perspective, has long regarded technologies (broadly defined) as both:

- factors of production, embedded in 2 of the 3 principal factors or inputs - capital (physical capital - the 'plant and equipment part'), labour, and land/resources:

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[14] Paul Shaffer, *New Thinking on Poverty Dynamics, Implications for Policy,* (2001) provides a very good survey of these broad approaches, and more specific measures within each, together with an assessment of lessons learned in each case: http://www.un.org/esa/socdev/poverty/paper_shaffer.pdf

- eg, farm production technologies are embedded in the buildings and machinery, and the knowledge/skills/abilities of farmers and support industry personnel;
- technologies are embedded in different ways and degrees in the 3 factors, for different markets, eg more in labour/human capital in knowledge-intensive industries; and

- processes that represent the way factors are combined to produce goods and services:
  - this idea is applied to producers, and also to entire markets - both private and public;
  - in this sense 'technology' describes the production and consumption structure of an agricultural market, or the production and delivery structure of a primary education service - what factor inputs are used, and how they are used/combined to produce the output.

Both are useful. In a simple example, production and distribution can increase with no measured change in the amounts of capital and labour (or other) inputs. Is this because the quality of machinery and equipment has increased, or quality (productivity) and knowledge ('human capital') of labour has improved, or because better production techniques (and science) and processes have been developed? Probably all; measuring factor and process quality are difficult enough that empirical studies lack some resolution. But they generally agree on the fact that a large part of production growth in industrialized and other countries is **not** explained by the quantities of labourers, capital stocks and land/resource stocks - **something like half**.[15]

Production of   =   a function (combination/process/technology) of
a good or service   [capital, labour/human capital, land/resources, other products and
                                  services as intermediate inputs]

The (40-50%) unexplained portion has variously been attributed to unmeasured factor quality increases, to technological change - better means of combining the factors - to overlooked factors (eg management or governance, knowledge base and infrastructure) - with attempts to measure and explain the missing elements.[16] 'Total factor productivity change' is another way of looking at this, and TFP changes are routinely measured in firm/micro studies of competitiveness. Nevertheless, there remains a substantial gap in understanding the *determinants* of productivity change and growth, and a tendency to look ascribe much of the explanation to technological change - in a very broad sense - as the ways in which people, enterprises, markets and economies develop/absorb/use new knowledge, skills and inputs.

In this framework, information and communications technologies are particularly interesting in several ways. Like other classes of technologies, they are used in production in their own (ICT) industries - and this itself is a growing sector in most countries, and a substantial growth engine in most developed and rapidly changing developing countries.

But more than most other technologies, ICTs are prominent in, or expanding rapidly into, most other sectors - some very slowly and others dramatically. Quantitatively, they are thus becoming more prevalent and important. In this sense, they might be compared to earlier technological revolutions or major changes. Michael Spence, for example, makes comparisons with electricity and the electric motor - as soon as the electric motor was invented, anyone thinking about it at the time would have seen that all the existing steam driven technology was 'history,' but it was a history that would take 50 years to unwind. [17]

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[15] Further data/evidence and country detail is available and is being explored.

[16] See for example: Robert M. Solo, *Growth Theory, an Exposition*, Second Edition, OEP, January, 2000;
- Ahn, Sanghoon and Hemmings, Philip (2000*), Policy influences on economic growth in OECD countries: an evaluation of the evidence.* OECD ECO working paper;
- Temple, Jonathan (1999), *The New Growth Evidence*, *Journal of Economic Literature*, 37(1), March, 112-156;
- Aghion, Philippe and Howitt, Peter (1998), *Endogenous Growth Theory*, The MIT Press, Cambridge.
- Keely, Louise C. and Quah, Danny T. (1998), *Technology In Growth*, CEP discussion paper no. 391.
For a simple but quick summary, see *The Chemistry Of Growth* , Economist, 00130613, 03/06/99, Vol. 350, Issue 81

[17] Michael Spence, Keynote address at the meetings of the MIMAP Network, June 2002, at Université Laval: www.pep-net.org (under "meetings and workshops", "MIMAP network"). Characteristics of ICTs

But the characteristics[18] of ICTs also, arguably, make their impact on development considerably more varied and rich. A few (related) characteristics appear to be of particular note.

ICTs **reduce transactions costs**: ICT/Internet have reduced transactions costs in many economic activities and markets by massive amounts and in all markets by significant amounts. The way this plays out in different markets, depending on the nature and extent of transactions costs, is a major element of ICT/Internet impacts…
- agricultural producers and households obtain market information, make better decisions and escape poverty;
- business services sectors (eg 'personnel' or human resource management) in developed countries are transformed by Internet-based giants.

Left to markets, this characteristic pushes ICTs in all activities where transactions costs are high and important (in total costs), and where ICTs can penetrate. And importantly, they also make possible new activities which would simply have been beyond considering otherwise; eg researchers in developing countries search major world libraries in an hour. It is perhaps this aspect that explains some of the excitement and fascination with ICTs; they can be very liberating by enabling wholly new possibilities. They also enable new possibilities for control and repression, as elaborated in examples below.

It also can be argued that transactions costs have tended to rise with time, distance and correlated variables, as the global economy has expanded and become more integrated. With modern ICTs, time and distance essentially don't matter, so the reduction in transactions costs can be larger in absolute and percentage terms than the rising trend. This has lots of economic effects, eg:
- it pushes boundaries of markets out so they become less local;
- it **integrates global and local markets** and supply chains better/more efficiently.

Another way of describing this, in economic terms, is that ICTs can make services, previously non-traded, tradeable - within countries and internationally. This aspect of ICTs looks to be particularly important to many developing countries.

Further, in this context, ICTs *untrap human resources*: The Internet enables individuals in any/developing countries to participate in markets or activities beyond the constraints of their locations, and even globally:
- 'Telework' is becoming widespread;
- Children receive better education in their homes, community centres and schools.
- And over time, labour mobility is increased, intra- and internationally, by skills learned locally.

In this context, seen broadly, ICTs cause people's skills (human capital) *to jump in potential asset values*. This includes poor people, and is a very powerful and widespread positive economic (and social) possibility and even, over time, probability. But for the potential to be realized requires development of both the needed ICT infrastructure and connectivity, and the needed economic and social infrastructure and networking.

The economic infrastructure can vary from local networks sharing market information to global corporate supply chains. The key aspect of these is the networking which enables new forms of economic coordination, and the key element of this for larger and more complex supply chains, is the Internet. In the West, ICTs caused little/no measurable productivity change for 40 years; network based ICT expansion, with its coordination of economic activity, is dramatically changing this picture today.[19]

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[18] Much of this discussion of characteristics comes directly or indirectly from Michael Spence, op. cit.

[19] Michael Spence, *The informational structure of markets, information technology and economic growth and development*, inaugural W. Edmund Clark Lecture on Public Policy, Queens University, Ontario, March 14, 2003: http://qed.econ.queensu.ca/ (forthcoming). To put this further in perspective, fully ICT-integrated global supply chains are not yet a reality, but will be realized by some of the world's most globalized corporations within the next few years.

People, including poor people, appear to quickly appreciate the power of ICTs/Internet in untrapping human resources and expending their horizons. As illustrated below, this energy and excitement lends a dynamism to ICT-related poverty reduction activity which is otherwise often missing..

ICTs *embody a LOT of knowledge*. Particularly if ICTs include electronic networks, they embody and convey knowledge, and in this sense provide important intermediate products and services - and content - in education, and human and social capital formation activities. *Education* is thus a place where all the positive functions and attributes of ICTs converge.

They *embody broad communication and processes of economic/social/political activity and organization*. In this context, they *can empower*. In enabling broad and relatively open and uncontrolled *communications*: ICTs, and the Internet in particular, appear to have major impacts and implications for increasing transparency within and among societies, and fostering empowerment and accountability at many levels:
- political discussion, activism and transparency;
- supporting local access to information, public hearings and other public accountability initiatives and movements;
- supporting civil discussion of poverty reduction strategies and programs.

By the same token, their *absence or presence can disempower*. Particularly in circumstances of market or political competition, those excluded or with limited access to the technologies can be disempowered or made worse off. This is the main sense of the 'digital divide.' In a more active sense, these technologies can be used to invade privacy, control and oppress:
- for the developed and ICT-rich nations, competitiveness in ICT-intensive global markets is enhanced;
- for poorer groups within countries, often minorities, economic welfare and political power can decline.

They **condition and change the structure of markets, private and public**. Markets have information structures, which are part of their (broad) technology. As ICTs have been changing rapidly, so have the information structures and overall technologies of private and public markets and sectors: retail sales and business services in developed countries are well known examples:
- the organization and delivery of health services is improving in many countries, as ongoing monitoring mechanisms are used with health system management methods;
- the same is true of education systems, beyond the untrapping and empowering effects;
- disaster relief efforts may be improved greatly by early and accurate information flows;
- consumers are/can be better informed and make better decisions on everything, from autos agricultural inputs to foods.

From a macro perspective, the 'ICT revolution' is a major force of **structural change** and adjustment. Like other forces[20], whether positive or negative in aggregate and in the end, the change and adjustment creates winners and losers. Understanding and predicting impacts of ICTs on efficiency, productivity, growth, employment, distribution and poverty become important to economic stability and management. But as elaborated below, research on impacts of ICTs on productivity, changes in market and economic structures, growth, equity and poverty is basically a collection of very many sector and investment/intervention case studies, with synthesis and additional analyses emerging regularly.

In this context also, ICTs - as with the steam engines, electricity, combustion engines… of other technology revolutions - are **disruptive technologies**, initially creating some economic dislocation, and often some increase in distributive equity. Given the powerful positive potentials of ICTs, it is perhaps not surprising that many

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[20] There is a growing range of shocks, and related structural changes and adjustments, for countries to contend with. Technology change has always been one major factor. Public debt build-up and collapse and OPEC (major market restructuring) generated structural change in the 70s and 80s and trade and financial sector liberalization and crises in the 80s and 90s. Natural disasters, local conflict, famine (caused by both climate and politics), and epidemic (HIV/AIDS) lengthen the list currently, along with major policy mistakes (eg, in retrospect, in response to financial crisis).

market and 'social' entrepreneurs see the positive aspects of disruption itself - for example, the challenging of existing political and social hierarchies and helping create more capable, equitable and accountable ones.

It appears useful also to view ICTs as combinations of different kinds of **information** technologies, and **communications** technologies. The latter, of the more modern ICT era, include telegraph, telephone, radio, television, and Internet. The former are dominated by computers and local information/data systems. The combination embodied in the Internet, in particular, produces multitudes of major networks of knowledge and practice. For this reason, from an economic perspective, the Internet (and its successors) look to have a range and magnitude of impacts different from other major ICTs. Key related characteristics include common protocol; widespread and potentially universal reach/access - but individual use, search capability, difficulty of control, extreme information richness, instantaneous - synchronous or asynchronous by choice, and fairly low and falling in cost.

In this light, this paper often refers to 'ICT/Internet,' keeping the different nature and range of Internet spread and impact in mind. Not all share this view, and it is certainly remains a matter of enquiry and discussion. Certainly, the Internet in the developed countries came on the back of - and then together with - long processes of ICT invention and diffusion from print to television, and all the changes in skills and ideas involved. So the Internet is not separate or separable from other ICTs, and their development and experience, though it has a lot of its 'own' hardware and software technology. It does appear to be taking ICT spread to new breadth and variety of impacts on economic and social activity. But it also is evident that wireless mobile phone and PDA technologies are having large impacts in developing countries, including poorer populations.

ICTs are also frequently discussed as **infrastructure**, and this set of perspectives is also valuable. The elements of the infrastructure are basically 'economic' and 'social/political' in nature or, in a functional representation - in *telecomms, television, radio, phone and mobile, Internet, computers and peripherals, print media etc:*

- *'physical' and technical infrastructure*
  - *policy/regulatory regimes*
  - *technical supplier/provider industries*
  - *hardware and software/applications*
- *knowledge and networking infrastructure*
  - *content providers and content - WWW, programs, knowledge networks/networking..*
  - *attitudes and technical capacity of users - ICT literacy*

There are several lessons of experience from this perspective. In particular, **all** of these elements must be in place, in order to benefit from the ICT infrastructure, and the lack of any is serious. Policy regimes were perhaps overlooked in the early days on Internet expansion, but what content and process constitutes 'good' policy are reasonably well known today, and advisory support available from many sources including several international donors. Getting the full portfolio of policies 'right' in any individual country is nevertheless challenging - 'right' in terms of industry and user expansion, openness/democracy and control, social development and equity. Several country examples and approaches are sketched in III and IV below.

Some important further questions[21]
- What is the right mix of investment among private, public and international sectors?
- How should private sector incentives be structured, particularly with large fixed costs, low variable costs, and large externalities?
- What variables do the answers to these questions depend on, and how are they different for the USA and Cambodia?

In spite of many cautions, there is a predominance of optimism for the ultimately positive potential of the ICT expansion globally, though much less faith that inequities and poverty will be addressed. There is undoubtedly a

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[21] A. M. Spence

digital divide, and information 'haves' and have nots.' And this has undoubtedly contributed to greater global disparity. But this appears to be the initial impact of most major technologies. The optimism no doubt relates to the kind of cost-reducing, enabling, untrapping, educating and empowering characteristics noted. The remainder of this note takes the position, essentially, that ICT expansion is happening, that it can be sped, slowed and influenced by societies, and that understanding its impacts and ways of improving them for development and poverty reduction is a challenge with large rewards.

ICT 'Transmission Channels' and Impacts

Turning to a more specific look at transmission channels and impacts, a fairly long list is suggested here, and in many cases, questions flagged with respect to poverty reduction impact or potential. This list was initially derived from the considerations above, and is compared with the growing wealth of ICT diffusion experience in Section III below.

1. There are broad groups of technology investments in the form of *multi-purpose community access* points or telecentres. These provide commercial and public services in poor communities, and a wealth of social innovation, and thus have several economic and social channels and impacts:
    *   large scale microfinance, livelihood, ICT (village phone, village Internet) combinations like the Grameen Bank initiatives in Bangladesh;
    *   a wide array of smaller pilots, in virtually every country, involving combinations of livelihood support and development, education, health information/education, cultural and social activity - and different technologies - notably mobile phone, internet/computer/PDA.

2. Clearly, ICT and ICT-poverty strategies must depend on both technologies which are anticipated, and technologies which can be developed. The feasibility and time frame for widespread connectivity of poorer communities, for example, depends significantly on new low-cost, easy and universal broadband access. There are many promising experiments and pilots in low-cost wireless broadband, largely from ICT4D pioneers, and the probability that Wi-Fi and wireless (phone, PDA) technologies will permit a major leap forward. More broadly, there are good summary documents, referenced below, which clarify a large range of: technology/software/content prospects; successful efforts to develop technology, software and content oriented to poorer constituencies; constraints, realistic scenarios and key challenges.

3. A third broad area of social and economic impact of ICTs is in supporting greater gender equality. Gender equality goes beyond poverty reduction, but mounting experience and evidence indicates that most everything that is done to reduce poverty needs gender perspectives and gender equality objectives to succeed. Experiences (IV below) range from empowerment initiatives at local levels, to national and regional/international networks and movements, to human rights and gender-responsive budget support. Gender equality, of course, also cuts across other 'transmission channels,' and is very much related to engagement and empowerment aspects of the last item 9 below.

4. In the sense that balanced accumulation of human, physical and social capital are central to economic development and poverty reduction, Internet/ICT have a huge impact and potential impact on *education and human resource development*. Examples related to poverty reduction would include:
    *   schoolnets and remote-area provision - impacts on primary education, on girls going to school or getting education;
    *   distance learning of all kinds, and which are currently/potentially most relevant to poverty reduction
    *   widespread online journal access in tertiary education and research;
    *   training and data/systems management support in public services management and delivery, especially health and education.

    From the perspective of poverty reduction, universal or pro-poor primary education - and particularly girls' education - is a very appealing target, and one that could apparently be assisted by ICTs. At the same time,

secondary and tertiary education are the keys to science and technology advance. To the extent that ICTs can contribute greater efficiency to the production and delivery of education services, more of all levels of education are affordable. Hard evidence is again lacking, but cases and experiences suggest that ICT use can increase productivity in education, and provide rational for both public and private financing of ICTs as part of education (and health etc.) programs and investments.

5. *ICTs/Internet as growth engines and engine-parts:*

Many developing countries seek to increase *private or private/public research collaboration and innovation* through Internet/ICTs, as these are necessary technologies in high-tech growth sectors including the ICT/Internet sector itself. This has tended to happen in developing countries where a skilled part of the domestic labour force meets foreign capital and know-how, and subsequently acquires its own strengths. Public vision, support and promotion has been an important ingredient most cases. Technology management and transfer is an area well studied and documented, including more recently with respect to ICTs.

In this context, the potential spread of the new molecular *biotechnologies*, along with their inorganic nano-technology counterparts - needs a hard look, as well their integration with ICTs - which appears to be essentially almost total.[22] These technologies can be expected to initially create a ***molecular divide*** and increase global disparities. But will they benefit today's and tomorrow's poor more through eradication of diseases, already started, increases in food production and security, environmental management? Could ICTs be used to rapidly expand bioliteracy globally?

The *ICT/Internet sector can itself be a growth engine* in a macroeconomic sense, where the sector producing ICT and related goods and services grows much more rapidly than most other sectors. This has happened (eg India) even where other high-tech sectors aren't so prominent, but where technical (and English language) skills connected with (often Indian) counterparts abroad. The number of cases is not large, but beginning to grow. Risks of volatility have recently come to roost in ICTs of course, but long-term potential and growth is not doubted by many. Which are the next likely countries, and what is stopping or constraining them? Material below surveys countries and examines Bangladesh, Indonesia, Ukraine, Iran, Vietnam, Philippines, Russia and China. What lessons for poverty reduction can be identified and promoted?

6. ICTs can be used in important ways to *instigate and support livelihoods development*.

One of the largest focuses of ICT-poverty initiatives on the ground has been in working, in or closely with, poor communities in agriculture and local/rural/community development. Often these are associated with multipurpose community telecentres in poor communities, so support a range of other (education, health..) services as well:
- services supporting micro and family or personal enterprise - eg agricultural, crafts, arts, cultural - through networking, marketing services including e-commerce;
- networks providing agricultural market, pricing, input cost and other information - and frequently benefiting (small) producers by cutting middleman margins;
- sustainable telephony supply/services provided by (poor) villagers (eg Grameen);
- sustainable introduction of multipurpose telecentres into poorer communities.

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[22] ICTs are not just tools and carriers of these newer sciences, but also its substance. The challenges of both mapping the human genome, and the many technologies now aimed at identifying genes with functions and remedies, for example, have information sciences at their heart. See for example Arthur M. Lesk, *Introduction to Bioinformatics*, Oxford University Press, 2002. Coming from the opposite directions, it appears that next rounds of computers will include 'biocomputers,' or processing systems that behave like (if not actually) living organisms. This is not surprising in the sense that cells, and complex living systems based on them, such as people, embody the most powerful/evolved/advanced bio and nano technologies known.

Another range of ICT impacts occur largely in small and medium enterprises (SMEs), and include *telework, e-commerce, e-business*: There appear to be many examples, but little overall sense of which sectors and countries are most engaged in telework, and which forms mean most for poverty reduction. There are also many variations on this theme - parts of supply processes (design, marketing) being done by Internet/ICT - with particular potential and impact for small enterprises. In addition, *e-commerce at a market or industry level*, while small, is expanding in most developing countries, and there is expansion of other forms of *e-business* in some. What common factors underpin successes with respect to poor communities or poverty reduction?

7. ICTs are important in public sector, social services and poverty reduction management. (strategies, programs and interventions).

National management (economic, fiscal, financial, legal etc) relies critically on good information and statistics - from national accounts and household surveys to international economic intelligence - and good processing and communications systems for their collection and use. Budget (fiscal) management is often disastrously weak, for example, and good examples exist of ICTs bringing speed, accuracy and transparency to budget making and implementation. E-government 'systems' for the most basic and common of national government functions have been developed by many countries and are readily adaptable.

Sectoral policies and public services delivery which particularly affect poverty (all do to some degree) - *notably social services delivery, and especially health and education* - require very good information bases, and these are improving rapidly in some countries due to Internet/ICT. Some elements of these services are being actually delivered in increasing amounts by ICTs, eg telemedecine and, most notably, distance learning. And both the community/participatory needs monitoring mechanisms and the sector management systems need good ICT, networking and data/evidence.

ICTs are used in, and are highly important in many specific ways *to particular kinds of poverty reduction strategies/policies/programs/projects* - to list a few..
- disaster prevention, prediction and response efforts of many kinds are improved by ICTs - natural disaster, famine, epidemic;
- local-level poverty monitoring and poverty reduction initiatives are showing dramatic success in some countries, in terms of awareness, participation, transparency AND local government budget decisions - they depend heavily on easy information capture, processing/aggregation, transmission, and presentation at all levels - good technologies range from village boards to GIS-based presentations transmitted by Internet;
- poverty reduction efforts at all levels need good information about the poor - the methods for capturing, processing, analyzing and integrating knowledge from many sources of information are beginning to improve noticeably in many countries, in significant part just by the bringing together and better analysis of information regularly collected. These often entail important social changes, and have both their information and their civic discussion dimensions heavily supported by ICTs.

8. ICT/Internet and related technologies (eg remote sensing) are used in improving *environment and natural resource management*; 'ENRM and poverty reduction' is an expanding area, focussing perhaps in three ways:

In a livelihoods approach to poverty reduction, natural resources are among assets that individuals/households and communities accumulate. So too are social assets, especially community management systems for collectively owned or used resources, and the range of local-to-national public

policies and institutions which can support or undermine them. ICTs have many supporting roles in resource monitoring and social asset building.[23]

Natural resource quality and degradation have clear and not-so-clear links with human health. The possibilities for ICTs in better health services delivery and sector management apply here, particularly in bringing the environment-health linkages to the fore in health policy and budget decision making.[24]

Natural resource management will be based, to a gradually increasing basis, on biotechnologies, from existing bioremediation processes to genetic fermentation of biowastes and beyond. ICTs, as above, are the hosts of this knowledge, whose impacts even on poverty promise to be large.

9. ICTs clearly have an innovating *and empowering role at several levels.*

   At the very micro/community/ household/enterprise level, there are hundreds of cases, but also studies of broader instances such as the impact of cellular phones in Bangladesh, or the impact of telecentres and cyber cafes everywhere… Collecting, categorizing and understanding cases and evidence, and their relationship to poverty reduction, is quickly moving area of research, generating valuable 'lessons,' among which empowerment of women appears constantly as a theme.

   There are many examples, somewhat of the same nature, of *empowerment and engagement at more macro levels*, assisted by Internet/ICT spread. For example, during political events (eg the attempted coup in Cambodia in 1994, or the people-power revolutions of the Philippines in the 1990s) political monitoring and discussion via mobile phone, email and internet - internally and with outside connections and interests, has been both active and important in influencing and constraining actions and events. More generally, many of the growing public accountability frameworks, including access to information at all levels of government, rely in significant part on ICT for their implementation. In what ways do these broader social/cultural/political empowerment impacts benefit the poor, and how can they be improved in this respect?

   There is something of the same kind of possibility of *transparency and accountability at a global level*: for example, the cases and extent to which ICTs/Internet are and can be used more to counter causes of conflict, governance and corruption, human rights, arms trade etc. can be highly important to poverty reduction. Instability, and domestic and cross-border wars, create the worst combinations of poverty and deprivation, and annihilate poverty reduction prospects, for years or decades in their wake.

These groupings are useful only if they helps to clarify an overall picture of ICT-poverty impacts; no categorization works perfectly, and as Section III shows, this one suffers from a few general shortcomings including the tendency for categories to be highly cross cutting, notably:
- Current and prospective IC technologies and infrastructure are the basis for all the 'channels and impacts.'
- There are a whole set of poverty-related initiatives in the area of 'multipurpose community access telecentres,' which by nature are aimed at many channels - health, education, agriculture, livelihoods and e-commerce etc.
- There is an empowerment element to most ICT applications; the last category above is meant to refer to the more specific and political aspects of engagement, empowerment, transparency and accountability.
- There are at least a few other cross-cutting categories including gender equality.

Nevertheless, this set of categories has come out of both conceptual thinking and reviewing a large amount of case material, and is thus used for presenting the sector/issue case studies/snapshots of Section IV:

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[23] As one example of many projects and activities, see the IDRC supported *community based natural resource management* programs (CBNRM) in Asia, Africa and Latin America at www.idrc.ca.
[24] See for example the IDRC supported program on *ecosystem approaches to human health* at http://www.idrc.ca/webmap_e.html#Environment.

1. multipurpose community access;
2. access technologies amenable to poverty reduction;
3. gender equality;
4. education and human resource development;
5. science, high-tech and ICT-sector growth;
6. business and livelihoods development and support:
7. public sector, services & poverty management
8. environmental and natural resource management;
9. transparency, accountability, empowerment

This list can certainly be expanded, differentiated or modified. Discussion of channels and impacts has also more recently taken on terminology like e-industry, e-commerce, e-government, e-society, e-education e-tc. Seeing the e-sectors not just in themselves, but as e-parts of societies and economies, is a broader perspective worth maintaining.

III   Country Cases: ICT, Development and Poverty-Reduction Experiences of OECD, Rapidly Changing, and Other Developing Countries

The next two sections use a lot of material from publicly available websites, from websites available through subscription to online libraries,[25] and from the recent literature review cited in Annex A. Often the best way to convey experience is just to quote a section from a study or project document, so this method is used liberally. It is also quite selective, somewhat impressionistic and not meant to be exhaustive.

There are many examples of countries using ICTs prominently in generally successful development strategies - including Ireland, Estonia and Finland among the European countries, and many among the rapidly changing developing countries. Korea, Singapore, Taiwan, Hong Kong, Malaysia and Thailand are prominent in East Asia - also Turkey, Brazil, Mexico and India in a global perspective. Perhaps of particular interest to less advanced developing countries - because of their ICT initiative combined with relatively poor and rural populations - are countries like India, China, Mongolia, Philippines and South Africa. China and Vietnam provide quite different examples of countries initially resisting and controlling Internet/ICT expansion and 'opening.'

OECD

Annex A, "Evidently, many authors write about 'poverty' and 'rural areas' on the assumption that these terms are almost synonymous. Hudson's (1984) volume was one of the first to examine the role of telecommunications in rural development. Sixteen years later, Kenny *et. al*. (2000) conducted an empirical study where they argued that econometric studies have found increasing evidence of a causal link between telecommunications development and economic development; however, most evidence springs from the high returns on investment in the telecommunications sector. Some studies have extended these correlations to other indicators, such as social development, cost savings for industry, and increased transport efficiency. The Internet's potential is discussed at micro-level, in the sense that it provides an opportunity for firms and entrepreneurs to reduce costs, increase market coverage, and achieve economies of scale… After Hudson's (1984) paper, she wrote one seventeen years later generally on the same topic…The empirical studies cited on the contribution of ICTs to

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[25] In this case, the main databases used, via EBESCO Host, are Econlit, Academic Search Premier, Sociological Abstracts, TOC Premier and CAB Abstracts. In this context, many IDRC programs provide online library/database access to all their partners. The MIMAP program, for example, provides access to about 400 individuals at an annual cost of US$65/person and falling (about $25000/year in a program of $3+ million; ie trivial in cost). These services contribute enormously to learning and capacity development of partners as well as IDRC. There is no reason that research and other partners of donors should not all have access to advanced resources of the Internet, and one specific suggestion would be that all donors provide this as a matter of course.

development are mostly drawn from the USA... She cites examples of the benefits of telecommunications from the developing world (mostly Asia and South America). The examples used in the paper are categorised under agriculture and fisheries; transportation savings; business and industry; distance education; and health services."

Many will recall, also, several studies in the 1980s on how the post-industrial revolution in North America and Europe had especially favoured women, had hardly affected systemic poverty among minorities but had disadvantaged blue collar male workers the most. Was this true at the time, and is it still true? More evidence is needed, but one might venture 'yes, and no.' The speed of ICT and related technology change in the 1980s and 90s created major structural change and adjustment. Lessons from many kinds of 'overall positive' structural adjustment experience suggest that there are winners and losers, the losers tend to be concentrated among old-technology sectors (and blue-collar workers in them), the poor tend to be hit hardest - especially in their relation to their ability to cope, and after a substantial adjustment period, aggregate welfare increases.[26] Emerging evidence also underlines the extent to which initial computer and ICT investments produced adjustments but little productivity gain, while the more recent 'networking society' development from the ICT revolution - with its particular transactions cost-reducing, untrapping, organizing and managing etc. characteristics, which has reversed the picture, enabling large economic and social gains at moderate cost.

Technology, Computers and Wages[27]

"Abstract: Increasing returns to schooling and rising inequality are well documented for industrial countries and for some developing countries. The growing demand for skills is associated with recent technological developments. Sakellariou and Patrinos argue that computers in the workplace represent one manifestation of these changes. Research in the United States and industrial countries documents a premium for computer use. But there is recent evidence suggesting that computer skills by themselves do not command a wage premium. The authors review the literature and use data from a survey of higher education graduates in Vietnam. The results support the unobserved heterogeneity explanation for computer wage premiums. They suggest that computers may make the productive workers even more productive. However, given the scarcity of computers in low-income countries, an operational strategy of increasing computer availability and skills would seem to offer considerable hope for increasing the incomes of the poor.

Table 1   Wage Impacts of Computer Use

Author	Country	Wage Impact (% incr. over non-user)	
Krueger 1993	United States	1983	15.0
		1989	18.0
Boozer, Krueger & Wolkon 1992	United States		22-23
Hamilton 1997	United States		13-25
Handel 1999	United States		7
Krashinsky 2000	United States		0
Borland, Hirschberg & Lye 1999	Australia		10-18
Miller & Mulvey 1997	Australia		10-15
Reilly 1995	Canada		15.5
Morrisset & Drolet 1998	Canada		14
Entorf & Kramarz 1997	France		2-10
Entorf & Kramarz 1998	France		2-20
Entorf, Gollac & Kramarz 1999	France		1-18
Asplund 1997	Finland	1987	8.4
		1989	8.1

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[26] Over the years, some studies have addressed productivity changes in industries, particularly in the USA, which provide some evidence on the nature and timeframes of adjustment periods … eg

[27] Chris N. Sakellariou and Harry A. Patrinos , *Technology, Computers and Wages: Evidence from a Developing Country*, World Bank Policy Research Working Paper 3008, March 2003: http://econ.worldbank.org/view.php?type=5&id=24990

		1991	6.4
		1993	0
Dinardo & Pischke 1997	Germany		17
Haisken-DeNew & Schmidt 1999	Germany		1-7
Oosterbeet 1997	Netherlands		11
Arabsheibani, Emani & Marin 1996	United Kingdom		20-23
Arabsheibani, & Marin 2000	United Kingdom		19
Bell 1996	United Kingdom		13
Green 1998	United Kingdom		13-18
Borghans & Ter Weel 2000	United Kingdom		21
Sakellariou & Patrinos 2000	Vietnam		10-14"

The Employment Effects of the 'New Economy'[28]

"This paper provides an analysis of the trends in labour productivity and employment growth at industry level in the European Union and the United States during the 1990s. We analyse relationships for groups of industries, i.e. industries that produce ICT products and services, those that invest strongly in ICT, and those that make less intensive use of ICT. The main findings are that the inverse relationship between employment and productivity growth has been much more prominent in manufacturing industries than in services industries. Secondly, during the 1990s, this relationship has turned positive in many industries, in particular in ICT-producing and ICT-using industries in the service sector. Finally, the employment reducing effects of productivity growth have remained considerably stronger in Europe than in the US."

Does the Internet Make Markets More Efficient?[29]

"The Internet has the potential to significantly reduce search costs by allowing consumers to engage in low-cost price comparisons online. This paper provides empirical evidence on the impact that the rise of Internet comparison shopping sites has had for the prices of life insurance in the 1990s. Using micro data on individual life insurance policies, the results indicate that, controlling for individual and policy characteristics, a 10 percent increase in the share of individuals in a group using the Internet reduces average insurance prices for the group by as much as 5 percent. Further evidence indicates that prices did not fall with rising Internet usage for insurance types that were not covered by the comparison websites, nor did they in the period before the insurance sites came online. The results suggest that growth of the Internet has reduced term life prices by 8 to 15 percent and increased consumer surplus by $115-215 million per year and perhaps more. The results also show that the initial introduction of the Internet search sites is initially associated with an increase in price dispersion within demographic groups, but as the share of people using the technology rises further, dispersion falls."

ICT and the productivity debate[30]

"An increasing number of studies highlight the productivity benefits of using Information and Communications Technology (ICT). In a report entitled A New Economy? the OECD concluded that: "the contribution of ICT capital to output and labour productivity has been significant and rising in relative terms. In Canada, the United Kingdom and the United States, ICT equipment contributed about half of fixed capital's contribution to output growth. In France, Germany and Japan its contribution has been somewhat smaller."

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[28] van Ark, Bart, Inklaar, Robert, McGuckin, Robert H. and Timmer, Marcel P*., The Employment Effects of the 'New Economy' A Comparison of the United States and the European Union*, National Institute Economic Review, April, 2003: http://www.niesr.ac.uk/epke/bartrev.pdf

[29] Brown, Jeffrey R. and Goolsbee, Austan*, Does the Internet Make Markets More Efficient?*, NBER Working Paper No. w7996 Issued in November 2000: http://www.nber.org/papers/w7996

[30] Houghton, John, *ICT and the productivity debate* , Information Age. Derived From OECD (2001), Science, Technology And Industry Scoreboard 2001, Paris:
http://www2.idg.com.au/infoage1.nsf/all/9BA02AAC2B8AEDAECA256CC900099B51?OpenDocument

It is increasingly evident that the rise in (multifactor) productivity growth is no longer limited to the ICT-producing industries, which implies that the benefits of using ICT is spilling over to other industries. Recent evidence from the United States shows an acceleration of (multifactor) productivity growth during the late 1990s, with technological progress, particularly the rapid advances in semiconductor technology, and capital deepening, seen as the main factors behind this acceleration. Recent Australian data shows there was a substantial acceleration of multifactor productivity growth during the most recent business cycle (1993-94 to 1999-00) – with productivity growth averaging 1.7 per cent a year, compared to average rates of between 0.4 and 1.5 in previous cycles.

Exploring the sectoral origins of this recent productivity growth, the Productivity Commission has shown that the relatively high intensity ICT-using industries identified by US studies are significant contributors – eg. wholesale trade (supply chain), finance and insurance services, manufacturing and communication services… measured the contribution of ICT investment to Australia's productivity growth, and concluded that ICT made a significant contribution to labour productivity growth in Australia during the 1990s, ICT contributed more to productivity growth than generic capital deepening, and the direct contribution of ICT increased during the 1990s. Evidence of the productivity benefits of ICT use has led some to suggest that Australia can simply be a user of technology and should not worry being a producer. However, evidence of the benefits of being an ICT producer is clear.

Looking at productivity growth for the decade of the 1990s (adjusted for the business cycle), the OECD report Science, Technology and Industry Scoreboard 2001 revealed that those OECD countries with the largest growth in GDP per hour worked (ie. labour productivity) were Korea, Ireland and Luxembourg. Australia ranked ninth and the United States 12th, both well behind the leading three. Ireland and Finland experienced the highest multifactor productivity growth during the 1990s, well ahead of any other OECD countries. Looking at ICT production, the same report noted that the three OECD countries with the highest share of ICT value added in business sector value added in 1999 (ie of ICT production in total production) were Ireland, Finland and Korea. The top two OECD countries in terms of ICT equipment share of manufacturing trade were Ireland and Korea, and the three countries with the highest trade surplus in ICTs were Ireland, Korea and Finland.

Obviously, Finland, Korea, and to a lesser extent Ireland, are advanced ICT users, but the productivity benefits of ICT production are critical. The OECD's leading ICT producers have experienced the highest labour and multifactor productivity growth over the last decade. Elsewhere, the OECD recently reported of 10 countries examined, labour productivity growth during the period 1995-99 was substantially higher in the ICT-producing sector than it was in the rest of the economy. Similarly, in Digital Economy 2002, the US Department of Commerce recently reported that the ICT-producing sector continued to contribute disproportionately to economic growth. Between 1995 and 1999, the IT-producing sector accounted for an average seven per cent of US Gross Domestic Product, but was responsible for 28 per cent of overall real economic growth.

Table ICT production and productivity performance Highest labour productivity growth during 1990s Korea Ireland Luxembourg

Highest multifactor productivity growth during 1990s	Ireland	Finland	Belgium
Highest ICT value add in economy	Ireland	Finland	Korea
Highest ICT share of manufacturing trade	Ireland	Korea	-
Highest ICT trade surplus	Ireland	Korea	Finland"

Generally, equity and poverty pictures have also improved, but these results vary, and depend on the education and mobility of work forces, and a wide range of accompanying characteristics and policies of the societies in question. Aside from the recent 'big bubble' impacts of the ICT explosion, few would argue today that it has been bad for many people or groups in the developed countries, including the poor. After adjustment, rather

than machines displacing people, more skilled people and machines replaced less skilled people, and produced more. During adjustment, many people lost jobs, and some substantial proportion faced very stiff adjustment challenges in job search, relocation, retraining, unemployment. And the *disparity* or digital divide between haves and have nots does at least initially increase.

At the same time, **many** of the rapidly advancing countries in the North and South have addressed and achieved social development and poverty reduction objectives in their ICT and broader knowledge economy strategies. European countries which have recently accelerated ICT and economic development - eg Ireland, Finland, Estonia - provide important insights about national commitment as well as market forces - and have a lot in common with current realities in earlier developments including Silicon Valley.

Ireland

First Stop on the Road to E-urope[31]

"Irish High Tech Industry is Smiling: For decades, *Ireland's* biggest export was its people. But an economic turnaround led by the high-tech industry is reversing that trend. Software, semiconductors, and E-*commerce* are fuelling an economic boom and keeping technical talent at home. Far from losing labor to destinations abroad, *Ireland* is importing skilled workers to make up for shortages created by business expansion.

"*Ireland* has never had it so good," says Gerry McGovern, CEO of Web-content management company Nua Ltd. "Less than 10 years ago, people were flooding out of the country; now, they're flooding back in." McGovern's company is typical of the startups that have mushroomed throughout the country. Efforts began in the 1970s when *Ireland's* Industrial Development Agency (IDA) tried to sell the country as an English-speaking, low-cost labor area that gave good tax breaks to investors. The IDA's marketers could also point to *Ireland's* youthful population--even today, 40% of the country's population is under 25--and an education system recently cited as Europe's best by the International Institute for Management Development.

Technology companies that responded to the campaign read like a roll call of the industry: Apple, Compaq, Dell, Gateway, IBM, Intel, and Microsoft all have major facilities in the Emerald Isle. In June, Intel unveiled plans to spend $2 billion building its most sophisticated chip plant outside the United States, in Leixlip, County Kildare. Microsoft picked *Ireland* as the base for a data center that will distribute its products online throughout Europe, the Middle East, and Africa... New ventures are also springing up. *Ireland* is Europe's largest exporter of software, and Irish companies such as object-oriented software developer Iona Technologies, encryption specialist Baltimore Technologies, and E-payments company Trintech Group are making waves.

IT departments are proliferating as well. The country has an expertise in financial processing, if the growing number of banks with data centers in *Ireland* are any indication. That's what persuaded First-e Group plc, Europe's leading Internet bank, to set up its operational center in Dublin, staffed with about 300 employees… With dot-coms such as First-e leading the way, *Ireland* aspires to become a regional center for E-*commerce*…Telecommunications is a cornerstone of industry policy, the economy is buoyant, and the government has already been successful in attracting investment in E-*commerce*.

A key element in this goal is the government's significant investments in broadband communications. The government has already spent as much as $5 billion upgrading the country's telecommunications services with fiber-optic lines, digital telecom exchanges, and new international links. The state has

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[31] Lamb, John *, First Stop On The Road To E-Urope*, InformationWeek, 87506874, 10/23/2000, Issue 809

also guaranteed to buy half the capacity of a 25-Gbps trans-Atlantic link being installed by network operator Global Crossing Ltd."

Europe Experiments With Multimedia: An Overview Of Social Experiments And Trials[32]
"Until very recently, the majority of multimedia experiments in ***Ireland*** have taken place within research networks supported by the European Union. Many of these trials are technically oriented, and are characterized by a lack of explicit provision for interaction with final users. A significant focus of multimedia policy has been the creation of jobs and export products in line with past IT policy.

A second, more recent, current is a focus on the role of and production of content for multimedia systems in education. With regard to content development, the Irish case is interesting in that the presentation of culture and presentation of nation (although within the experience of the Irish diaspora the two are intimately linked) have been predominant themes for exploration through the new multimedia systems.

To date there has been little long-term planning for implementation of IT in the public sector, although the launch of the "Information Society *Ireland*: Strategy for Action" report in spring of 1997 marked the launch of government initiatives in this area. This report was followed by the establishment of advisory committees in strategic areas: tourism, government, libraries, *commerce*, manufacturing, etc. The main policy documents and initiatives that have emerged so far are in education (see Schools IT 2000 project, described later), while the government has also established a Web presence.

A major public-sector player in the Irish context is the semistate telecommunications company Telecom Eireann (TE), which has recently expanded its technical experiments to engage more end users, some on a relatively large scale. TE's strategy has been to prepare for liberalization of the telecommunications market through the introduction of new pricing schemes and to invest in experiments such as the "Information Age Town" and the government' s Schools IT 2000 project.

The Information Age Town project generated considerable public interest and action when 46 towns bid for £15 million investment in hardware, software, and skills to benefit their local community. The winning town, Ennis, was announced in October 1997, and the majority of homes will now be equipped with telephones, voice-mail services, and Internet services, while businesses will receive free ISDN access and subsidized computers. Telecom Eireann will also equip all the other towns that competed with semicommercial community access centers.

As part of this new strategy, Telecom Eireann also announced in November that it was investing £10 million to assist the government's Schools IT 2000 project, which aims to connect every primary and secondary school to the Internet within the next 7 months and continue this investment so that in 3 years there will be at least 60,000 computers in Irish schools. This government program will also invest in teacher training, the development of pilot case studies in "exemplar" schools, and the establishment of a dedicated schools Internet called Scoolnet.

This follows upon the TE experience with the Classroom of the Future project: a small-scale technical and content development trial conducted by its research and development arm, Broadcom Eireann. This center was established by Telecom Eireann, Trinity College, and Ericsson in 1987 to develop broadband communications technologies. Broadcom Eireann is usually involved only in commercially secret technical trials. This project therefore was unusual in that it generated much public interest in the company and required the researchers to deal with more social issues. The researchers found that while

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[32] Jaeger, Birgit, Slack, Roger S., Williams, Robin, ***Europe Experiments With Multimedia: An Overview Of Social Experiments And Trials***, Information Society, 01972243, Oct-Dec2000, Vol. 16, Issue 4

the technical implementation of the project was relatively simple, the trial encountered much "technological fear" and a low level of motivation from teachers who lacked IT skills.

An exemplar of the importance of culture and nation in multimedia content development can be found in the work of the Nerve Centre, Derry. A community arts project situated in the north of *Ireland*, the Nerve Centre explores the potential of interactive ICTs as tools for the examination of ancient Irish culture and the empowerment, through jobs and skills, of disadvantaged groups. The center has secured government and European funding for training, education, production, and exhibitions.

A further publicly funded initiative of the Nerve Centre is the 3-year ***Cultural Heritage and Technology educational*** program. The impetus for the project was a commission from BBC Northern *Ireland* Children's Education Department to develop six 5-min animated cartoons based on the legends surrounding Cu Chulainn, a mythical Celtic hero. From this, a broader educational program of workshops, courses in multimedia, touring road shows, and CD-ROM production has evolved.

The center has also received funding under the EU Horizon program for a project called Advance, which explores interactive ICTs for the transfer of training and skills across boundaries in the context of disadvantaged groups, particularly the young and the long-term unemployed. This project will supplement the Interzone initiative, which offers young people an Internet drop-in point and enables them to learn about ICTs within the context of their own communities in order to develop a skills base in the area…

The Audio-Visual Centre in University College Dublin received formal public funding for four educational projects and one library project under the 1996 round of the EU Telematics Program. These projects propose to develop new educational services and adapt existing course materials for delivery through a variety of technologies and to a variety of end-user groups. Similarly, the Dublin Institute of Technology is involved in a 2-year Knowledge Assurance in Multimedia Publishing project, which has evolved from an initiative between five European universities to develop a European MA in Interactive Multimedia. The MA project was responsible for launching the first MA in Multimedia in *Ireland* and importantly developed course materials that will now be delivered universally using EU funding.

Finally, the EduNet experiment has evolved from private interests. Supported by Internet *Ireland*, a private Internet service provider (ISP), the project has encouraged up to 200 schools to develop Web sites and use e-mail. The project aims are to encourage greater communication between educational establishments, allow for collaborative project work, and encourage new forms of administration, such as *electronic* notice boards and e-mailing parents. The site collates educational resources of interest to the Irish curriculum and links to establishments abroad. The initiative has now spawned a separate company and will no doubt gain further momentum from recent government initiatives."

Rapidly Changing Developing Countries

Should we expect similar outcomes in the developing world? 'Yes but..' In many rapidly changing developing countries, as sketched below, similar outcomes have occurred or are occurring, and they are taking place rapidly. These include cases sketched in this section:
- Korea, Taiwan, Hong Kong, Singapore, Malaysia
- Brazil, India, Mexico, Turkey, Thailand

Korea, Taiwan, Hong Kong, Singapore, Malaysia[33]

Korea

The New Net Tigers[34]

"Korea has caught Web fever. Ten million people already use the Web, 3,500 new high-tech startups were launched last year, and broadband is booming. This may be just what the country needs to keep its economy growing.

It doesn't have quite the evocative ring of Silicon Valley, but a stroll down Tehran Street in southern Seoul will take you past the headquarters of 80% of South Korea's Internet companies--and thus past the main source of what may still be the world's hottest Internet market this year. That claim would have seemed inconceivable even a couple of years ago. Back then Korea brought to mind the chaebol, the huge conglomerates that could no more understand dot-com logic than they could the idea of shareholder value. The chaebol are still there, but Korea itself, driven by an entrepreneurial burst of energy, is being remade with surprising speed in an online image. In fact, it's a good bet that Korea will be seen in a few years as the most successfully restructured economy in Asia. What's behind this burst of energy? Koreans, it seems, love the Web, and they have taken to it at a pace that is astonishing even by Internet standards. Consider the following:

- In 1997 there were only 1.6 million Koreans online. Today nearly ten million are. That number should hit 20 million--about half the population--sometime toward the end of 2001.
- Mobile Internet use is poised to take off. Already, there are more mobile-phone subscribers than fixed-line ones (and more than half the Korean population is telephonically on the move, twice the U.S. rate).
- Korean mobile-phone makers churn out 70% of the world market for the next-generation CDMA-standard handsets--a technology developed by America's Qualcomm--which will make mobile Internet services fast and easy to get.
- Korea has the world's fastest-growing market for high-speed (broadband) Internet access, with two million subscribers expected by the end of this year and five million by 2002.
- The entrepreneurial spirit has been freed; 3,600 new companies were formed in January alone, with 50,000 expected for the year (relative to GDP, more new businesses than even the U.S. will create). Of the 50,000, about 4,000 are expected to be information-technology firms--in other words, about ten high-tech startups will be born every day this year.
- Every nook and cranny of the economy seems to have succumbed to Internet mania. It has become practically impossible--except for months in advance--to book ad space in papers or magazines, or on billboards or TV, because the dot-coms are promoting themselves so heavily.

Then there is the stock market. Korean Internet stocks as a group rose about 15-fold last year. Lately, though, they too have been badly hit in the global selloff of tech stocks in April. Even so, the volume of online trading is approaching 50% of total market turnover, by far the highest share in the world and within striking distance of the U.S.'s online trading volume even in absolute terms. How could all this possibly be happening in a middle-income country of 45 million people with an economy notorious in the past for its rigidity and conservatism? A lot of seemingly unrelated pieces locked together in the right way.

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[33] See also Quibria, M. G., Ahmed, Shansun M., Tschang, Ted and Reyes Macasaquit, Mari-Len, *Digital Divide:, Determinants and Policies with Special Reference to Asia*, ERD Working Paper No. 27, Asian Development Bank, October, 2002.

[34] Rohwer, Jim; Chowdhury, Neel; Kraar, Louis, *The New Net Tigers*, Fortune, 05/15/2000, Vol. 141 Issue 10

First, Korean education levels and technological sophistication are the highest in Asia outside Japan. Not only are primary and secondary standards among the best--Korean kids routinely score at the top in international surveys of competence in science and math--but university education is as widespread as it is in the West. Nor is the Hermit Kingdom keeping to its cave. According to one survey, Koreans account for 8% of all foreign students in American universities. In January alone, says Wonjong Koh, head of research for the Seoul branch of ABN Amro, Korea ran a current-account deficit of $45 million on education services. If they can't go to America, they study in Australia or even in the Philippines--anywhere the language of instruction is English. The reason: The Asian financial crisis convinced Koreans that in this world America calls the shots, and they had better learn how to speak English if they want to compete--a point President Kim Dae Jung even made in his New Year's press conference. And it is not just English the government is pushing. Since the early 1990s it has given incentives for universities and technical schools to turn out software engineers.

One upshot of this: Korea is actually inventing some Internet technologies instead of just applying them. Serome Technology, known in America for Dialpad.com, the world's biggest free Internet phone-service provider, developed its software protocols in Korea. ThinkFree.com is a Silicon Valley firm (with a Korean CEO) hoping for a Nasdaq listing later this year. It offers a free Internet-based clone of Microsoft Office--much like what Sun Microsystems and Microsoft itself aim to provide--but with a Java technology so elegant that the whole of the program takes up only eight megabytes of hard-disk space. And all that software technology, says Tae-Jin Kang, the company's Seoul-based chief technology officer, was created in Korea.

Second, Korea's government "gets it" in all sorts of ways. President Kim, a septuagenarian former dissident, was elected in December 1997 to much groaning by businessmen because of his union ties and supposed socialist leanings. But whatever the motivations of the longtime chaebol-unfriendly President, the result is that he has been trying with some success to destroy out-of-date business structures and industries instead of protecting them--in glaring contrast to his undistinguished counterparts in Japan over the past decade. That has helped clear the way for new businesses.

Kim has also been good at pushing things ahead in more direct ways. He has ordered state-owned firms to move half their purchasing online by 2001--a directive that will produce a lot of business for American companies active in Korea, like Commerce One and Oracle, which are vastly more experienced at setting up such systems than any local competitor. And, pointing to the indispensability of computer literacy for everybody these days, Kim started a program last year that allows poor families to buy $900 computers for their children on a 36-month installment plan.

Third, the financial crisis did Korea a lot of good. Low-return Korea Inc. started mending its ways and restructuring. One result was the release--at first involuntary--of many skilled workers onto the job market. At the high end, engineers left chaebol systems-integration units to join Internet startups; Samsung Display Devices alone lost 20% of its engineers. Lower down, says ThinkFree's Kang, laid-off middle managers set up Internet cafes--of which there are now 15,000, one of the world's highest concentrations--and thus helped bring an already tech-savvy younger generation further into the e-culture.

Last, Korea's cost structures favor the Internet. The monthly fee for Internet access over regular phone lines is one of the lowest in the OECD. Broadband access costs less than $40 a month, significantly cheaper than in America. Even the boom in online stock trading has, in part, been driven by price. Whereas in most countries outside the U.S. brokerage commissions for online and offline trades are pretty similar, in Korea online trades cost less than a quarter as much to execute. Maybe the most important price of all--that of money--has also fallen sharply since the financial crisis, with interest rates now around 5% to 6% instead of their 15% level three years ago; this has opened the floodgates for both startup financing and widespread stock market investing."

All Wired Up in Korea[35]
"The heart of South Korea's exploding Web world--expanding faster than any other nation's during the past two years--is to be found in its 15,000 "PC rooms." These aren't old-hat Internet cafes. They're more like game arcades, only with desktops and monitors as the focus of the frivolity. Could this be headed west?

Every other neon sign in the entertainment district surrounding Korea's Sanyong University displays Korean-language characters alongside the Roman alphabet "PC." Inside basements or in walk-up spaces are packed, dingy dives that have replaced karaoke rooms, video rental outfits and bars throughout Korea during the past year. Rows of computers are jammed in as tightly as they will fit. Men playing games and women chatting (using Web video cameras) sit mesmerized in front of their screens, some oblivious to their surroundings, others working in groups.

Mostly younger Koreans have flocked to such rooms during the past year. That has helped triple the online population to 10 million, a quarter of the country, and helped feed an estimated 5,000 Internet startups, lifting the value of Kosdaq--Korea's Nasdaq equivalent--80-fold in the past year, to more than $100 billion.

One star enterprise is Haansoft, once a near-bankrupt maker of word processing software whose stock price has risen 120-fold in two years. It was saved from a Microsoft takeover by key Asian capital infusions and a burst of patriotism that prompted more than 1 million Koreans to replace their pirated software copies with legitimate ones. Today Haansoft's application software, available on the Internet, is the major hub for Korean chat rooms, game playing, e-commerce, messaging and services aimed at the booming PC-room market."

Weaving a Web to Catch the Corrupt[36]
" It was a declaration of war on politics as usual. In Seoul on Jan. 24, almost 500 civic groups ranging from environmentalists to shareholder activists pledged to oust South Korea's most corrupt politicians from the National Assembly by driving them to defeat in upcoming elections in April. The activists have posted the names of 67 "unfit" politicians on a widely read Internet site that is updated daily. In the coming months they plan to spread their message to every constituency and college campus around the country. The fierce protests--which are recruiting people in their 20s and 30s who account for more than half of Korean voters--are aimed at ensuring that dishonest politicians don't get re-elected.

Call it the nation's first cyberspace revolt against corruption. With Internet use growing explosively in Korea, to 11 million, or about 24% of the population, the activists' online push has potentially greater effect than street demonstrations of old.

The activists, who include even a group of songwriters, are technically breaking six-year-old laws banning election activity by civic groups. But their zeal to unseat the unsavory has the support of four out of five Koreans polled. That means Korea's political parties can't afford to ignore them, and their campaign will play a large role in determining who will be on the ballot in April. "Korea's No. 1 vice is corruption," says Park Won Soon, the leader of the movement called Citizens Solidarity for General Elections. "Corrupt politicians are unable to present solutions, so they themselves are the target of reform."

The Internet campaign does an end run around party bosses, who have traditionally chosen who will run for specific Assembly seats, often with little regard for ethics or popular opinion. But with the level of public awareness and concern growing, these elders are under pressure to drop questionable politicians.

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[35] Fulford, Benjamin, *All Wired Up in Korea* , Forbes, 03/20/2000, Vol. 165 Issue 7
[36] Ihlwan, Moon, *Weaving a Web to Catch the Corrupt*, Business Week, 02/07/2000 Issue 3667

No political party is spared. Among the targets so far are coalition partner and former Prime Minister Kim Jong Pil, opposition elders, and the National Assembly speaker. The activists accuse them of either taking bribes, violating human rights, or incompetence. While two lawmakers have asked prosecutors to press a libel case and others deny any corruption, many have kept silent. The pressure has also forced the parties to back a bill lifting a ban on election-related activities by civic groups."

Taiwan

The New Net Tigers[37]
"Taiwan is no longer just a center for high-tech manufacturing. Its software engineers and entrepreneurs are turning it into a dot-com startup machine. In the forefront of this movement is Jeffrey Koo and his Internet empire. As Jeffrey Koo Jr. tells it, he stumbled onto the Web through dumb luck. About three years ago, just before Asia's financial crisis hit, this young heir to Taiwan's venerable conglomerate, the Koos Group, was poised to invest the $430 million in cash he had raised for his new venture capital fund in all sorts of old-economy companies. Luckily for Koo, disaster struck. "A week after our fund closed, Thailand collapsed," recalls Koo. "I couldn't do a single investment for more than six months. My father insisted we just watch."

As Koo scanned Asia's horizons for deals amid the financial carnage, his eye kept wandering to the fortunes being made by Asians in Silicon Valley. "I knew Softbank's Masayoshi Son and Yahoo's Jerry Yang personally, and I was astounded by their success," Koo says. Today the 35-year-old Koo has become the Internet king of Taiwan. He controls Bex.com, an online company that acts as middleman between Western computer makers, such as IBM and Hewlett-Packard, and their Asian suppliers

It's no surprise that Koo has gotten off to such a quick start. After all, Taiwan has been a hotbed for other high-tech businesses, like PC screens and microchips; why should e-commerce be any different? In fact, Taiwan has nourished thousands of new e-company startups over the past two years by offering low corporate taxes, a minimum of red tape, and as much as $3 billion in venture capital raised by more than 100 private funds. That money is chasing a fast-growing market of Internet users. Today nearly two million people use the Net, giving Taiwan the fourth-largest online population in Asia…

Koo is also betting big on cable TV-based and wireless broadband services. But unlike Gates, who must do deals with other cable giants like Time Warner and AT&T to reach a critical mass of customers, the Koos family singlehandedly owns big stakes in Taiwan's cable television system. Acquiring cool content, though, won't be a big expense. Because the Koos also own Taiwan's most popular television and radio stations, as well as a gaggle of cable-based sports and news channels, they were able to stuff GigaMedia with Chinese-language content almost from the start. Being based in Taiwan, a fountainhead of pop music and movies for the entire Chinese-speaking world (the "Hollywood of the East).

Here's the real clincher, though. Because the Koos-owned Chinatrust bank is one of the biggest banks and credit card issuers in Taiwan, Koo has managed to integrate his e-commerce billing systems with his customers' bank accounts almost seamlessly, a feat that has eluded most Web ventures in Asia. Says GigaMedia's Chang: "Chinatrust has played a very important role in the growth of GigaMedia. To make e-commerce safe over our network, we needed a strong financial institution like them behind us."

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[37] Rohwer, Jim; Chowdhury, Neel; Kraar, Louis, *The New Net Tigers*, Fortune, 05/15/2000, Vol. 141 Issue 10

Hong Kong[38]

(continuing from the quote above) "There's just one tiny problem for Koo. He lives in **Hong Kong**, and his name is Richard Li. Since Li's audacious acquisition of Cable & Wireless Hong Kong… Li's business model is beginning to mirror Koo's. Both men are betting big on broadband. And both realize that to create killer content is not enough. Both must also possess the cable and telecom infrastructure that will carry the content. The question is, though: As both Koo and Li venture out of their home turf and try to grab the Greater China market, an ambition neither has been shy about, who will walk away with the big prize of China?

By 2003, China will be the third-largest e-commerce market in Asia, according to International Data Corp., with annual e-commerce sales exceeding $3.8 billion. More significant, analysts predict that most of that coming e-commerce traffic in China will be conducted over broadband devices like mobile phones and televisions. Why? Partly out of a cultural affinity for high-tech gadgets and partly because PCs are still a novelty item in most Chinese households, whereas mobile phones and televisions are not. (There are 50 million mobile-phone users and 450 million television sets in China, vs. only 20 million PCs, estimates Credit Suisse First Boston.) If Koo and Li can grab a big chunk of broadband e-commerce in China--and so far their Chinese-language content has made them the most powerful players in this market--both could walk away with a fortune.

Hong Kong is buzzing with risky dot-com startups that may--or may not--turn into great companies. The real action, however, may be in old-line firms like Li & Fung that are finding new ways to expand their business on the Web. Hong Kong has gone Internet-crazy. Over the past few months a slew of startup Web companies with lots of promise but no products or profits have been driven to sky-high valuations, only to shed billions in the recent market meltdown. Yes, the dot-com game will continue, but a new trend is emerging. It seems that some old-line Hong Kong companies with solid profits are now getting into the game.

No one fits this description better than Li & Fung, a 94-year-old family trading company that manages the global production of items like clothes, sneakers, and teddy bears for big multinationals such as the Limited and Reebok. Li & Fung has just launched a new B2B company called lifung.com that caters to small retailers and promises to dramatically expand its traditional business. Says William Fung, 51, managing director: "The Internet gives us a cost-effective tool for reaching a whole new segment of customers." In fact, brokerage house HSBC Securities expects that within five years, lifung.com will generate $2 billion in annual sales--the parent company's total revenues last year… One thing investors like--especially those who have been bruised by Hong Kong's brutal dot-com selloff--is that Li & Fung is no Internet fly-by-night…"

Singapore[39]

Singapore[40] was a poor Asian country in 1965 when it split from Malaysia, and by 1997 just prior to the Asian financial crisis, was a little ahead of Canada in income and its purchasing power. Often argued to be a special case because of its small and organized population, Singapore did many remarkable things that can be emulated in different ways. The high-tech shift, from roughly the mid-

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[38] Rohwer, Jim; Chowdhury, Neel; Kraar, Louis, *The New Net Tigers*, Fortune, 05/15/2000, Vol. 141 Issue 10

[39] See also:
- Warschauer, M, *Singapore's Dilemma: Control versus Autonomy in IT-Led Developmen*t, Information Society, Oct2001, Vol. 17 Issue 4
- Mahizhnan, Arun., **Information Technology for an Intelligent Islan**d, Southeast Asian Affairs, 2000
[40] R Spence, based on living and working in Singapore 1990-2000.

70s to mid 80s, was particularly interesting, accomplished to a large degree by increasing minimum wages to make unskilled labour too expensive, and heavily investing in (subsidizing) technical and skills training, and housing of skilled workers.

Much of Singapore's infrastructure (broadly defined) investment has been financed by the National Provident Fund, to which employees contribute 18% of salaries and employers another 22%, and against which individuals can borrow for housing, health and education prior to retirement. Singapore examines other countries for the way they have handled urban development, transportation, high tech etc and chooses the practices considered best. ICTs have played a central role in science, research and technology development, particularly with the Internet since the mid-80s, whose development has both stimulated and accompanied an opening up of public control over media.

Singapore has highly qualified science and technical skills in entrepreneurial public and public-private institutions, and attracts research and development collaboration from outside corporations and countries in active and innovative ways - for example by taking all the risk of a technology development, if there are assured buyers for the technology if its development is succcessful. In the 90s, Singapore accelerated universal broadband connectivity plans, and Singaporeans have consistently developed and used ICT/Internet technologies and applications for education and skills development. Singapore today is a developed country with almost no poverty.

Be an architect of value-added chains[41]
"When the world is your market, it makes good sense to start a global company. The perception is that a global company operates all round the world, employing different nationality, but that would be just a domestic company operating on a global scale. The reality is, a global company should be an "architect of the value-added chain", Lee Kuan Yew Distinguished Visitor Prof Michael Spence told a packed audience at NUS. He was delivering a public lecture "Global Economy and Global Business: The Reality and the Perceptions."

Prof Spence, who is the Dean of Stanford University's Graduate Business School, elaborated on what this "architecture" would entail -- coordinating efficient suppliers globally and outsourcing work to these third parties, integrating the supply chain into a global chain. "The role of a global company is to find, access, deploy and co-ordinate resources world wide, to achieve greatest efficiency and a high rate of innovation," he said.

Outsourcing could result in the moving of manufacturing work outside a country. "Economic activity is being moved around the world at great speed," said Prof Spence. This scared people all round the world because they have to move rapidly to other sectors, from what they were used to. There could be outbursts of protectionism, labour practice issues such as health and safety; as well as environmental issues. These are difficult to manage and live with, said Prof Spence, but one has to look at it from a global business point of view. One has to be ruthless -- if outsourcing means getting a job done faster, cheaper and better, then it should not be done in-house.

A set of conditions is necessary for a country to change from an inner economy into a global economy. The country needs conditions such as an open economy, sound education and communication infrastructures, and an economy "that is building up" -- with wages which are below the level of advanced industrial countries. When you get these conditions which are really intangible assets, you get a manufacturing country developing quickly and contributing towards a global economy, said Prof Spence.

The Dean of Faculty of Business Administration, Assoc. Prof Hum Sin Hoon who chaired the public lecture, elaborated at the end of Prof Spence's delivery, how Singapore can be an "architect of supply

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[41] Report on the National University of Singapore website at http://www.nus.edu.sg/Publ/cnews/may99/ARCHITECT.htm

chain". Setting up warehouses and storing things for global companies is not good enough because that is not significantly value-adding for Singapore. Not owning tangible assets, but software and technology, Singapore can play an architect's role in the supply chain, by having access to resources in the world and coordinating them, he said."

Information Technology for an Intelligent Island[42]

"Singapore's Senior Minister Lee Kuan Yew presided over a midnight launch party in April 2000 for a new telephone company in *Singapore* and it was front page news in local newspapers. This was not just news about a new telephone company. It is a sign of the times -- only a few years ago, it would have been almost inconceivable that the most venerable political leader of *Singapore*, especially someone of Lee's stature and inclinations, would be part of a midnight bash for the launch of a commercial operation. Lee is now presumably game for this sort of ceremonies because the big game has changed. The big game in *Singapore* is information and communication technology (*ICT*). It is not just the technology sector that is changing but indeed the entire economy is going through significant shifts. These changes are reflected in terms like Knowledge-Based Economy (KBE) or, even more briefly, the New Economy, which punctuate public discourse these days. This article traces the *development* of *Singapore's ICT* strategies and policies --especially in the areas of infrastructure, commerce, and education -- to meet the challenges of the KBE.

Genesis of an Intelligent Island: Though technology has always been part of *Singapore's* economic growth from the time it embarked on its major industrialization programme in the 1960s, the role of technology as a primary and central source of national *development* and economic growth is a relatively recent phenomenon. *Singapore* had been referred to as the "Emporium of the East" and "New York of the East" and by other such monikers in the past, by many writers outside *Singapore*. But there is one name that the government has given itself: "Intelligent Island". In 1992, the then National Computer Board released a document entitled "A Vision of an Intelligent Island: IT 2000 Report", outlining the government's strategic vision of *Singapore* in the information age. In painting a futuristic picture of the Intelligent Island, the report said: "In our vision, some 15 years from now, *Singapore*, the Intelligent Island, will be among the first countries in the world with an advanced nationwide information infrastructure. It will interconnect computers in virtually every home, office, school, and factory."

At the beginning of 2000, the target year, *Singapore* is almost the Intelligent Island that was imagined just eight years ago -- at least in some key aspects. For example, by June 1999, 98 per cent of all homes in *Singapore* could be connected to the broadband network called *Singapore* ONE. ONE stands for One Network for Everyone and it is a nation-wide multimedia network capable of delivering high-speed, high-capacity information services to almost "everyone, everywhere". These services include a wide range of information and transactional facilities. Government information and services, public databases, directories, educational materials, travel information, music, movies, games, access to cybermarts, e-commerce malls, banking and trading facilities, and business-to-business applications are some examples of what are available through *Singapore* ONE.

ICT 21: Even before the dust settled on the IT 2000 Masterplan, the government has come up with yet another called the Information and Communication Technology 21 (*ICT* 21). Realizing the tremendous speed and complexity with which the *ICT* industries have been growing around the world in the past decade, the government revamped some of its own ministries and created a new one -- Ministry of Communications and Information Technology (MCIT) -- to cope with *ICT developments*. In addition, it merged two existing statutory boards, the National Computer Board (NCB) and the Telecommunication Authority of *Singapore* (TAS), into a new one: Infocomm *Development* Authority (IDA). IDA's primary role is to develop, promote, as well as regulate *ICT developments* in an integrated manner so as to position *Singapore* as a leading *ICT* centre in the world. This would appear to be a tall order. It is

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[42] Mahizhnan, Arun., *Information Technology for an Intelligent Island*, Southeast Asian Affairs, 2000

rather difficult for a regulatory authority to be, simultaneously, a developer and promoter. These roles, especially the first and the next two are somewhat mutually exclusive. The ethos of the regulator would be an ill-fitting cloak for the promoter to wear and vice versa. But this is not the first time such arrangements have been made in *Singapore*.

Only a few years ago, the *Singapore* Broadcasting Authority (SBA) was set up with a similar mission with regard to the broadcasting industries. As there is no research available on the conduct of the SBA, it is difficult to judge its performance. However, if one were to go by the general performance of the *Singapore* government in its market intervention policies over the past decades, the success of the *Singapore* economy would clearly suggest that *Singapore* regulators could be market-enabling and not just market-distorting, as is generally assumed. In any case, as the IDA was established only in December 1999, it is far too early to make even cursory observations on its efficacy. IDA's new masterplan has three strategic thrusts: (a) to develop the *ICT* sector as a major sector of growth, (b) to leverage on *ICT* as an enabler to boost the competitiveness of key economic sectors, and (c) to prepare *Singapore* for the information society of the future.

E-Infrastructure: One of the key foundation stones of the above-mentioned vision is the electronic infrastructure for information and communication technologies. This e-infrastructure is not just confined to the national boundaries but need to be interconnected to the major *ICT* centres of the globe. Though the national electronic superhighway such as *Singapore* ONE has already been built, it is hardly enough for the complex needs of an *ICT* node. There are numerous other electronic services that should be in place to make *Singapore* a competitive, innovative, and leading player. The *ICT* world is undergoing such rapid changes that even a fleet-footed government like *Singapore's* finds itself caught off-guard sometimes.

One illustration of this situation is the sudden and, to some, shocking reversal of its earlier policy on the liberalization of the telecommunications industry in *Singapore*. In 1997, when it opened up the basic telecommunications services market, the government had committed itself to only partial liberalization up to March 2002. This obviously attracted certain kinds of companies to test the market, whose calculus of profit and loss was based on a restricted market. StarHub succeeded in getting the only other licence to compete with incumbent monopoly SingTel, effective April 2000. But in January 2000, the government announced that it was bringing forward the full liberalization plan by two years, to be effective April 2000, the very date StarHub was to begin operations. In explaining the government's surprising reversal of policy, the Minister for Communications and Information Technology said: "... info-communications industry is changing so dramatically, and industry players and other countries are moving so quickly, that *Singapore* would be left totally out of the game if we waited two years till 2002. In the national interest, we therefore have to move now." The Minister also conceded that both SingTel and StarHub would need to be compensated for certain potential losses.

This episode is reflective of the changing administrative culture of *Singapore* as it is of the technology field. Policy reversals are rare in *Singapore*, certainly those that are publicly admitted. But lately the government has not flinched from doing just that and also taken a far more entrepreneurial approach to public administration. "Swift response" and "Light touch" have become common refrains among government regulatory authorities these days. Another key focus of the *ICT* 21 is what the MCIT has called "dot-coming the people sector". Fearing the potential risks of a digital divide between those who become net-savvy and those who do not, the MCIT and IDA are focusing on the ubiquitous adoption of computer and *Internet* usage. All Singaporeans, regardless of socio-economic or demographic differences, are expected to have easy and ready access to electronic information. In fact, with the advent of hand-held and wrist-worn devices, even personal computers (PCs) may no longer be the primary instrument for e-communication. With every *Singapore* resident plugged into some form of electronic device, there would, in effect, be an e-infrastructure in human form. What is missing so far is a government masterplan to do just that.

E-Commerce: _Singapore's_ economic success over a thirty-year period had earned the epithet "an economic miracle". But for this miracle to be sustained, the very fundamentals of economic planning and implementation have had to be reviewed in recent times. It was increasingly becoming apparent that _Singapore_ could not remain a leading production centre for multinational corporations (MNCs) as it had been for decades because of mounting competition from other countries. _Singapore_ needed a very different business platform to maintain its leadership position and two intersecting phenomena provided that platform: the spread of IT and globalization. Though some forms of information technologies such as telephone, facsimile, and television have been in use for many decades, a revolutionary breakthrough occurred with the invention of the computer and even more significantly with the introduction of the _Internet_ in the 1990s. Few countries caught on to these new technologies as _Singapore_ did.

Also in the 1990s, globalization of trade and investment took off at a feverish pitch. While the economic crisis of the late 1990s in Asia is partly a result of that phenomenon, there is little doubt about the opportunities it provides -- especially for countries like _Singapore_. In addition to the obvious advantages of a clean and efficient government and a talented work-force, reliable high-speed, high-capacity communication channels are a vital requirement for globalizing companies. These channels form the lifelines of transaction and management for the MNCs. But in a surprising manner, these same channels also provide unprecedented opportunities for very small enterprises to conduct their business locally or globally at very little incremental cost, once the basic infrastructure is in place. Which is why there are now so many start-up companies that have grown into multi-billion dollar businesses in such a short time, as Amazon.com and Ebay.com have demonstrated. In contrast to the few thousand large corporations, _Singapore_ now has more than 100,000 small and medium enterprises and many of them have the potential to grow to unprecedented levels through e-commerce.

In characteristic fashion, the government once again drew up another masterplan -- the Electronic Commerce Masterplan -- in 1998. It was designed as a comprehensive national initiative to bring e-commerce to mainstream businesses and the average citizen.[9] The plan has five main thrusts: Develop an internationally linked e-commerce infrastructure; jump-start _Singapore_ as an e-commerce hub; encourage businesses to use e-commerce strategically; promote usage of e-commerce by the public and businesses; and harmonize cross-border e-commerce laws and policies.

The second-mentioned initiative requires not only local efforts but also foreign support and involvement. It requires major international companies which are digital infrastructure providers, online service developers, trading and distribution companies, and retailers and wholesalers to use _Singapore_ as their e-commerce hub. To attract them, incentive schemes and other support programmes are being put in place. The Approved Cyber Trader (ACT) is an example of such programmes. The ACT offers a 10 per cent tax concession on offshore income derived through e-commerce. Other schemes include the _Development_ Expansion Incentive, Innovation _Development_ Scheme, and Cluster _Development_ Fund. In response, several companies, including Citibank, Sterling Commerce, and Hewlett Packard (HP), are reported to have committed to anchor substantial e-commerce activities here.

E-Education: However, it is not just in laying the electronic infrastructure or building electronic commerce that some of the greatest challenges of incorporating _ICT_ into the Intelligent Island lie. Like many fundamental social and economic changes, the shift towards a KBE, which will provide the sustenance for the Intelligent Island, requires the transformation of the mindset of the people. One of the best ways of achieving that is to catch them young -- before the mind becomes too set. While many adult education programmes are going on around the country to induct the older generation into the world of computers and the _Internet_, the biggest and most productive effort is being channelled into the education system. In fact, a slogan has been coined by the government to reflect this focus: Thinking Schools, Learning Nation.

Though some might wonder if it should not be the other way round, the government is keen to make "learning schools" -- which is perhaps a traditional way of thinking of schools --into "thinking schools" -- which is perhaps what many have criticized *Singapore* schools of not being! *Singapore* has taken specific and sustainable steps to align the education system to meet the challenges of the new century. The masterplan for IT in Education, drawn up in 1997 by the Ministry of Education (MOE), set out clear goals and specific milestones for the schools. The goals include enhancing creative thinking, lifelong learning, and social responsibility. The milestones include completing core computer training for teachers in every school by the year 2000, and achieving a 2:1 ratio between pupils and computers in schools, with 30 per cent of curriculum time devoted to IT-based learning by 2002.

In addition to providing hardware and software infrastructure to transform the education system, the MOE is also focusing on the more important aspect of curriculum *development* and teaching. Information technology is seen as a means to expand and enrich the learning process itself. School children are now routinely doing project work that necessitates surfing the net and looking for materials that are normally not available within *Singapore* itself. They are also exposed to different technological possibilities in assembling and presenting these materials in ways never before done. In the process, they are not only learning different things but also learning things differently. There are also virtual classrooms now whereby pupils may remain in their respective homes but join their classmates in cyberspace with the teacher conducting lessons through the computer or a nifty hand-held device called Edupad. Several libraries are digitizing their collections to create virtual books that could be accessed anywhere, anytime. All these seem to add to the children's ability to learn independently, to think innovatively, and even to cooperate constructively. These are attributes that any Intelligent Island would consider prerequisites.

Conclusion: Though every one understands Rome was not built in a day, increasingly the challenge for the modern metropolis is one of coping with the task of neverending building. As *Singapore* has learnt, there is no completion date for building the Intelligent Island. Even as one part is being built, another part becomes obsolete, or worse still, what one is building becomes obsolete even before completion. This is the nature of information and communication technologies. The most famous of the computer-related laws, Moore's law, which stated that computing power doubles every eighteen months, is itself becoming outdated. Thus, the Intelligent Island may never be completed but it seems likely to flourish even in an unfinished state."

Singapore Eyes Global Trade Role[43]
″ Long a locus of Asian trade, *Singapore* is seeking to extend its influence internationally by pressing local companies to adopt *Internet*-based electronic commerce over the next five years. According to an e-commerce blueprint, Trade 21, developed by *Singapore's* Trade *Development* Board, new technologies are the linchpin of the strategy to reach out to international businesses. One goal is to convince global companies to use *Singapore* as a staging area for trade. The trade agency is formulating a program called Internationalizing *Singapore* Enterprises as "a more concerted effort in all stages [of market *development*] rather than in individual stages," said Balagopal Nair, board director of corporate planning. It is urging local companies to sprout a "third wing" to take their business beyond Asia as a countermeasure against another Asian economic downturn.

The Trade 21 plan includes initiatives designed to help *Singapore* expand its global trade by 4 to 6 percent annually through 2005, to S$500 billion ($295 billion), for high-tech and other exports. Exports of services are seen growing under the plan by 5 percent a year, to S$43 billion. Analysts said the plan's targets could be reached because *Singapore's* total foreign trade is already S$382 billion. The plan would support local companies' e-commerce ventures by offering hardware and software support and Web site *development* assistance. The programs are expected to help the trade board meet its 6 to 8 percent annual growth targets for expanding local trade to S$175 billion in 2005. During the same

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[43] Santiago, Tony, *Singapore eyes global trade role,* Electronic Engineering Times, 01/24/2000 Issue 1097

period, overseas direct investments as a proportion of the gross national product are forecast to reach 30 percent, up 11.5 percent from 1996. Trade hub services could grow as much as 6 percent annually, observers said.

The trade agency hopes to convince 25 companies to use *Singapore* as an *Internet* portal for e-commerce. Tax incentives will be offered to qualifying companies to reduce the corporate tax rate to 10 percent from 26 percent. So far, two companies have qualified: Kian Ann Engineering, which distributes heavy equipment, and EXCA, a joint venture between Japan's Sumitomo Corp. and Boston-based New England Circuit Sales. The World Economic Forum (Geneva) predicts that *Singapore's* economy will grow about 5 percent a year between 2000 and 2008. In its "1999 Global Competitiveness Report," the forum ranked *Singapore* ahead of the United States and Hong Kong in terms of global competitiveness. *Singapore* ranked 12th internationally on the microeconomic competitiveness scale, which assessed such factors as business operating practices, strategies and the overall business environment."

Asia's Computer Challenge: Threat or Opportunity for the United States and the World? [44]
In a study analyzing "how *Japan, Korea, Taiwan, Hong Kong, and Sing*apore, defying their lack of comparative advantage in computing, set out to build competitive advantages in this sophisticated, knowledge-intensive industry… The book's primary strength is the wealth of data it provides on companies and national policies in these countries since the 1960s. No other book systematically puts this wide range of information together in such a concise, readable form. It will be enjoyed by a broad academic and corporate audience and is a must read for those interested in how these nations have emerged as international players in the computing business…

The authors have four major conclusions regarding the success of Asian companies and countries in the field of computing.
- Successful firms, they argue, have been flexible in responding quickly to market changes and have been highly focused on specific market niches that fit their core competencies.
- Successful countries, they conclude, are those characterized by focused firms within diversified industry structures that have strong links to the global production system.
- The key to success has not been simply the result of corporate actions or those of the government; but rather, effective cooperation between the government and the firms.
- Finally, they conclude that there is an Asian model for computer industry policy. The key features of this model are: an emphasis on creating and enhancing national capabilities; an outward orientation that emphasizes export promotion and encourages technology transfer from abroad; strong policy coordination both within the government and between the public and private sector; and a priority placed on production and investment over consumption."

Malaysia[45]

Malaysia's Multimedia Super Corridor and its First Crisis of Confidence[46]
"In this paper, Malaysia's attempt to join the 'information society' and 'knowledge economy' by embarking on the ambitious multimedia super corridor (MSC) is mapped out and analyzed. The discussion is framed in the context of globalization, modernity and the situation in other Muslim

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[44] Anchordoguy, Marie, Reviewing Dedrick, Jason and; Kraemer, Kenneth L, *Asia's Computer Challenge: Threat or Opportunity for the United States and the World?*, Journal of Economic Literature, March 2000, v. 38, iss. 1, pp. 152-153.
[45] See also:
 - Abbott, Jason P., *Democracy@internet.asia? The challenges to the emancipatory potential of the net: lessons from China and Malaysia,* Third World Quarterly, Feb2001, Vol. 22 Issue 1
- The tiger and the tech.; Economist, 02/05/2000, Vol. 354 Issue 8156
[46] Huff, Toby, *Malaysia's Multimedia Super Corridor and Its First Crisis of Confidence*, Asian Journal of Social Science, 2002, Vol. 30 Issue 2

societies. Notwithstanding the present national scepticism regarding the MSC, the project has been reasonably well designed and launched. But it is, in the final analysis, only a part of the larger structure of national innovation systems that function equally as 'engines of economic growth.' "

This paper tells the story of the MSC from initial vision in 1991 to completion of infrastructure in 1999 and beyond, with comparisons with other Muslim countries. Malaysia was already quite advanced technically and commercially in 1990.

Vision on the part of leaders, and strategic institutions, was important. Companies demonstrating technical, entrepreneurial and financial commitment received the state of the art facilities and MSC status - with guarantees within the 50x15 km. corridor of ownership rights, access to international financial markets and unrestricted use of foreign 'knowledge workers.' A major consultant report in 2001 let out what most knew - that the MSC had been somewhat oversold, optimistic in timing, under and occasionally mis-managed. But the principal weaknesses, in skilled labour, support services (eg ISPs) and management experience, are certainly being learned.

The 'flagship applications' of the MSC included electronic government, a multi-purpose card, smart schools and telemedicine - followed by an R&D cluster, and borderless marketing (e-business) and an electronic labour exchange. In e-government, Malaysia did not adapt available systems for basic government systems and services, but started from scratch. There was from 1993 a strong promotion of a knowledge economy (K-economy) agenda, the main pillars being e-conomy, e-public services, e-community, e-learning and e-sovereignty (citizenship/identity). Major public investment in R&D and the construction of all parts of a national innovation system took place during the same period.

Mahathir's Paradox[47]
"The Committee to Protect Journalists ranks him among the world's 10 greatest enemies of press freedom, but Malaysian Prime Minister Mahathir Mohamad fancies himself a friend of the Internet. Determined to court high-tech investment from overseas, Mahathir has for over five years maintained a no-censorship policy for the Web, even as he suppresses domestic print and broadcast journalism and curbs the distribution of foreign publications deemed irresponsible, such as the Far Eastern Economic Review. So far, Mahathir's government has resisted the urge to harmonize online regulations with offline press laws.

The laissez-faire Internet policy has allowed dissenting Web sites to blossom. One of the most popular is Malaysiakini (www.malaysiakini.com), a news site founded by Steven Gan and Premesh Chandran, two refugees from the Malaysian daily Sun. It has received grants from the U.S.-based Media Development Loan Fund (MDLF). However, mdlf's link to financier George Soros-whom Mahathir partially blames for the country's 1997 crash-has been milked by the government to question Malaysiakini's motives. Nevertheless, the site attracts 100,000 unique visitors a day. Also on the Internet is the country's oldest human rights group, Aliran. It supplements its monthly print magazine with a Web site carrying its latest statements and news flashes (www.malaysia.net/aliran).

Malaysia's most popular alternative site is probably Harakah Daily (www.harakahdaily.net), claiming at least 400,000 hits a day. It is an organ of the Islamic Party of Malaysia (pas), which-despite its fundamentalist label-has found common ground with an eclectic mix of secular opponents of the government. Harakah Daily carries streaming video of pas leaders' speeches; columns by other politicians, intellectuals, and activists; and even occasional criticism of the party's leadership-all to showcase what a free press in an Islamic democracy should look like. Every now and then, exasperated Malaysian officials threaten to suppress online dissent, yet Mahathir appears satisfied that the Internet's

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[47] George, Cherian; Saad, Tobie; Rich, Jennifer L.; Brunn, Stanley D.; House, Jeff., *Net Effect*, Foreign Policy, Nov/Oct2002 Issue 133

influence is no match for the daily newspapers and airwaves he controls. Internet journalists agree. "Given the choice, I would publish a newspaper," says Gan."

What's Next?[48]

"Most school buses are low-tech affairs. But cruising the bumpy backroads of *Malaysia* are mobile *Internet* units, wired Netmobiles packed with 20 Pentium workstations, digital video cameras, printers and modems. The government project spreads e-literacy and raises understanding about the *Internet* in computerless villages. What's next? A wired boat to float the e-gospel up the rivers of Malaysian Borneo."

Thailand

Approaching poverty reduction through ICT's[49]

"Agenda (NECTEC - National Electronics and Computer Technology Center): Thailand ICT Policy Framework: IT 2010 : Knowledge Based Economy
Towards the Knowledge-based and Sustainable Economy/ Society
- Promote Innovation
- Build Human Capital
- Strengthen Information Infrastructure & Industry

Thailand ICT Policy Framework: National ICT Master Plan: ICT Development Program for 2001-2006 (NECTEC)
- Economy / Society, Quantity / Quality
- e-Industry / e-Commerce, e-Government, e-Society / e-Education
- Science and Technology, R&D, Knowledge
- Information Development, IT Literacy, IT Human Resource
- Telecommunication Infrastructure

Current Information Society Indicators of Thailand
- Telecommunications (As of May 2002) Source: TOT and NECTEC
  - Fixed telephone line per 100 people 12.47 (7.86 millions lines)
  - Mobile phone per 100 people 20.39 (12.85 millions lines),
- Internet (As of March 2002) Source: NECTEC, Thai ISP Club, Thai Network Information Center, National Bureau of Statistics
  - Internet users per 100 people 5.64, Internet hosts per 10,000 people 4,854
  - Internet domains (.th) 6,282 domains, Internet Hosts (under .th) 78,508 domains
  - Domestic Backbone Bandwidth 761.3 Mbps, International Bandwidth (inbound) 727.6 Mbps, Data volume at domestic exchange 1,531 Gytes/day

Roles of ICT towards Thai Economy, Source: DBE (Department of Business Economics)
- Increase economic well-being throughout the country
  - DBE estimated that E-commerce transaction in Thailand will be higher than US$ 0.5 billion for the year 2000-2001or 0.37% of GDP (GDP of year 2000 = US$ 134.4)
  - Provide higher capital and labor productivity for business and industry development Narrow the Digital Divide between the metropolitan and rural areas, which will result in social equity

Bridging the digital divide in Thailand: Initiative projects

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[48] Fisher, Lucy, Roderick, *What's Next?*, Dafydd, Time Atlantic, 9/17/2001, Vol. 158, Issue 12
[49] Kittipong Tameyapradit, Vice President, Telephone Organization of Thailand, APT Seminar *on Digital Opportunity for all: ICT & the fight against poverty*, July 29 - August 1, 2002: www.aptsec.org/seminar/meeting-2002/digital-op/ ICT-04-Mr.Kittipong-TOT.ppt

- SchoolNet
  - To offer free Internet access for public secondary schools throughout Thailand
  - Coordination between NECTEC, TOT and participated schools
  - The first free nation-wide Internet network in Southeast Asia by the UNDP Human Development Report 2001
  - Full service up to 5,000 schools by the end of 2002
- UniNet
  - Integrated UniNet and EdNet network and renamed "EdNet" in 2001
  - Optimize the network utilization and other resource allocation for SchoolNet and UniNet
  - Emphasize on the development of teachers' capabilities in ICT
  - Core network to link the regional centers and provincial centers together with transmission speed of at least 2 Mbps
- EdNet
  - About 33,000 schools in every province can be connected with the provincial centers either through leased lines or dial up modems
  - About 176 schools in remote areas still have no electricity supply. TOT will install solar cell panels to power the phone lines.
  - Some other 20,700 schools, located outside the service areas, connection will be made by using WLL
- TambonNet
  - To facilitate the Tambon or the Sub-district Administrative Organization (SAOs) around the country to access to important policies and information from various centralized government agencies
  - To support the government policy of "One Tambon, One Products"
  - The Ministry of Interior supplied computer hardwares, softwares, web contents and training of local people in each SAO for computer know-how.
  - TOT supports the Internet connections through its IP network as well as 5 telephone lines for each location.
  - Overall target of 6,745 SAOs 1,000 locations was implemented in 2001 3,000 more SAOs are now in process for 2002 2,745 locations will be completed by 2003
- Rural Long Distance Public Telephone Project
- Public Internet Access

Conclusion: Success in using ICT for reducing poverty needs
- Cooperation between government agencies and private sector to take active parts in providing information communication infrastructure i.e. network, Internet access, hardware, software, web contents and etc.
- Capacity building on Internet usage and skills for potential users. Young people who are eager in learning new innovation to promote their community growth are good participants.
- Promotion for innovative ideas. These ideas should be practical and relevant to community needs for long term sustainability."

Personal Reflections[50]
"Some of Thailand's experiences in the ICT development:
- Telecommunications monopolies in Thailand have ended since March, 2000. This was a result of the new Radio Frequency Management Act which also covers the telecommunications and broadcasting regulatory reform. There was concession-type private-sector involvement in the

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[50] Thaweesak Koanantakool (Director, National Electronics and Computer Technology Center NECTEC, and Executive Secretary, National Information Technology Committee, Thailand), *A discussion paper concerning the issue of digital inclusion and Thailand's ICT development Proposed to DOT Force, OECD*:
www.nectec.or.th/users/htk/publish/DigitalInclusion/ Thailand-comment.htm

development of telecommunications infrastructure since 1994. This change will help all of the private-sector to be in a level playing field, and it would help decreasing the cost of communications due to a better competitive environment.

- As a result of the private-sector involvement, the actual costs of phone connection, mobile phones and pagers are being driven down. Internet services have been opened to the private-sector operators since 1995, and this also help in lowering the cost with good services.

- Due to the economic crisis since 1997, many telecom operators were suffering from foreign debts. Some operators solved their problems by bringing in strategic partners from multinational telecom companies and form a joint venture.

- There are about 2 million Internet users, or 3.3% of the population. The figure is as of November 2000. Starting in 1995, there are now 18 commercial Internet service providers and three academic Internet service providers. The usage fee have been driven down dramatically by competition. A typical subscription is pay-per-use, without any monthly fee, at a typical rate of about USD 0.50 per hour

- The rate of increase of Internet Café around the country is unprecedented. In the past six months, there are new Internet Café in Bangkok. Any visitors to Thailand will find a Café within a five-minute walk from their hotel in Bangkok and main provinces. The typical service rate is between USD 0.50 to 1 per hour, depending on the setting of the Café. It comes in the belief that this rate is better than Tokyo and San Francisco. At the business center of a typical hotel in USA or in Europe, the service fee is about USD 20 per hour.

- The Government-supported SchoolNet Thailand project is a forerunner in e-Education since 1996. Now SchoolNet project connects more than 2200 schools nationwide to the Internet. Schools do not have to pay for the Internet connection. However, they still have to pay for the phone (about USD 0.08 per call) and leased circuits (not optimal vs. fast/always on/un-metered access). Excess usage of teachers, students and the community go for the commercial market which have completed their infrastructure since the year 1999 for local access everywhere.

Some observations concerning ICT development in Thailand:
- International bandwidth costs commercial ISPs in Thailand about 50% to 70% of the total expense of the companies. Developing countries run their Internet business by investing the full communication circuit to North America or Europe in order to let the information flow in both directions. And this is irrespective of which side of the line users initiates the information request. In this respect, the developing countries are apparently subsidising the users in North America whenever they access information elsewhere. This bandwidth cost must be brought down through international cooperation if we want to declare a global digital inclusion with fairness.

- The development of telecommunication backbone is a must for every country. Financing this large project can be a challenge and good examples could be brought up and followed whenever possible. In Thailand, we opted for two laws: one to manage the common infrastructures such as the radio frequency spectrum, fiber-optic network and satellite, and the other law deals with the Universal Access Obligation. Both laws were required by our Constitution of 1997.

- The so-called "last mile" problem can be solved by leapfrogging in technology. Instead of using copper cables to link the access points to the home, which can be very costly for the last few kilometres in the rural area, the Wireless Local Loop (WLL) technology can be used effectively (if it is secure) to lower the cost and expedite the installation for homes. Not only this technology can bring in the voice phone, but it also allows connections to any digital network at the speed of up to 128 kbps.

- The language problem is one of the major concern in developing countries, especially in Thailand where only small percentage of population can read and write English. It would be a pity investing all of the infrastructure just for the people to "see" what they cannot read or understand and they consequently go for some other things such as entertainment sites, pornography or downloading mp3 music. In another words, this problem can be called as "the last meter" problem (i.e., a gap between the screen and the user. Challenging tasks are ahead of all developing countries. The solution is either to create more contents in one's own language, or to teach the citizen to be more fluent in other languages, or use ICT to help with this. So far, for our quick fix for this is to provide an automatic machine translation from English to Thai language on the web (http://www.nectec.or.th/services). The translation website gained instant popularity since its launched in June 2000. Another last-meter problem deal with people with disability who may not be able to use the keyboard and display, or they are at a remote site where voice input/output is necessary. Strategic R&D program dealing with this at the national level has been quite successful in Thailand through the initiative of the royal family.

- Building a National Information Infrastructure (NII) is so crucial, if not critical, to the development of any country. NII means all sorts of infrastructure which is a basis for knowledge-based economy; and this includes people's literacy, contents, software, communication facilities, laws to protect the society and also to create trust and popularity of e-Commerce. Government needs to create a level-playing field to facilitate the win-win-win atmosphere to the people, to the nation, and to the private companies. It should also provide all the means to lower the risks and the cost of doing business in a liberated atmosphere. It is imperative that the government and the private sector mutually work out to legislate new laws and deregulate unnecessary rules that prevent the progress of ICT and K-economy.

Started in 1998, Thailand planned for the reform of business and creation of ICT related laws. There are six of them:
- The NII Law (Universal Access Law)
- Electronic Transactions Law
- Electronic Signature Law
- Data Protection (privacy) Law
- Electronic Funds Transfer Law
- Computer Crime Law

At the moment, the first three laws have been drafted and submitted to the Cabinet for approval, while the eTransactions and eSignature laws have been approved by the House of Representatives, and are reaching their final stage of approval by the House of Senates. The certain updates in the Intellectual Property Law and Consumer Protection Law aimed to assist the safe passage for e-Commerce are also expected.

The last part of affordable of the NII includes the low-cost PC and Internet applicance, low cost of GUI operating systems, office suites, and database. There have been a strong collaboration program based on the Open Source movement in Thailand in order to bring Linux and Star Office for Thai language into popular use. In Thailand, both software suites one becoming popular among new engineers and developers who want to create new businesses.

Call for Actions:
There are several actions which can be done at the national level. However, this will require commitments within each economy and a strong program to convert the sceptics into the realistic believers of ICT. If one can make five big wishes to the Digital Opportunity Task Force (DOT. Force), here are our wishes:

- Can we effective build a new kind of cooperation to construct a symmetrically financed digital connections? The current bandwidth financing for Internet infrastructure is naturally a digital exclusion for those who cannot afford the link to the developed countries.

- Would each participant propose the strategies to go for solving the "first-order problems" with ICT and knowledge as part of the solution? The "first-order problems" are meant to be what defined by Tim Kelly of the ITU: the poverty, hunger, health and basic education. Would this approach bring up real progress and leapfrogging with some realistic landing point?

- How can community access centers be set up with the initiatives of the local communities, using the lowest cost model? Could it be started with just telephones, fax and pagers? PC and the Internet can be a second-level option which should come with some good information dissemination program to improve the earning of people in the rural areas?

- In addition to the WWW and free web browser software, could there be a few versions of WWL (world-wide Linux), WWO (world-wide Office) and WWX (world-wide translation service)? The development program for all of these software can be well below USD 50 million each, through the Open Source concept.

- Shall we convince the sceptics and high-level decision makers in each country to see the best-practice examples? Will Estonia, Brazil and China be willing to host visitors from developing countries to see how they are successful in bridging the digital divide in their countries so well?

- Last but not least, the partnership concepts and true actions should be able to help providing the desirable digital inclusion that we are all looking for. Many developing countries which have been cited in world-class reports are ready to join the (DOT) force. Should the issues be taken seriously as the world challenges?"

Brazil, India, Mexico, Turkey

Liberalization and the Computer Industry: A Comparison of Four Developing Countries[51]
"…*National Economic Environment.* Brazil, Mexico, India, and Turkey are all relatively large developing economies with significant growth potential. In terms of income, Brazil, Turkey, and Mexico are all in the US$3000–5000 range in per capita income. India is much larger in population, but is much poorer, with per capita income of only US$390 (Table 1). These economies each were large enough to tempt policymakers to try import substitution in the computer industry, but in the end were not large enough to support high-volume hardware manufacturing. Ultimately, each decided to lower trade barriers and open domestic markets to international competition.

Political Environment. Decisions over whether and how to liberalize are shaped by domestic political factors, including constitutional restrictions, ideology, and the influence of interest groups. For instance, Turkey's constitutional requirement that the government provide communications services has limited the scope of telecommunications liberalization, while entrenched interest groups have hampered

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[51] Kraemer, Kenneth L. and Dedrick, Jason, *Liberalization and the Computer Industry: A Comparison of Four Developing Countries, Information Society, April 2001. See also in this issue:*
- Tigre, Paulo Bastos and Botelho, Antonio Jose Junqueira, *Brazil Meets the Global Challenge: IT Policy in a Postliberalization Environment;;*
- Lal, Kaushalesh, *Institutional Environment and the Development of Information and Communication Technology in India*
- Dedrick, Jason;, Kraemer, Kenneth L., and Alacios, Juan J, *Impacts of Liberalization and Economic Integration on Mexico's Computer Sector*;
- Wolcott, Peter and Cagiltay, Kursat, *Telecommunications, Liberalization, and the Growth of the Internet in Turkey.*

the process of privatization. By contrast, Mexico's institutionally powerful presidents have been able to overcome domestic opposition and institute sweeping liberal reforms. The pluralistic governments of Brazil and India have taken a more gradual approach to liberalization of the IT industry, responding to internal and external pressures to open up, but retaining some protection for domestic producers.

National Capabilities. The potential impacts of liberalization on a country are affected by its national capabilities, that is, those resources needed for production or use of computers and information technology. Most important of these are the quality of the telecommunications infrastructure and human resources, and the size and competitiveness of the IT industry before liberalization. Telecommunications infrastructure is vital to effective use of IT, especially in the era when the Internet and other network technologies are coming to dominate. Human resources include everything from literate workers for advanced manufacturing facilities, to engineers and technicians needed by the IT industry, to scientists and researchers who can conduct R&D and develop new technologies.

The capabilities of the existing IT industry also can affect the results of liberalization. If domestic companies are already exporting and are internationally competitive, they are likely to survive and even thrive under liberalization. If they have succeeded only by taking advantage of the protected domestic market, they are unlikely to survive the onslaught of foreign competition after liberalization. However, even if existing companies do not survive, there may be a cadre of individuals who have gained experience starting and managing companies, and these skills will still prove valuable to the country after liberalization. They can shift to different industry sectors, start new companies, or help foreign MNCs carry out higher value-added activities within the country. The ability of a country to participate in a global, post liberalization environment and to realize the potential benefits of that participation depends to a great extent on whether it has or can develop these capabilities. Turkey has the highest level of telecommunications infrastructure, while Mexico tops the four countries in PC and Internet penetration, and Brazil is investing most heavily in IT (Table 2). Mexico, Turkey, and Brazil have similar literacy rates, with India much lower, but all four countries now have similar rates of secondary school enrolment. Each country also has similar numbers of scientists and technicians per 1000 people, meaning that India has a much higher absolute number. The significance of these data is that each of the four countries has sufficient resources and capabilities to take advantage of opportunities in IT, both as producers and users. And in fact, each country has excelled in one or more areas, such as software development in India and banking automation in Brazil. There is plenty of room for improvement in each case, but these countries did not liberalize without having important capabilities already in place.

Preliberalization Policies. Before liberalization, Brazil, India, and Mexico all protected their domestic IT markets to varying degrees, creating space for local firms to enter the industry. India's policies in the 1970s were the most restrictive, leading IBM to abandon the Indian market rather than submit to government requirements that it enter a joint venture with local partners (Dedrick & Kraemer, 1993). Brazil's "market reserve" policy reserved the minicomputer and PC markets for local companies and joint ventures, but allowed MNCs (mainly IBM) to retain their position in the mainframe market. The market reserve policy was protested vigorously by foreign companies and the U.S. government, but remained in place throughout the 1980s. Mexico took a similar approach in the early 1980s, but bowed to pressure from the United States and IBM to give up its joint venture requirement, and later eased other restrictions. In the end, however, all three countries banned or severely limited at least some categories of computer hardware imports. The impact of these policies was higher prices and limited availability, which hurt domestic users and also hampered the development of software and service industries.

This led to pressure from computer users and software makers (especially in India, with its large pool of software professionals) to liberalize. There was also ongoing external pressure from the U.S. government acting on the behalf of U.S. companies, and in the cases of Brazil and Mexico, from the International Monetary Fund (IMF) and World Bank in the wake of the Latin American debt crisis. Ultimately each of these countries liberalized their IT sectors, although in different manners. Turkey,

driven by economic decline and social turmoil, introduced market-oriented reforms and invested heavily in telecommunications in the 1980s, but did not privatize or liberalize the telecommunications sector, even in the 1990s.

*Computer Industry Liberal*ization. The process of liberalization among the four countries has ranged from sudden and complete to gradual and partial. Liberalization of Mexico's computer sector took place in a sweeping move when the Computing Program was abandoned in 1990. The only remaining barrier to the Mexican market was a 20% tariff on hardware imports, which was phased out by 1998 within NAFTA. Since liberalization, Mexico has taken a laissez-faire approach to IT, even at the cost of losing out on potential foreign investment to countries that offer incentives. Brazil likewise removed most barriers to its computer market in 1992, but left in place a somewhat complex mix of tariffs and taxes, which could total over 30% of the cost of a computer. By maintaining these taxes, Brazil could offer exemptions as a means of promoting domestic production. Brazil also has pursued various policies to promote the local industry through investment incentives, incubators for startup companies, and software export promotion. India has liberalized in two phases. First, from 1991 to 1997 it lowered trade barriers and promoted the software industry through policies such as export zones. Second, since 1998 it has created free-trade zones and enacted other policies to promote hardware production. Turkey has not liberalized telecommunications, but it has created a competitive Internet services market built on a backbone infrastructure provided by the state telecoms monopoly. The differences in the nature of liberalization can be attributed to the economic and political factors discussed above. More interesting from a comparative point of view are the results of liberalization.

Impacts Of Liberalization. Liberalization has led to many positive results in the four cases, as neoliberal economists would have predicted. IT use has expanded as prices have dropped and a greater selection of hardware and software has become available. In addition, local software and services companies have benefited from access to cheaper hardware and a growing domestic market. On the other hand, in Mexico and Brazil, many local computer makers have been driven out of business (or at least into different markets) by foreign competition. In India, local computer companies have retained their leadership in a somewhat more protected domestic market. The result of de facto liberalization in Turkey's Internet services market has been an impressive growth in availability and use of the Internet. The beneficiaries have been local Internet service providers, which operate under minimal regulation and do not face competition from Turk Telekom, the state-owned telecoms monopoly. However, Turk Telekom's control of the TURNET backbone and the high costs of international leased lines has restricted the ability of local Internet service providers (ISPs) to improve their infrastructure. In this case, the continuing lack of liberalization puts limits on the development of the Internet.

However, factors other than liberalization help explain many differences among the countries' IT sectors. For instance, in recent years the PC industry has become extremely time sensitive, thanks to the rapid depreciation of products and the build-to-order production model pioneered by Dell Computer (Kraemer et al., 2000; Curry & Kenney, 1999). This has pushed PC makers to locate production close to the end market. As a result, Mexico has experienced a large inflow of foreign investment by computer makers and contract manufacturers seeking a low cost production site for the huge North American market. The result has been a boom in computer exports, which topped US$3 billion in 1996, the last year for which comparable figures are available (Table 4). Brazil and India are too far isolated from the major world markets to serve as export platforms, and have attracted much less foreign investment. In reality, while they are touted as emerging markets, the combined IT markets of the four countries is less than 6% of the U.S. market. Surprisingly, Turkey, which is well situated geographically for serving the European market, has yet to develop a computer industry at all, with production of just US$217 million in 1998.

Other idiosyncratic factors have affected outcomes in each country. For instance, the success of Brazilian firms in banking automation is often attributed to the exceptionally high inflation rates that prevailed throughout the 1980s and early 1990s. Banks were able to take advantage of constantly

shifting prices and exchange rates by automating their processes during this time. As a result, Brazil was an early adopter of banking automation and has used those capabilities more recently for applications such as online banking and risk management analysis. In addition to liberalization of the computer sector, broader liberalization policies can also influence outcomes. For example, IT use in Mexico and Brazil has been spurred by increased competition across newly liberalized segments of the economy such as banking, retail, and manufacturing. As foreign competitors have entered these previously protected markets, they have brought in advanced information systems and exposed Brazilian and Mexican managers to those technologies. Domestic companies have either looked for foreign partners to gain access to such systems, or worked with foreign and domestic IT companies to develop their own capabilities. After a slow start, the Internet has caught on in recent years. Among the reasons have been the availability of lower cost PCs to access the Internet in Brazil, Mexico, and India, and a competitive ISP market in Brazil, Mexico, and Turkey. India still lags far behind the others, due partly to the lack of telecommunications infrastructure and partly to its much lower income level.

Conclusions And Implications. In conclusion, we would argue that some degree of liberalization was necessary and probably inevitable for all of the countries discussed here, given the nature of the global computer industry in the 1990s. The idea of promoting a domestic computer industry behind protective barriers is not tenable in an industry marked by rapid technological change and dominated by multinational companies who control global technology standards. The question was no longer whether to liberalize, but how to do so. Each country took a different approach to liberalization, and each had different results. The differences in results cannot be separated from differences in environment (size, location, capabilities), but they also are related to the nature of the liberalization process. Mexico's sweeping liberalization led to the demise of much of the local industry, but also created a more attractive environment to become an MNC export base. Brazil and India, with their more gradual liberalization, left more local firms intact, but have not developed export-oriented hardware production, partly due to their more remote locations from major markets. Brazil has, however, seen significant growth in production for the large local market.

More interesting perhaps is the evolution of the software, services, and Internet sectors. As we have argued before (Dedrick &Kraemer, 1998), there are great opportunities for developing countries to promote "production close to use." This means promoting IT use because of the benefits from using the technology, and also because domestic use creates opportunities for local entrepreneurs. This part of the market does not require the massive economies of scale needed for hardware production, and local companies can get started by finding niche opportunities in the domestic market. This was the case with Brazil's banking automation industry and Internet content developers, and Turkey's Internet service providers. By contrast, import restrictions on hardware limited the local market for Indian software makers and forced them to rely on "body shopping" and subcontracting, rather than on developing original products. As a result, India's software industry is large, but has developed few successful commercial products.

To summarize, we would make the following points about liberalization. On the positive side:
- Liberalization in the computer sector has resulted in lower prices and greater use of computers. Broader liberalization of the economy has likewise spurred demand for computers and IT as companies respond to new foreign competition.
- Liberalization of telecommunications related to the Internet has resulted in rapid growth in Internet use, further stimulating demand for computer hardware and software, and creating a market for local Internet service and content providers.
- Liberalization of foreign investment laws and lowering of trade barriers on parts and equipment have led to investment in computer production in those countries that are located close to major markets, or that have large internal markets.

However, on the negative side, liberalization has often driven local computer makers out of business, as those companies lack the resources to compete with foreign multinationals who enter the market. It also

is possible that liberalization discourages local entrepreneurs from entering some segments of the IT industry where they are likely to face foreign competition. Regarding the argument as to whether countries are better off following the neoliberal prescription of complete liberalization or the revisionists' strategic approach, the case studies suggest more nuanced conclusions. Removal of barriers to trade and foreign investment will bring significant benefits, although some transition period is likely to help local companies adjust and find new market opportunities. More importantly, liberalization does not preclude the adoption of policies to better prepare a country's industry and to take advantage of opportunities in both production and use of IT.

What then can we say to developing countries trying to develop such policies?
- First, the key to a successful policy is to understand one's own circumstances and develop policies that are appropriate for those circumstances. Simply trying to follow another country's model is not likely to work very well. What worked for Mexico will not work for countries that are not located next to the U.S. market, and what worked for Brazil will not work for countries with very small domestic markets. India's software export success will not be duplicated by a country without a large pool of software professionals.
- Second, even after liberalization, there is a role for government. In Brazil, the national government and state governments are promoting production of hardware, software, and services. In Mexico, the state government of Jalisco has been especially active in promoting the IT industry in conjunction with MNCs and local universities. We would argue that the policies most likely to succeed are those that enhance national capabilities, including education of engineers, programmers and other IT professionals, investment in communications infrastructure, and support for science and technology.
- Finally, liberalization of the computer sector is not enough in the Internet era. Equally important is liberalization of telecommunications, which creates competition and drives down the cost of Internet service. Even selective liberalization, as in the case of Turkey, can make a difference, but more complete liberalization will have broader impacts. The greatest benefits of IT in the future will come from being linked to the global Internet, so policies that lower the cost of connecting are a must for developing countries.

The debate over liberalization has shifted from whether or not to liberalize, as the process is already far advanced in most developing countries. Liberalization is now seen as a first step to ensure that countries have access to international markets, technology sources, and foreign investment. Beyond that, the issue is how to realize the potential benefits from increased competition at home and participation in global markets and global production networks. One point that has been made clear by the case studies in this special issue is the importance of developing national capabilities such as human resources, high-quality
and low-cost telecommunications networks and Internet connections, and financial systems capable of supporting local entrepreneurs. By doing so, countries can take advantage of opportunities in the global market as well as develop unique national applications of information technology."

Other Developing Countries

In much of the developing world, ICT expansion will take much longer. In the OECD, it came on top of quite advanced human, social and economic development, and a gradual spread of older ICTs - telegraph, phones, television, computers. So similar outcomes might be projected, for less advanced developing countries, but over considerably longer periods of time, and starting with those more advanced in stability, political and economic management, and all areas of infrastructure including technical skills development.

For the less advanced countries, depending on individual circumstances, some combination of building stability/management/infrastructure, and expediting selected technologies and applications, will be optimal, but identifying and accomplishing it difficult. Some, like Mongolia, Philippines, South Africa, China and Vietnam,

have quite clear game plans and some 'country case study' literature readily available; these are profiled below.[52] Along with India, these appear to be particularly interesting as cases for other less advanced countries due to their relative poverty and large rural populations.

- Many other developing countries have relatively little or uncoordinated ICT strategy and policy, and an abundance of civic and donor supported initiatives aimed at poorer segments of society. Country case study material for these has not been readily available, but there is a wealth of case material on initiatives in a wide range of sector and issue areas illustrated in IV below.

Mongolia, Philippines, South Africa, China, Vietnam[53]

Mongolia[54]

Mongolia was ejected into independence with the collapse of the Soviet Union in December, 1991, with good Soviet science and technology, state enterprise, a technologically strong and inquisitive ICT sector, a quarter of its 2.25 million people in Ulan Bataar, and many in small or remote locations. The shares of the state enterprises were distributed to the public. Mongolia had a prior ICT history including 'ham' radio, perhaps due to its remote populations, and it was not unusual in 1991-92 to find Mongolians in East Asia learning about and acquiring Internet/networking technologies. When the first external Internet connection occurred in 1992, there was already an electronic network by which Mongolians could buy and sell shares of public enterprises from 12 urban locations. Datacom (previously state owned) and others have led the way to expand television and Internet education support coverage to much of the country, to develop Mongolian content, and to support promising development applications. Politics remain strongly contested but Mongolia, true to its history, has a quite clear focus on priorities, and ICT/Internet development is an important component. 80% of the adult population is literate. ICT/Internet expansion has been consciously directed in both commercial and social directions. 'Pre conditions' of literacy, core technical capability and clarity of policy vision have played central roles.

Nomads on the Net[55]
"The *Internet* has sharply divided the rich from the poor nations of the world. The reason is simple -- to join it you need access to a computer, modem and telephone line. But an exciting new project in Asia aims to change all that, as Geoff Long found out when he visited *Mongolia*.

In the remote Mongolian mining town of Erdenet, situated about 250 kilometres northwest of the capital Ulaanbaatar, publisher and small business owner Batkhuu (in *Mongolia* the surname doubles as the firstname) is using the *Internet* to find out more about the herbs listed in a long forgotten Mongolian medicine. The medicine is detailed in a traditional Mongolian text known as a sudar -- an unbound manuscript wrapped together and protected with pieces of cloth, and suited to the rigours of a nomadic lifestyle and the country's harsh conditions. So passionate is Batkhuu about his growing collection of sudars, that he has named his business "Mongol Sudar", and he sponsors a team of scholars to research the history and significance of the texts. To date, the team has published four books on subjects covering Mongolian medicine, linguistics and history. Batkhuu's long-term goal is to

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[52] For many other country papers - Bangladesh, Maldives, Pulau, Iran.. see Asia Pacific Meeting On Bridging The Digital Divide & Preparation For The WTDC-02, New Delhi, 13-16 February 2002: www.aptsec.org/DD-WTDC-02/DocumentLists.htm. Nepal's ICT strategy is also sketched in IV below.

[53] See also:
- Tipton, Frank B, *Bridging the Digital Divide in Southeast Asia: Pilot Agencies and Policy Implementation in Thailand, Malaysia, Vietnam, and the Philippines*, ASEAN Economic Bulletin, April 2002, v. 19, iss. 1, pp. 83-99
[54] R. Spence, from experience in Mongolia with IDRC's Pan Asia Networking program.
[55] Long, Geoff , Nomads on the net, Geographical Magazine, Mar97, Vol. 69 Issue 3

make this research and the texts available to his fellow Mongolians and the rest of the world via the *Internet*.

For a country whose economy is still recovering from the collapse of the Soviet Union in 1991, and whose basic utilities (including power and telephones) are severely run-down, the fact that *Mongolia* has any *Internet* infrastructure at all is impressive. It is an achievement that has been accomplished from scratch in the past two years. In fact, its success is now being used as a model for other developing countries in Asia.

The ingredients for connecting *Mongolia* to the *Internet's* global community came together in late 1994. With a more liberal political environment and a government push towards a market economy, newly privatised local software and networking company Datacom had plans to start an *Internet* service. But it didn't have the funds. At the time, a Canadian-based research organisation, the International *Development* Research Centre (IDRC), was implementing a programme known as Pan Asia Networking (PAN), which aims to support the *development* of communications infrastructure in the least developing countries of Asia. The IDRC was created by the Canadian government to help the developing world find solutions to social, economic, and environmental problems through research.

By offering funding to existing organisations already involved in information exchange or networking, the PAN project plans to establish a series of *Internet* sites at a national or sub-national level that can be linked to form efficient regional networks. One of PAN's first activities was to compile a report based on the views of individuals from regional research institutions, government agencies, universities, and NGOs on the current conditions of data communications in individual countries. The programme is now moving to support projects in Bangladesh, Nepal, India, Sri Lanka, Cambodia, Laos, Vietnam, Burma, China, *Mongolia*, the Philippines, Indonesia, and Thailand, with the aim of promoting the sharing of information resources, especially for researchers, NGOs, and *development* agencies in Asia.

Mongolia was the first site in the PAN programme and was chosen as a pilot for a number of reasons. Having only recently made the transition to a market economy, it was in desperate need of information from the rest of the world and was ready to re-forge links with neighbouring countries. Datacom, the only domestic provider of data communications services, also had a team that could undertake the demanding technical requirements needed to become an *Internet* provider. And as a remote country without *Internet* access, it offered a chance to study the technical challenges that would be applicable to other countries in the region. Paul Wilson, a consultant for Australian-based networking company Pegasus Networks, was involved in the preliminary stages. He was impressed by the technical capabilities of Datacom at the time and, as a result, the likelihood of success. "They were clearly out there and ready," he says. However, he points out that the conditions they had to work under were poor, although similar to many other developing countries in Asia. Problems included unreliable telephone lines, telephone exchanges based on non-standard and outdated Russian technology, erratic power, and not enough computers.

Nevertheless, Datacom had already built-up its own in-country e-mail system, adapted from Russian software, which was robust enough to cope with the poor conditions. According to Wilson, the system (called PC-Mail) was very reliable and allowed for messaging in *Mongolia's* Cyrillic-based script.

Since the first permanent link was made in January 1996, the *Internet* connection has now been upgraded to a 128 kbps satellite link -- not fast compared to somewhere like the US, which has links of 45 mbps, but adequate nonetheless. More importantly, perhaps, the success of the pilot means that similar projects are now underway in Cambodia, Sri Lanka, the Maldives, Laos, and Vietnam. Many of these will follow the framework set by the PAN-Mongolian project. For example. a grant has been given to the Science, Technology and Environment Organisation (STENO) of Laos to start a preliminary dial-up *Internet* system. This is a temporary connection to an external *Internet* system,

made once or twice a day to transfer information. And, in Vietnam, a grant has been given to the Institute of Information Technology in Hanoi to implement permanent *Internet* access using a leased telecommunications line. Eventually it is hoped that the various PAN *Internet* sites will be connected, allowing for greater regional communication and collaboration.

Meanwhile, Mongolians are harnessing the *Internet* in projects that they hope will benefit the country in its push towards modernisation. It will also help to communicate some of its unique culture to the rest of the world. Surenguin Badral, the foreign policy adviser to the Mongolian prime minister, says that one of the central tasks of the new government is to reduce its spending and at the same time improve infrastructure, especially to remote areas. "The *Internet* network that the country is starting to build up is most important in terms of reducing costs and secondly communicating with the country people and getting information from remote places," he says.

Development agencies such as the UNDP, UNESCO, and the Asia Foundation are all users of the *Internet* in *Mongolia* and in turn are helping local groups with *development* goals. The Press institute of *Mongolia* (PIM) is one such beneficiary and is now in the process of installing *Internet* training facilities for the country's journalists. According to Managing Director Enkhbart, the plans include sending news to the countryside and holding courses on using computers and sourcing news from the *Internet*. In turn, the PIM is forging links with other *development* agencies and similar institutions such as the Nepal Press Institute.

Another goal of the PAN project is to encourage other sources of funding once the programme gains momentum. *Mongolia's* educational institutions recently received grants from the National Science Foundation in the US and the International Science Foundation, which was formed four years ago by Hungarian-born financier George Soros to support scientific projects in countries aligned with the former Soviet Union. As a result, they can now set up separate radio modem links to Datacom's system enabling them to have their own *Internet* hosts. Soros' Foundation has also agreed to provide a separate grant to start a public *Internet* centre in Ulaanbaatar.

Mongolia's new class of entrepreneur is also finding ways to deliver new services on the *Internet*. With more business people, foreign organisations, and teachers coming in as a result of *Mongolia's* policy of liberalisation, Ganbold, the director general of the World Mongolian Federation, which is a group promoting cultural, educational, and humanitarian ties with overseas Mongolians, realised these people would welcome basic information about the weather, banking and exchange rates, entertainment and eateries. He started E-Mail Daily News, a daily supply of information and tips for *Mongolia's* growing expatriate community. Another permutation supplies weekly news and information about the country to the outside world, both Mongolians living abroad and interested foreigners. Ganbold sums up the possibilities of using the *Internet* to create awareness of the country: "*Mongolia* is a place of interest for many people around the world, but still it has very little information available. If we want to be a part of the international community and among those countries that has something to offer, we have to be open and we have to be easily known. So this [*Internet*] is one of the few efficient tools and ways of making it possible." "

Philippines[56]

One whole chapter of the Medium-Term Philippine Development Plan 2001 to 2004[57]
"is devoted to how information and communications technology can be the main instrument to combat poverty and bridge the digital divide in the country."
Government official, Philippines "The government has a tendency to encourage/woo multinationals and foreign IT companies at the cost of ignoring local IT companies…

Enthusiasm within the Philippines for the economic potential of ICTs became evident in 1994 with the nation's formulation of the National Information Technology Plan. The plan laid the foundation for an overall strategy to spur national competitiveness through adoption and use of ICTs. Over the past few years, the Philippines has become a major East Asian hub for multi- national ICT companies and a primary hardware exporter. The Filipinos have become global leaders in the use of Short Messaging Service (SMS). The Government of the Philippines has taken some aggressive initial steps in the right direction, and has shown its commitment to ICTs by efficiently passing important ICT laws and creating several ICT parks. Nonetheless, substantial challenges remain to achieve more sustained ICT development.

 The Philippines ranks fifty-eighth overall in Readiness for the Networked World. One of the most pressing barriers lies in the telecommunications sector. Although the Philippine government was quite advanced in liberalizing its telecommunications market as early as 1995, these efforts have not translated to low prices. Significant investment in telecommunications infrastructure during the 1990s was not accompanied by efficient allocation of resources. There has also been a lack of leadership in telecommunications regulation (Ranking in Effect of Telecommunications Competition: 36). In the Philippines, more than 50 percent of the installed fixed lines remain unused.

At the same time, there has been dramatic growth in mobile telephony. The number of cellular telephone subscribers now far exceeds the number of fixed-line subscribers. Use of the Internet has grown rapidly in the Philippines. Internet cafés have become very popular in the cities. In addition to online banking and stock trading, the Internet has had an impact on political participation in the Philippines, through increasing online political discussions and petitions. However, low levels of PC penetration, low incomes, a precarious economic situation, and relatively high Internet fees have stifled diffusion of the Internet to a wider portion of the population.

Built on the strength of the national ICT skill base, low labor costs, competence in English, and very favorable support from the government, a sizeable ICT industry has been created in the Philippines. Software, semiconductors, and microelectronics represent a major portion of the Philippines' total export revenues. However, challenges to the software industry include a high level of brain drain of the

[56] See also:
- Alampay, Erwin, *The impact of access strategies and policies to ICTs: the case of Carmona and Puerto Princesa, Pan Asia Networking All Partners' 2003 conference, Vientiane, Laos, 3-10 March 2003*:
http://www.panasia.org.sg/conf/lao2003/paper/d3-1400-gaspar.doc
- Eleanore C. Sanchez, *Low demand, poor infrastructure hinders ICT growth in Mindanao,* i.t. matters:
http://itmatters.com.ph/news/news_11262001a.html
- Metropolitan Computer Times editorial staff*, Jaime Augusto Zobel de Ayala Creating a Global Powerhouse in the Digital Economy*, 16 September 2002: www.mctimes.net/ Special_Reports-09162002-18%20Luminaries%20Movers%20and%20Shakers%20of%20ICT%20in%20RP
- Saloma, Czarina, *Making Women Visible: Gender Spaces and **ICT** Work in the **Philippines,*** Gender, Technology and Development; 2002, 6, 1, Jan-Apr
- Coronel, Sheila S., The Media, the Market and Democracy: The Case of the ***Philippines,*** Javnost/The Public; 2001, 8, 2
[57] Mridul Chowdhury, Harvard University with Roberto DC Yap, IntelTech Resources, Inc.:
www.cid.harvard.edu/cr/profiles/Philippines.pdf

ICT labor force (Ranking in IT Brain Drain: 67), the expensive and inefficient electricity supply, lack of financing options, and a high software piracy rate. E-commerce is beginning to develop in the Philippines (Ranking in e-Commerce micro- index: 37). B2B e-commerce marketplaces have emerged in the agricultural and other sectors, and there is a growing demand for e-commerce solutions, driven mainly by foreign multinational companies. Many B2C e-commerce sites that provide online shopping and tourism services are becoming popular, although online payment is not yet common.

One strength of the Philippines is its highly educated population (Ranking in Social Capital micro-index: 48); the country's literacy rate exceeds 94 percent. Recognizing the importance of education, the government's national ICT strategy has placed heavy emphasis on enhancing the education system with ICTs and creating an ICT-skilled workforce (Ranking in Quality of IT Education: 31)…

Philippines country profile: Population 76,500,000 Rural population (% of total population) 1999 42.32 % GDP per capita (PPP) US$3,956 Global Competitiveness Index Ranking, 2001-2002 48 UNDP Human Development Index Ranking, 2001 (adjusted to GITR sample) 51 Main telephone lines per 100 inhabitants 3.92 Telephone faults per 100 main telephone lines 5.20 Internet hosts per 10,000 inhabitants 2.54 Personal computers per 100 inhabitants 1.93 Piracy rate 61.00 % Percent of PCs connected to Internet 1.31 % Internet users per host 102.84 Internet users per 100 inhabitants 2.61 Cell phone subscribers per 100 inhabitants 8.23 Average monthly cost for 20 hours of Internet access US$16.45."

2001- the case of Positive Electronic political change[58]

"President Joseph Estrada was driven from office by angry citizens mobilized by electronic messaging [short message system – sms – as available on the GSM Mobile Phone network in Philippines]. The Philippines network operator Smart Communications Inc.'s public affairs department said that they received 70 million text messages a day during that week as against the daily average of 45 million text messages. Globe Telecom also said it handled a higher volume of text messages as People Power II began, but officials say they can't say how many messages were sent over the five-day period. The public relations officer at Globe's public relations division, said that the volume clearly exceeded the company's average daily text messages of 24.7 million."

Mobiles, jobs, politics, people, Nokia and GSM security[59]

Mobiles are the main ICT for many younger people in the Philippines, including people from poorer communities outside main cities, who get on-call work in construction or in caddying for golf, ball-boy for tennis, delivery, other personal services… But to do this, the poorer need the low cost of texting, and also need cash cards because they have no credit. Mobiles have also had a major impact on political activity, including the successful people power revolutions. And they are now having a strong impact on relationships and culture among young Filipinos and Filipinas. Nokia has been studying the impacts of mobiles. GSM (global system for mobile communication) technology has major unresolved security problems, but these appear not to undermine the growth of these kinds of jobs, politics and people/relations applications in the Philippines.

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[58] Salman Saeed, *The Role of Internet in South Asian Development,:* www.the-south-asian.com/Feb2001/ Internet_&_South_Asian_Development2.htm
[59] Based on a conversation with Julian Payne, Canadian E.D. of the Asian Development Bank, in Manila Feb. 2003. I haven't found the Nokia study(s) yet, but articles on Nokia involvement in environmental education, as well as business and IT, are on the Internet, eg: *CGFI, cell phone makers join hands in nurturing nature*: http://www.inq7.net/lif/2002/oct/18/lif_27-1.htm

South Africa[60]

Fighting poverty online in South Africa[61]

"Ikaneng Primary School, a neat one-story brick building surrounded by a high metal fence and packed to the bursting point with 585 uniformed elementary school children, is a humble starting point for *South Africa's Internet* revolution. Many children in this impoverished Soweto community, near the vast metropolis of Johannesburg, live in metal shacks or tiny, apartheid-era houses shared by multiple families. Their parents struggle to pay the few dollars a year in school fees and to keep them dressed in the school's navy uniform. But under a program launched in June, Ikaneng has a working, though makeshift, computer lab. It is among 25 public schools in Gauteng Province - also home to the capital, Pretoria - due to receive new, *Internet*-wired computers by the end of this year. The Gauteng government's wider goal - in a first for this country - is to provide *Internet* access for all of the province's 1.5 million students by 2006. If successful, the plan could become a model for *South Africa*.

Some question, however, whether the push for technology access will come at the expense of schools' more basic needs, such as classrooms, teachers, and schoolbooks. Gauteng has earmarked 500 million rand (about $60 million) over the next three years - nearly its entire equipment budget - to put 25 computers with *Internet* access in each the province's 2,400 public schools. The money will also send at least five teachers from each school to computer-training classes. "It's a tool to fight *poverty*," says Lebelo Maloka, spokesman for the Gauteng department of education. "It will ensure that when students become citizens, they will be able to face the information highway. And it will also in the long run put *South Africa* in line with other [information technology] giants."

Africa lags far behind Europe and the US in terms of communications technology - there are more web hosts in New York City than on the entire continent. And although *South Africa* is by far the most-wired African nation, access to computers and the *Internet* remains largely limited to the white and wealthy. *South* African President Thabo Mbeki has made reducing the digital divide one of his top priorities, and says that technological literacy will be key to the country's future in an increasingly globalizing world. At the recent Group of Eight summit in Genoa, Italy, Mr. Mbeki and other African leaders called on developed nations to support technology initiatives on their continent.

Gauteng's provincial effort is seen as an important pilot program for Mbeki's technology agenda. Proponents argue that computer literacy must begin early, and that investing in technology in schools now will pay important dividends later. But there are many who question whether *Internet* access should be the top priority, in a country where more than 90 percent of schools have no libraries, and there is a shortage of more than 50,000 classrooms. Located in the country's wealthiest and most urbanized school district, Gauteng schools have more basic services than most. But even here, 172 schools still do not have electricity. "We're not opposed to the concept of giving people computer skills. That's great, we need to do that. The problem is the pragmatics of the situation," says David

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[60] See also:

- IYU New Initiatives Program, *Broadband: the Case of South Africa*, Case Study for Regional Implications of Broadband Workshop, May 2001

- Wiring African Universities Proves a Formidable Challenge.; By: Useem, Andrea., Chronicle of Higher Education, 4/2/99, Vol. 45 Issue 30, pA51, 3p, 1 chart, 2 maps, 3c,

- Patterson, Rubin., *A special Issue on Science & Technology in Southern Africa and East and South Asia,* Journal of Developing Societies (Brill), Apr99, Vol. 15 Issue 1, p1, 4p2

- Kaplan, David E , *The South African Mobile Phone System,.; Europe and developing countries in the globalised information economy: Employment and distance* education, 1999, pp. 126-31, UNU/INTECH Studies in New Technology and Development, vol. 9. London and New York: Routledge in association with UNU Press

- Schreiner, H, *Rural women, development, and telecommunications: A pilot programme in South Africa*, Gender and technology Oxford: Oxfam Publishing, 1998, p.64-70 (book chapter)

- *The development of the Internet in South Africa,* Communication Abstracts, 10/1/2000 Vol. 23 Issue 5

[61] Itano, Nicole., *Fighting poverty online in South Africa*., Christian Science Monitor, 8/15/2001, Vol. 93 Issue 183

Quail, a spokesman on education for the opposition Democratic Alliance Party. "A lot of schools don't have sufficient classrooms. There are not sufficiently trained teachers. Until those concerns are addressed, I don't think you should try to give all schools computers."

Mr. Quail says that rather than trying to put computers in every school, the government should focus first on building strong computer programs in a few target schools. But at Ikaneng, where a temporary, makeshift lab with about 12 computers has been set up in a heavily alarmed room, teachers and administrators say access to computers and information technology is opening up whole new worlds for their students. "Each child has an e-mail address, and they can interact with children from other countries.... They have pen pals in America and New Zealand and are learning basic computer literacy," says Flora Lesele, the school's principal. "For the teachers, it will help them plan their classes."

A year ago, the school had a small computer bank funded by a private company, but the company withdrew the computers because most students couldn't afford to pay the $2.50 fee. Now, the school is waiting for its 25 new computers from the government to arrive. Brenda Mamela, one of four Ikaneng teachers receiving computer training, can't wait for the new computers. She is excited to pass on her new knowledge to her 7- and 8-year-old students, and says she is constantly amazed at how quickly the children become technologically literate. "Most of the time, you find the children helping us," she says with a laugh. "They tell us: 'No, no. You must do it this way.' The first computer training I went to, it was so difficult. I couldn't even hold the mouse. These kids learn so fast." "

South Africa: Technologically Divided[62]
"Johannesburg,(South Africa) - It is a common sight in South African cities to see people using mobile phones to read stock exchange data or a weather report with the touch of a button. But talk to anybody in the country's rural areas and they wouldn't even know what a telephone is, leave aside a mobile phone. According to the Universal Service Agency -- a statutory body established by the Telecommunications Act of 1996 to promote universal telephone access for all, especially for the disadvantaged communities -- on an average there are 10.3 phone lines per 100 people in country. This figure is, however, misleading because in some of the rich suburbs, this figure goes up to 50 per cent whereas in parts of Eastern Cape, one of the poorest provinces, this 'tele-density' is a mere 0.1 per cent.

"We are aware of the fact that South Africa is characterised by enormous contrasts and imbalances ranging from highly developed to under developed areas; from high tech on the one hand to no tech on the other," says Communications Minister Ivy Matsepe-Casaburri. "The challenge facing us is to ensure that we close this gap and do it soon. Universal service and access is an urgent imperative," she adds. This thinking is not without reason because experts maintain that in such a scenario, the gap in information, knowledge, prosperity and opportunity between the different regions of the country is widening at a fast pace. " This gap, in a country like ours has the tendency to reinforce and perpetuate the historical, political, social, cultural and economic legacy born of the centuries-old practice of denial of rights and opportunities for the previously disadvantaged sectors of the population," Matsepe-Casaburri adds.

Realising the technological gap between the urban and rural areas, President Thabo Mbeki has decided to undertake a series of national and sectoral initiatives in order to prepare the country for a digital future. These include the setting up of a national commission on Information and Communication Technology (ICT) and an international advisory panel to help assist in the ICT industry. Since his announcement, government officials have been holding high-level meetings to find ways of using ICT to enable Africa to ride the information highway. The digital divide was also a subject of discussion at the Ministerial Oversight Committee and the Commonwealth meetings in Cape Town earlier this year. The main task of these committees is to address the issue of the digital divide between the developed

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[62] Israel Mogale, *South Africa: Technologically Divided,* http://www.wfsnews.org/citylife/inside2.html

and developing nations. At another level, the International Presidential Commission consisting of Presidents Mbeki, Olusegun Obasanjo of Nigeria and Abdelaziz Bouteflika of Algeria has also identified the bridging of the digital divide as one of the focal points for ending the marginalisation and under-development of Africa. Matsepe-Casaburri says it is the government's conviction that every region, every province, every community and every citizen, whether urban or rural, has to reap the benefits of access to the networked economy.

The establishment of telecentres in some parts of the country is seen as one way of addressing the digital divide problem. These centres will offer 24-hour access to telephones with a voice mail service, facsimile and electronic mail services provided at the telecentre. They will also provide computer services like word processing, spreadsheets and business and personal planning. A good beginning in this field has already been made and in Winterveldt, north of Pretoria, many residents have got certificates after completing basic computer training at the Good Sheperd Telecentre run by the local Catholic Church. The telecentres are being complemented by the provision of Internet laboratories, one of which has been established at Comtech High School in Mangaung's Freedom Square Informal Settlement, providing a service to learners from this area and providing neighbouring communities with access to the Internet and e-mail. Another way of trying to close the digital gap has been the establishment of 'Cyber Labs', which are also equipped with computers and a server, with basic software packages like word processing and spreadsheets.

The private sector too has responded positively to the challenge of empowering formerly disadvantaged South Africans. For instance, in May this year, IBM South Africa rolled out a programme aimed at familiarising underprivileged pre-school children with technology. The programme, called KidSmart, consists of colourful, child-sized plastic furniture that is durable and easy to clean and incorporates a powerful IBM computer, a 14-inch colour monitor, speakers and a membrane keyboard. The computer is loaded with award-winning software designed by education specialists to develop activity and problem-solving skills and engage young children in the learning process with maximum fun. The programme also includes training for teachers to familiarise them with computers where necessary and enable them to integrate KidSmart into their own syllabus.

IBM corporate social responsibility manager Alf Mandewo says 50 centres around South Africa will receive KidSmart, with a focus on the disadvantaged communities. "By making education and technology available to the underprivileged, we geometrically increase their chances of well-paid, productive employment," he says. The company has also launched Wisebus, a mobile education centre, in Kimberley in Northern Cape and in Attridgeville in the Gauteng Province. The Kimberley Wisebus is taking the world of computers and the information superhighway to the doors of more than 1,000 pupils in Galeshewe's five previously disadvantaged schools. Also known as the mobile education centre, the bus is fully equipped with networked personal computers featuring interactive CD-Rom technology and the ability to run powerful software applications to train children from previously disadvantaged schools. In April this year, IBM donated computer equipment valued at Rand 90,000 (1USD = approximately 8 Rand) to the South African Blind Workers Association.

The Soweto Digital Village, established in March 1997 and commissioned by Microsoft CEO Bill Gates, is another example of what providing technological and much-needed training in computers to disadvantaged communities of Soweto can do. Over the years, these communities have benefited from advances in information technology, used as a vehicle for skill development, job creation, information access, improved communications and collaboration. The centre is equipped with state-of-the-art technology, including computers, Internet access and the latest Microsoft software and books. It also provides the surrounding communities, schools, students and local entrepreneurs with the opportunity to develop their computer skills, access to information and communication technology as well as taking advantage of the power of the Internet. "The Soweto Digital Village has become the hub of information and communication technology where the community has access and exposure to these technologies which were a mere dream a few years ago," says Joe Mphahlele, the manager of the centre.

In June this year, Gauteng premier Mbhazima Shilowa launched an Internet initiative that will give free Internet access and an e-mail address to 1.5 million students in 24,000 schools in the province over the next three years. According to Shilowa the project arose out of a need to ensure that Gauteng's youth do not lack access to technological advancements and education methods. "By ensuring that our learners are computer literate, we will be able to provide the economy with a pool of trained candidates," he says. Gauteng Online will be installed in 25 pilot site schools this year. Each school will be provided with 25 computers.

But even though these steps seem encouraging there are many voices of protest, pointing out that these measures are not actually helping in reducing the digital divide. For instance, in many parts of the country, especially in far-flung rural districts, villagers remain in the dark when it comes to technological developments. According to a journalist from Dordrecht, a tiny town in the poverty-stricken Eastern Cape Province, despite the fact that there are telecommunications infrastructure for telephones and cellphones there is no provision for telecentres where villagers will have access to Internet or e.mails. In Taung, in the North West province, workers at various institutions say they have outdated computers, and are therefore unable to use services such as the Internet and e-mail.

And it is this crucial issue which will first have to be addressed, if the country has to make relevant and useful technological advances. "

China[63]

The New Net Tigers[64]
"..by 2003, China will be the third-largest e-commerce market in Asia, according to International Data Corp., with annual e-commerce sales exceeding $3.8 billion. More significant, analysts predict that most of that coming e-commerce traffic in China will be conducted over broadband devices like mobile phones and televisions. Why? Partly out of a cultural affinity for high-tech gadgets and partly because PCs are still a novelty item in most Chinese households, whereas mobile phones and televisions are not. (There are 50 million mobile-phone users and 450 million television sets in China, vs. only 20 million PCs, estimates Credit Suisse First Boston.)."

Digital Dilemmas[65]
"The most interesting example is China which, with 46m users already has the world's third-largest number of internet connections after the United States and Japan. Rapid growth in usage has been actively encouraged by the Chinese government, which sees electronic commerce as a main plank for modernising the economy and maintaining growth. At the same time, it uses a panoply of techniques to curb the internet's political effects… In addition to blocking sites, the Chinese government has deployed a range of other technical tools, from sophisticated monitoring of e-mail traffic and chatrooms to hacking attacks and viruses aimed at hostile websites. But even more effective has been encouragement of self-censorship among internet service providers, content companies and users.

Although China has welcomed private investment into its telecoms infrastructure, it has carefully retained control over operating licenses, and over the system's backbone. This allows the authorities not only to use sophisticated monitoring techniques, but to punish any firms that step out of line. Most, including many big western firms, have been eager to comply… Chinese users never know who may

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- Moodley, Sagren, *E-Business in the **South** African Apparel Sector: A Utopian Vision of Efficiency?,* Developing Economies, March 2002, v. 40, iss. 1

[63] See also *Electronic Decentralisation in China: A Critical Analysis of Internet Filtering Policies in the People's Republic of China*.; By: Lacharite, Jason., Australian Journal of Political Science, Jul2002, Vol. 37 Issue 2,

[64] Rohwer, Jim; Chowdhury, Neel; Kraar, Louis, *The New Net Tigers*, Fortune, 05/15/2000, Vol. 141 Issue 10

[65] Caught in the Net, in *A survey of the Internet society*, The Economist, January 25th, 2003

be watching the way they use it, or when the axe might fall. So far, this approach has been highly successful… China's employment of advanced technologies to filter and monitor web usage has outraged many computer programmers in the West. These so-called "hactivists" are combining hacker skills with political activism to fight what they see as a perversion of the internet's promise… With millions of programmers of its own, China is bound to get some home-grown hactivism as well.

But the contest looks decidedly lop-sided. On the one side are small bands of political dissidents, human-rights activists and hackers; on the other stand not only authoritarian regimes, but also western governments who want to stay one step ahead of the hackers and are reluctant to support hactivism even against dictatorships. They are supported by most of the commercial world, which wants to monitor and record web usage to make money, enforce copyrights, acquire customers, deliver new services and protect its own operations from malicious hacker attacks… Worryingly, the same technological trends that are so rapidly eroding privacy in the West could put powerful tools in the hands of repressive regimes."

Flying Freely But In The Cage[66]
"Flying Freely But In The Cage*: an Empirical Study Of Using Internet For The Democratic Development In China*. Abstract. With the advent of *Internet* technology, scholars have begun to examine the role this new communication technology can play as a mass medium in promoting democracy in Third World countries. This paper did a case study by examining the impact of diffusion of *Internet* technology on the democratic development in *China* at grassroots level. Using a combined method of web observation and qualitative content analysis, the author observed five selected bulletin board systems so as to find out how ordinary citizens have used the *Internet* to continue their age old fight for democracy, and how their self-expression and discussions have been politically framed both by netizens themselves and by the *Internet* services providers. The findings tell us that the *Internet* does not carry an inherently democratizing force that is irresistible, and it is not inevitably an agent of democracy. The *Internet*, however, concluded the author, has created a virtual classroom, that is otherwise unavailable, for Chinese people to start to learn what democracy means to them through their daily exchanges of ideas and information."

Beijing Beckons Its Scientific Exiles[67]
"Despite the government's Net censorship, at least one top Chinese scientist in the West thinks the repatriation effort will succeed. Regular readers of this column know that favorite topics recently have been how the Chinese government has been trying to control what people in *China* can see and say on the *Internet* and how Beijing's critics have been trying to avoid the censors. Throughout September, authorities were busier than ever, zapping Google and other "dangerous" Web sites in advance of the big Communist Party powwow in November that will decide who rules the world's biggest country over the next few years.

Given that the government of President Jiang Zemin is intent on making *China* a science and technology powerhouse, these efforts to stifle the Net might seem more than a little self-defeating. When it comes to technology, how can *China* be anything more than a bit player if the top minds at Tsinghua University -- Beijing's equivalent of Massachusetts Institute of Technology -- can't get to MIT's Web site? Yet Shoucheng Zhang doesn't buy the idea that scientific leadership and *Internet* censorship are mutually exclusive. "You can clearly have both," he says. The 39-year-old *China* native is a professor at Standford's physics department and at Tsinghua. After all, he says, Soviet physics research flourished during the darkest days of Stalinism.

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[66] Huang, Edgar, *Flying Freely But In The Cage: an Empirical Study Of Using Internet For The Democratic Development In China* , Information Technology for Development, 02681102, 1998, Vol. 8, Issue 3

[67]Einhorn, Bruce, *Beijing Beckons Its Scientific Exiles*, Business Week, 10/7/2002

Zhang admits that censorship of the Net can be inconvenient for *China*-based scholars who want to see what their American counterparts are doing, but he says the problem can be overcome. If scientists in *China* can't access a U.S. university's Web site, they can easily reach sites that have archives of academic papers. Such science-only Web sites are "accessible by everyone," says Zhang. He's uniquely positioned to talk about the overlap of the Chinese and Western scientific communities… Since 1993, he has been at Stanford… Zhang also is vice-president of Hua Yuan Science & Technology Assn., a San Francisco Bay area nonprofit that promotes academic and commercial exchanges between the U.S. and *China*, focusing on ethnic Chinese in the U.S.

Hua Yuan, launched three years ago, has a similar goal, but this time the idea is to get people to return to the mainland. The organization has about 2,500 members in the U.S., and it's now forming chapters in *China*… "Basically, what we see is a tremendous opportunity, just like Taiwan in the early 1970s," Zhang explains. "The economic growth in *China* is just explosive. A lot of Chinese students came to the U.S., a lot of them stayed in the U.S., worked in industry, and some of them, like me, became academics and leading scientists in the U.S. There is a tremendous need among the community here to facilitate that interaction."

"*China's* focus is, within 50 years, to compete with MIT and Stanford," says Zhang. "They can't do that if they spread out resources too thinly." In the 1950s, he points out, "the university system was modeled on the Soviet system, where every university had a specialty. About five years ago, *China* decided to make major reforms to organize the university system according to the U.S. model and consolidate them so that they become a comprehensive university in its true meaning." Zhang says a lot of U.S.-based Chinese scientists and engineers are indeed going back… Sure, the political climate -- not to mention the inferior facilities and pay at Chinese universities -- may lead to potential recruits staying in the West. But no matter. *China* has the law of large numbers on its side. Notes Zhang: "*China*, just because of the sheer size, can be self-sufficient in terms of talent."

Vietnam

Tigers battle dragons in Vietnam[68]
"As in the dozens of other tiny, hole-in-the-wall computer shops that dot the side streets around Hanoi Polytechnic, Nungen Hong Hai's outlet bustled one humid March evening as students knocked out their dissertations. The lights sometimes flickered, highlighting faces made pale by the glow of smoke-smeared CRTs and throwing shadows across a detritus of discarded hard drives, motherboards and a voltmeter that seemed straight out of the 1950s.

Against this backdrop of primitive and modern juxtaposed, where sweat seeps out of fissures in dilapidated concrete walls and cases of pirated CD-ROMs become coasters for cups of tea, 28-year-old Hai beamed with excitement as he explained how his business has grown over the past three years. "I quit my job at a [state-owned] electronics and telephone company because I had enough technical skill but not a lot of money. It was hard. When we started in 1998, we sold four PCs. But last year we sold about 100, mainly to the students."

Hai is taking advantage of what thousands of crouching tigers-*Vietnam's* new generation of tech entrepreneurs-have discovered; the huge demand for, and the glaring lack of, cheap, reliable PCs for *Vietnam's* computer-literate young. Hai estimates that in Hanoi alone, some 400 computer "shops" have sprung up recently. The government has also made progress in its effort to wire *Vietnam*, following a series of initiatives that began back in 1993. With its Quang Trung Software Park in Ho Chi Minh City fully booked, the government is setting up another in Da Nang City and still another,

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[68] Kallender, Paul., *Tigers battle dragons in Vietnam,,* Electronic Engineering Times, 04/30/2001 Issue 1164

Hoa Lac High-Tech Park, in Hanoi. It has also set a goal of training up to 25,000 software engineers by 2005 in order to reach a turnover of $500 million in software exports.

Other policies with prospects include providing tax breaks and tax reductions for software companies and software engineers, increasing *Internet* band-width, and reducing leased-line costs for software companies located inside software parks. In a sweeping move that has proved a windfall for entrepreneurs like Hai, the establishment last year of the Enterprise Law abolished more than100 types of licenses. That has led to the creation of 13,500 private enterprises, with a total investment of around $1 billion so far, according to the commercial section.

After a crash in the late 1990s, the total registered capital for foreign-invested projects in *Vietnam* last year was $2.4 billion, up 9 percent from 1999, according to Michael Frisby, commercial counselor at the U.S. Embassy in Hanoi. Prospects have never looked better for foreign investment, ahead of the long-anticipated approval of the U.S.-*Vietnam* bilateral trade agreement later this year, he said. "It's been a slow process . . . but when the bilateral trade agreement is reached, it will lower average tariffs from about 43 percent to 3 percent, and that will lead to an investment stampede."

"We're just a baby," said Nguyen Quang Minh, director of business development at *Vietnam* Posts and Telecommunications Corp.'s Software Development Company (VASC). With a staff of 150, VASC has three years to build up a client base before its parent ministry cuts the cord and privatizes it. Meanwhile, VASC continues to recruit bright graduates and send them overseas for training in light of a "very poor" domestic engineering base, said Minh. VASC estimates that there are perhaps 20,000 qualified IT engineers in the whole of *Vietnam* and that only about 2,000 people capable of being retrained as programmers or software engineers graduate from the country's 100-plus universities annually.

Despite its many aspiring tigers, *Vietnam* is still also a country of hidden dragons. The American Chamber of Commerce (AmCham; Hanoi) cites insufficient protection for intellectual-property rights; limited, restricted *Internet* access; excessive taxation; and high telecommunications costs as the main business impediments to creating a domestic IT market. Despite a government directive (76/CP) and the signing of the U.S.-*Vietnam* Bilateral Copyright Agreement in 1998, *Vietnam's* software piracy rate continues at an astounding 99 percent of all titles sold. Monthly rental of a 64-kbit leased line costs nearly $2,000 here, compared with $319 in Thailand, $69 in Singapore and $40 in the United States, while data transmission speeds remain much lower than advertised because of chronic congestion.

So while there are seven major government programs to train software engineers, "Vietnamese programmers are at a severe disadvantage . . . and are shackled into producing small, unsophisticated, low-value software," an AmCham report states. "Until *Vietnam* can really participate in the worldwide revolution of *Internet*-based business operations, it will continue to lag behind." Even government officials admit that basic connection charges remain a major obstacle to increasing *Vietnam's* tiny online community.

Officially this year, foreign companies will be able to break into the *Internet*-service and *Internet*-access provider businesses here, potentially shaking up the cozy oligopoly of five government-regulated ISPs. But nobody is going to give up his slice of the pie without a fight, suggested Bui Quang Ngoc, vice managing director of the Ministry of Science Technology and Environment. MSTE believes in managed, regulated competition, Ngoc said."

***Information And Communication Technology With Social Changes*[69]**

"The world has been changing from an industrial society into information society. In this global information age, the world's economy and social activities will have to rely heavily on information. The success of any company or organisation will depend on their ability to access and to process information, so they could extract knowledge for their decision making processes. In this paper, I am going to discuss about the effects of information and communication technology on the economy and society of developing countries. Then I go on to talk about some difficulties developing countries face in their attempt to reduce the digital divide. Finally I would like to share some of Vietnam's initiatives to transform digital divide into digital opportunities.

The impacts of information and communication technology

Communication and Information Technology has been major driving force pushing social/economic development of nations, enhancing living standards of each individual on this globe. The governments of many countries have given high priority to the development of communication and information technology creating the basis for mankind to enter the age of knowledge based economy. The target is to provide communication and information services to anybody at anytime and from anywhere.

Internet is becoming more widely accepted in many developing countries, it provides a limitless information resource for its users. Its impact on the world's economies, and the culture of many countries is becoming increasingly important. The industrial age has gradually been transformed into a global information age. In this information economy, the creation of information (content), the transfer of information (communication network), and the processing of information (computers) would present a critical sector of any economy. This sector would contribute large portion to the total wealth of nations. Perhaps the percentage of GDP contributed by info-communication industry will become a major index to measure the development level of individual countries.

It is difficult to measure or just to describe the level of influence the information and communication technology has on many economies and societies of the world. Many well-established economic models need to be restructured in the advent of the Internet. The progress of the Internet and modern info-communication networks has transformed the world into a global village, in which people can promptly interact with each others through the utilisation of various info-communication services such as telephone, videophone, and Internet.

Firstly we need to talk about the influences of Information and Communication Technology on economic activities. The Internet and info-communication networks have deeply affected the way companies and corporations are conducting businesses. Many highly effective business processes have become outdated and need to be changed in the advent of the Internet. The Internet along with info-communication industry has been bringing the service sector of the world's economy into an important position, which can be compared with the manufacturing sector. In some highly developed countries, the service sector contributes the most important part of their overall national wealth.

The Information and communication technology has also changed the form of many products. We can take one good example in the music industry. Music products have been sold for customers in form of gramophone record, magnetic tape and compact disk. Nowadays through the Internet customers can buy music in electronic form of computer files. Not only the form of products has been changed but also the delivery method of products and services has changed radically. With the traditional way, customers need to go to a music shop and buy a tape or a CD-ROM. With the availability of Info-communication networks and services, customers do not need to go anywhere, they just need to sit down at their computers and download the music from virtual shopping malls.

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[69] Presented by: H.E. Dr. Mai Liem Truc, Vice Minister, Ministry of Posts and Telematics, Vietnam at ITU Telecom Asia 2002, Hong Kong, 2-7 December, 2002.

Information and communication technology has brought a new concept of "work from home" that is employees can stay at their home while working. Through computer networks they can receive instructions and requirements from and submit their work to their superiors. This new concept of tele-working has many advantages such as employers do not need to rent large office space, representing an important saving. Furthermore employees can save travelling time and transport expenses. As a result, fewer people would have to commute between office and home, alleviating the traffic jam and air pollution problems.

There are many more ways in which Information and Communication technology influences our economic life such as the electronic delivery of government services and healthcare services. Computer networking technology enables the automation of banking industry and supports the operation of many new financial services such as credit card service, electronic transaction service.

Information and communication technology affects not only economies of countries but also societies and cultures of individual nations. As I mentioned earlier the world has become a global village, people are in touch with each other. Cultural norms and life styles of individual nations or groups of people will become better known for the world and more widely recognised.

The education system has also been affected, besides the traditional classroom learning, now there is distance education method available. With this method students can chose their own learning speed, they can learn in their own class settings or just in their comfortable living rooms. With distance education ones can pursue continuous learning or life long learning if they wish to do so without any difficulties.

Difficulties in an attempt to reduce digital divide
The information and communication services have been introduced into developing countries much later than in developed countries. As a consequence the development of information and communication sector in these countries is still in the start up phase and the penetration of information and communication services remains low. Following are major reasons for low ICT penetration:

- Developing countries lack a reasonably developed IT industry so they have to use their hard earned dollars to import computers and communication equipment to build their info-communication networks. As a consequence the computer density and penetration in these countries remain low.
- The charges for using information and communication services in developing countries are too high to be affordable for most of the people in these countries.
- Vietnam's initiatives to transform digital divide problem into digital opportunity
- The Vietnamese government has recognised the strategic importance of communication and information industry. Steps have been taken to reform this sector to capture opportunities and to cope with challenges. The Ministry of Post and Telematics had been established to further accelerate the development pace of the post, telecommunication and information industry.
- Concerning the market structure and business environment, one of the reform principles is to move from monopoly to competition, making necessary preparations for international economic integration. Postal businesses had been separated from telecom businesses, individual services should be accounted independently, cross subsidisation should be removed.
- Concerning information technology, Vietnamese government had given special priority for the development of software industry, pushing the application and development of information technology in Vietnam. Although Vietnam is a developing country with relatively low income per capita, the illiterate rate of Vietnamese people is reasonably low compared to other countries of the world. The young generation of Vietnam is eager to apply and develop information technology. At most universities of the country, the best students usually enrol at information technology, telecommunication and electronic faculties. The telecommunication and Internet market in Vietnam has high growth potential, there is still a great need for development in this sector.

- In the process of opening the telecommunication market, there are many issues, which need to be considered and studied thoroughly. These include:
    - Regulatory system reform: The Ministry of Post and Telematics had been established to regulate all three parts of post, telecommunication and information technology sector.
    - Market reform: Mobilising all resources of the country, encouraging both public and private sector to invest in the development of telecommunication network infrastructure and to provide public services. Foreign investment should also be attracted to contribute in this development effort.
    - Clearly separating areas of universal service obligations from the provisioning of commercial services. Determining all rights and responsibilities of all telecommunication carriers/operators concerning this issue.
    - Creating transparent policies in the following areas: licensing, service charges, interconnection, the usage of resources such as: radio spectrum, telecommunication network numbers etc. and the USO policy."

Observations

From this range of more and less rapidly changing countries, some observations might be advanced:

- Successes occurred in both growth and poverty reduction. Equity did not always increase, but absolute poverty generally declined. The exact extent attributable to ICTs is not clear, but it is clear that ICTs often contributed strongly.

- Liberalization and opening of ICT sectors to some/much domestic and foreign competition was important in almost all cases. Internationally oriented players tend to win, and integration into global business and supply chains offers big economic growth rewards, though less direct and certain poverty reduction outcomes.

- Strategic government intervention and support were also both generally essential and culturally/ politically/socially specific.

- Countries whose 'vision' included social as well as commercial development have often generated a dramatic growth **and** equity or at least inclusion dynamic. The 'channels' by which ICTs contributed include all of those suggested in II above, with emphasis on 4-7, particularly business/commercial growth and education:

    1. multipurpose community access;   2. access technologies amenable to poverty reduction;
    3. gender equality;   4. education and human resource development;
    5. science, high-tech and ICT-sector growth; 6. business and livelihoods development and support:
    7. public sector, services & poverty management 8. environmental and natural resource management;
    9. transparency, accountability, empowerment

- Poverty levels in the *most rapidly* advancing countries were mostly low initially, and poverty reduction an explicit component of ICT strategy for few. The basic strategy of 'efficiency-productivity-growth' is implicitly the main approach to poverty reduction this group. Nevertheless, most included innovative social inclusion/buy-in and equity initiatives, and these were important parts of ICT and knowledge-economy development strategy, for domestic dynamics and success, and for foreign investment and donor support. Social and equity oriented initiatives were/are supported by multinational corporations as well as governments and communities.

- Another group of lower income countries are also very active on ICT and knowledge-economy oriented strategy, eg Brazil, Mexico, Turkey - and on the lower income end, Mongolia, India, China, Philippines,

South Africa. Some also are promoting software industries with considerable success - Bangladesh, Indonesia, Ukraine, Iran, Vietnam, China, Philippines, Russia. Some countries were more narrowly focussed than others (eg Turkey on Internet access).

- For the most part, their strategies are quite similar to those of the most advanced, covering the same terrain. More priority is given to 'earlier' capacity-building investments, and at least as much to poverty reduction - reflecting it seems both domestic realities/constituencies/policies and the relatively large size and influence of donor financed activity.

- Universal access, and successfully connecting and supporting poorer populations, have been major parts of the boom in ICT-development investment, including in the poorer countries, since the early 90s. The other parts of the picture, from a poverty perspective, include all the more systemic mechanisms by which poor people are in some position to take advantage of connectivity when it is available, eg
  - in terms of nutrition, health and security at the most basic level,
  - in terms of better governance, more efficienct and pro-poor public services, opportunities for empowerment and redressing impacts of corruption or repression where they exist,
  - in terms of economic growth and business/livelihoods development generally, for any direct economic benefits to poor communities or households, and for increasing public revenues…
  So there is a rather large range of ICT-related investments that serve poverty reduction but don't directly involve ICT assess for the poor.

- Given scarce resources in poorer countries, it is easy to think of both universal/pro-poor ICT *access* investments, and more *systemic* development/poverty oriented ICT investments as being a zero-sum game. And while there is some truth to this, a characteristic of more successful countries appears to be that they both balanced and integrated these strands relatively well in government policy and operations, including both:

  - maintaining a strong push to pilot pro-poor access, and in the process, developing experience, familiarization and institutional capacities and partnerships, testing demand and supporting innovation in applications, learning from experience, and being prepared to 'scale up' when possible;

  - having a coherent and knowledge-economy oriented vision, and:
    - building the capacities to adopt and adapt ICTs wherever most productive in government investments and operations (education, health, poverty reduction programs, natural resource management, gender equality and governance strengthening initiatives..) and
    - building policy and regulatory environments that attract and facilitate investment by private and civil society organizations.

- Culturally and politically specific factors were central to the intensity and form of the growth and knowledge-economy strategy of each country. On the political side, there appears to be some real trade-off between economic competition and political control.

  - There is also a real concern about privacy and control by western corporate and public interests, which often ignore or support political control in repressive regimes, in pursuing their commercial interests.

- Education and technical skills were either preconditions or strong co-investment areas for these countries, which are also often cases of major economic/social reform and restructuring.

- The factors of education and technical skills, and some proactive strength in political and public management, puts similar rapid-growth strategies somewhat down the road for many developing countries. Pre/present/post-conflict countries appear to be at the far end of the horizon.

- So less advanced countries and their donors might best initially promote ICTs not (or much less) as growth drivers - and more selectively in education, livelihoods, commerce, public sector performance and accountability, and poverty alleviation - with priorities depending roughly on the most binding of these constraints to development in each country.

  - *Countries are very different* in these terms, and ICT investments often respond to the most binding constraints. Mobile phones, for example, have been very important in many countries where governance is weak, political activism operative and Internet diffusion small.

  - Nevertheless, most of the underlying 'dictates' - eg education and skills development, physical and social asset building, governance and government improvements, sufficient economic competition, coherent economic strategy including ICT development - appear to be common to the more and less advanced countries. In this sense, a main lesson of the rapidly changing countries may be 'emulate us, but build first, as needed.'

  - 'Building first' may mean more focus on education, livelihoods, public sector performance and accountability, and poverty alleviation, but it isn't clear whether this means going a bit slower on ICT diffusion and universal access. On the side of going faster are many positive experiences surveyed above and in the next section. 'Kids', for example, pick up ICTs fast. In many cases, given a bit of exposure, poor people pick them up fast and use them well. There is often a lot of energy and time coming from poor people, especially young people, which is not typical of all poverty reduction approaches, and is vital in economic and poverty reduction terms. Government efforts to achieve widespread access early, even in the relatively poorer of the countries above (eg Mongolia) have been successful and are very appealing.

IV   Project / Initiative and Sector / Issue Cases: ICT Development and Poverty-Reduction Experiences Of Less Advanced Developing Countries

Overview

Unlike the cases of the rapidly changing ICT-oriented countries, there are fewer country studies for the less advanced developing countries. There are exceptions, such as South Africa and Vietnam above, but even here most of the research is about particular applications rather than country strategies. There is also documentation on ICT policy and regulatory regimes for many/most countries[70], but few detailed accounts or assessments of how ICT diffusion is occurring.[71] One recurring feature of the ICT-poverty initiatives and research cited below is thus that it focuses fairly heavily on the point at which the technology or application and the (poor) user meet.

Initiatives bringing ICTs and the Internet *access* to (poor) people and communities have been active since the early 1990s, and this process was accelerated buy the PRSP era since 1998 and the 1998-9 World Development

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[70] As one example: Chemane, Lourino, *Mozambique ICT Policy Implementation Strategy and e-Gove*rnment,
http://unpan1.un.org/intradoc/groups/public/documents/cafrad/unpan006472.pdf
[71] See for example Hafkin, Nancy and Wild, Kate, *ICT in Africa: The Challenge to Donors in a Global Information Society*, in *Rowing Upstream: Snapshots of Pioneers of the Information Age in Africa*:
http://www.piac.org/rowing_upstream/chapter5/ch5programchallenge.html. For an interesting recent study, see also Richard Gerster and Sonja Zimmerman, *Information and Communications Technologies (ICTs) and Poverty Reduction*, Discussion Paper, Swiss Agency for International Development, 2003:
http://www.gersterconsulting.ch/fs/fs_news_cur.html

Report entitled Knowledge for Development.[72] This has been one major dimension of ICT diffusion for poverty reduction, and often took the form of regional or global (small) grant mechanisms responding to best proposals; these programs are referenced repeatedly in the examples below. Domestic organizations have largely done the work, with poor communities, and donors have provided both animation and some of the needed technical support. Given the realities of development and donor activity, it is not surprising if the burst of initiatives was initially very dispersed and uncoordinated.[73]

More recently, the practices and investments of countries and donors had been expanding and changing toward the more *systemic* diffusion of ICTs[74], and there are now substantive programs in most countries aimed at e-strategies and action plans, e-government, e-learning, e-commerce, e-business, etc.

There are *many* success stories that highlight the case for optimism, both on what the poor can achieve by having access to ICTs, and on how countries can use ICTs/Internet more broadly in poverty reduction. They cover the ground of the types of transmission channels outlined above and offer or suggest evidence about which approaches or channels are most effective, and the circumstances underlying effectiveness.

There are also a small but growing number of more general studies of the impacts of ICT diffusion, and a fairly large literature on impact assessment approaches and methodologies.[75] The former reflect more activity from social scientists, and the latter started out being very micro in orientation, having originated in the need for assessment of individual interventions, but are also reaching toward broader frameworks for assessment of ICT diffusion.

1. Multi-purpose community access

There are many initiatives that cut across any categorization of 'channels and impacts.' Prevalent in the context of ICTs and poverty are the multipurpose telecentres and community access points which have been introduced in poor areas, particularly but not exclusively rural areas. Often combined with and following on rural radio, they typically provide phone, fax and computer/email/Internet access, and information and services in agriculture, livelihoods/commerce, health, education and other areas. There are dozens, going on hundreds, of pilots together with websites that document and assess them, and much has been learned. On a much larger scale, and unique but rapidly spreading form, one of the great pioneers has been the Grameen Bank of Bangladesh.

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[72] See for example:
- McGrath, Simon, *The British Department for International Development and Knowledge-based Aid*, Compare: A Journal of Comparative Education, Oct 2002, Vol. 32 Issue 3
- King, Kenneth., *Banking on Knowledge: the new knowledge projects of the World Bank*, Compare: A Journal of Comparative Education, Oct2002, Vol. 32 Issue 3

[73] See for example Aexander G. Fior, *ICT and Poverty: the Indisputable Link*, Paper for Third Asia Development Forum on "Regional Economic Cooperation in Asia and the Pacific" organised by Asian Development Bank 11-14 June 2001, Bangkok: www.worldbank.org/html/extdr/offrep/ eap/eapprem/infoalexan.pdf

[74] Many donors, for example, now argue that ICT support should be both top-down and bottom-up, see for example *Developing Countries and the ICT Revolution, final working document of the Science and Technology Options Assessment Committee of the European Parliament*, 2001, http://www.europarl.eu.int/stoa/publi/pdf/00-14-01_en.pdf

[75] See for example: M. Desai, S, Fokuda-Parr, C. Johansson and F. Sagasti*, Measuring the Technology Capacity of Nations and the Capacity to Participate in the Network Age*, Journal of Human Development, Vol. 3, No. 1, 2002
- Sam Lanfranco, *A Meta-Level Conceptual Framework for Evaluating Projects involving Information and Communication Technology (ICT)*: http://www.idrc.ca/pan/evaluation.html
- *LDIA: Learning for Development in the Information Age*, a Bellanet program area which explores the process by which organizations learn from their experience with information and communications technology: http://www.idrc.ca/pan/evaluation.html
- Asia-Pacific Development Information Programme and Human Development Resource Centre, New Delhi, *Promoting ICT for Human Development in Asia: Realizing the Millennium Development Goals*: http://www.apdip.net/rhdr/overview.asp

Halving Poverty by 2015[76]

"In this presentation I will draw your attention to five issues which need to be urgently revisited :

(a) widening the concept of employment

(b) ensuring financial services even to the poorest person

(c) recognising every single human being as a potential entrepreneur

(d) recognising social entrepreneurs as potential agents for creating a world with peace, harmony, and progress.

(e) recognising the role of globalisation and information technology in reducing poverty…

"..Grameen Bank or Village bank.. now works all over Bangladesh, giving loans to 2.5 million poor people, 95 per cent women. The bank is owned by the borrowers. In a cumulative way the bank has given a total loans of about US $ 3.75 billion. Generally the repayment rate has been over 98 per cent. It makes profit. Financially, it is self-reliant ― it has stopped taking donor money since 1995, stopped taking loans from domestic market since 1998. It has enough deposits to carry out its lending programme. It gives income generating loans, housing loans, and student loans to the poor families. More than half a million houses have been built with loans from Grameen Bank. Impact studies done on Grameen Bank by independent researchers find that 5 per cent of borrowers come out of poverty every year, children are healthier, education and nutrition level is higher, housing condition is better, child mortality declined by 37 per cent, status of women has been enhanced, ownership of assets by poor women, including housing, has improved dramatically.

Grameen type microcredit has spread around the world over the last two decades. Nearly 100 countries have Grameen type microcredit programmes. In 1997, a Microcredit Summit was held in Washington DC, which adopted a goal to reach 100 million poorest families with microcredit and other financial services, preferably through the women in those families, by 2005. At that time number of families reached with microcredit was only 7.5 million globally, of which 5 million was in Bangladesh. Today, I am guessing, this outreach has crossed 35 million. I am hoping it will cross half way mark, i.e. 50 million mark, by the end of this year…

Grameen Phone brings internet enabled mobile phones to the Grameen borrowers and make them "telephone ladies" of the villages. Today there are more than 21,000 telephone ladies selling telephone services in half the villages of Bangladesh. Many of these phones are powered by solar power because electricity does not exist in those villages. Soon these ladies can become "internet ladies" if we can design appropriate services for them. Technology is already in their hands. While extending tele-communication services to the poor Grameen Phone has also done very well as a business. It has expanded its services to become the largest mobile phone company in South Asia in five years of its operation…

Grameen Bank not only focuses on giving financial services, but it also promotes a strong social agenda. "Sixteen Decisions" adopted by Grameen Bank borrowers commit them to bring many non-economic changes in their lives, such as, keeping families small, sending children to school and making sure they stay in school, breaking away from the custom of giving dowry to the bride-groom's family, making sure they drink clean drinking water, etc. Because of Sixteen Decisions, Grameen borrowers have taken great care to send their children to school. Today not only are all of them in school, but some of them are also in colleges, universities, and professional schools. Grameen Bank hopes to see that the second generation of the borrowers will grow up to take advantage of the knowledge economy and permanently shift away from poverty. Grameen Bank offers nearly 4,000

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[76] Muhammad Yunus, *Halving Poverty by 2015 -We Can Actually Make IT Happen*, Commonwealth Lecture 2003, Delivered at the Commonwealth Institute, London on March 11, 2003: http://www.grameen-info.org/bank/Commonlth.html

scholarships every year to leading students of Grameen families, gives student loans to 100 per cent of students who are in the institutions of higher education…

Information technology (IT) can be a big help. Supported by microcredit IT can open up doors for opportunities of innovative financing, connection with market, and getting direct information. IT can eliminate layers of middlemen between the poor and the market. Individual poor person is an isolated island by himself and herself. IT can end that isolation overnight. A poor person can be at the central shopping mall of the world accessing not only finance and market but also health, education, ideas and friendship. IT, with microcredit, can bring dramatic results in eliminating poverty if we design IT appropriately for the poor. It can be easily and sustainably done.

Social entrepreneurs, information technology and microcredit can play a key role in taking globalisation in the right direction and help halving poverty by 2015."

In surveying a wide variety of other multipurpose community access initiatives, one finds a rich array material. For example, from videos prepared by IDRC on telecentres in Uganda (rural) and Senegal (urban), the Uganda video includes these overview comments:

"Like people in other parts of the world, Africans want to be able to communicate electronically and use computers for learning, work and leisure. And like people in other parts of the world, their businesses and livelihoods are benefiting by information and communications technologies. These people have collapsed more than a century of telecommunications development into a few years, and they have faced problems, everything from financing to fires. But the people of Nakaseke have not let adversity defeat them. Now they are reaching out to their neighbours, and smaller more remote villages, and starting the process all over again." [77]

"When I try to explain how ICTs affect poverty outcomes, I am drawn to the social-psychology concept of 'sequential causation'. ICTs create change in people's awareness of how information, and the technology that makes it more available, can improve business, education, health and local governance. This is followed by the development of skills and new services to assist organizations in using the technologies which eventually creates a private sector market for training, services and the like."[78]

Bridging the Digital Divide - a humble attitude needed to meet the rural people[79]
Description: ICT must offer relevant services carefully developed to meet the rural people and their needs. Such procedure is based on a deeper understanding of unique needs of the local rural community and can be designated as a humble ICT attitude in the development process of ICT solutions. Information about the ICT needs, sources of information, mode of learning as well as forms of business are ingredients to shape a realistic ICT profile particular to a rural community. This implies that the starting-point for ICT use must be the needs of people."

Annex A, Section 2.2.2 on ICTs and collective Access Points, covers a considerable range of experience with many approaches to extending assess to more rural, remote and poor communities. Several donor-supported programs also have excellent documentation of initiatives. Perhaps the main telecentre portal sites are:[80]
- those of IDRC programs - Pan Asia Networking, Pan Americas, Acacia, Connectivity Centres, Telecentre Research site
- the World Bank - especially InfoDev program
- UNDP Info 21 Telecentres

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[77]See http://stream.cfog.net/ramfiles/nakaseke.ram, http://stream.cfog.net/ramfiles/barakaenglish.ram, http://stream.cfog.net/ramfiles/barakafrench.ram.
[78] Richard Fuchs, Director of IDRC's ICT4D Program Area.
[79] Sundén, Susanne and Wicander, Gudrun, *Bridging the Digital Divide - a humble attitude needed to meet the rural people*: http://www.challenge.stockholm.se/columnist_right.asp
[80]*IDRC: see Telecentre Research*: http://www.idrc.ca/pan/telecentres.html,

- UNESCO, International Community Telecentre Resources

with other sites completing a wide range of further experience, as well as assessments, guidelines and assessment tools.[81] Some examples…

Finalists from the World Bank managed InfoDev Program (1999-2002)[82]
- Bridging the gap: Capacity-Building Programme in Cape Town, South Africa
- Connecting India Village by Village
- Internet Week: Bringing Internet to the People of Bassar
- Kabissa - Space for change in Africa
- Kyrgyzstan Development Gateway: From a Single Site to the National-wide web portal
- Marrying Radio with Internet in Nepal
- Closing the Gap
- Enriching Lives.com: Community-owned project enriching lives through online presence
- Nairobits: African youth online, www.nairobits.org
- The Bankilare Experience: a Successful Collaborative Effort to Bridge the Digital Divide
- The Digital Village: Towards a sustainable community technology centre

DENIVA, Uganda: [83]
"To make use of new technologies to facilitate vertical and horizontal integration of members. Areas of focus include information management, gender mainstreaming, environment, decentralised information exchange and others. This case study concerns an NGO network which is using modern media for communication. This case study demonstrates how ICTs can enhance existing networking activities among NGOs."

Digital Village, Soweto[84]
"is an "original" Telecentre. It was set up to be a resource for the a poor community to enable access to computers for training, information gathering and communication. As one of the oldest Telecentres in Africa, Digital Village offers interesting insights into sustainability. While one centre has survived, several others have had to close. This case study looks at what factors have kept the Chiawelo centre going."

MANAGE, India: [85]
"to groups increase rural farmers access to information services… Digital Village: to provide training in and access to information and communication technology to previously disadvantaged communities. As an experiment in information extension, Manage has also set up a network of information kiosks. This is another case where the availability of the kiosks is leading to timely and effective local information. There are clear examples of villagers accessing their rights, to loans, grants, subsidies, information."

Pan Asia Networking: www.panasia.org.sg, Acacia www.idrc.ca/acacia/,

Pan Americas: http://network.idrc.ca/ev.php, *Institute for Connectivity in the Americas:* http://www.icamericas.net/
- *World Bank InfoDev Program*: www.infodev.org. See the over 250 proposals of Infodev Program at:
http://www.infodev.org/projects/proposals/October2202.pdf,
- UNDP *Info 21 Telecentres*: http://www.undp.org/info21/sector/s-cc.html
- UNESCO, *International Community Telecentre Resources Website*:
http://www.unesco.org/webworld/build_info/gct/index.shtml.
[81] See for example:
- Gail Short, *Basic Steps In Establishing A Sustainable Multipurpose Community Telecentre*: www.itu.int/ITU-D/gender/documents/Asia-PaciflcIWrkshopKorea/ Doc4-7b.pdf
- *Non-commercial telecentre/cybercafe Guidelines for establishing basic computing facilities and internet access*:
www.tebela.org/d2pdfs/D2_4.pdf
[82] *InfoDev ICT Stories*: summary descriptions areavailable at http://www.iicd.org/stories/
[83] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm
[84] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm
[85] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

Information and communication technologies for development in Africa[86]

Abstract: "This book synthesises the results of the first 'generation' of pilot projects on the introduction of ICTs in poor communities. It highlights the opportunities and challenges that these communities face as they attempt to adopt ICTs as a means of their integration into the new economy. These results are analysed in terms of conditions, processes, methods, and strategies for appropriating ICTs. The book presents the results of four case studies conducted in communities in rural and suburban areas of Kenya, Senegal, South Africa and Uganda. In Kenya, the focus was on communities that had not yet been in contact with the new ICTs. It underscores the different institutional and regulatory changes that were implemented in the countries to develop the telecommunications infrastructure.

The book not only explores the expectations of African communities in using ICTs, but it also compares both the expected and observed impacts of ICTs within the communities studied in sub-Saharan Africa. Users noted some positive changes both in individual and collective activities and in their environment, thus attesting to the transforming potential of ICTs.

Finally, the book highlights the major challenges for appropriating ICTs for development. It analyses lessons drawn from the various ICT projects to identify and draw attention to the main challenges in, and prospects for, the appropriation of ICTs by poor communities. These challenges concern decision-makers, researchers, development actors, and the communities themselves. Main findings include: a consistent and systematic policy aimed at integrating ICTs in all aspects of the economic and social life of the communities is unavailable; ICT infrastructure is not present in all regions of these countries; most of the infrastructure and users are concentrated in the big cities, particularly in the capitals whilst the rural areas are neglected; thus creating a bipolarisation of ICT usage; communities need training and information on ICTs and on the opportunities that ICTs could offer; in Senegal, the case study demonstrated that the people effectively use ICTs, notably in their daily activities and for personal purposes. Although the uses are more individualised in these communities, ICTs have also been appropriated and used for community purposes; the evaluation of Msunduzi project in South Africa documented the relatively advanced use of the web site to support socio-economic development in the environment sector."

Extending access to poorer communities - while often intensive in time, effort, community development capacity and subsidy - is one key element in the way in which ICTs are being used for poverty reduction and essential longer term human development. For this, there is no alternative to the presence and accustomization of ICTs in poorer communities. There are also many further examples below of cases in which commercial or otherwise sustainable applications, in telecentre and other initiatives, are effective and quickly self-sustaining in terms of finance.

2. Access technologies amenable to developing countries and poverty reduction

Clearly, the feasibility and time frame for the full range of ICT/poverty depends significantly on new IC technologies. Widespread connectivity of poorer communities, for example, needs low-cost, easy and universal broadband access. There are many promising experiments and pilots in low-cost wireless broadband, largely from ICT4D pioneers, and the probability that Wi-Fi and wireless mobile phone and PDA technologies will permit a major leap forward.[87] There are also some good summary documents, which clarify the range of

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[86] Thioune, Molo, International Development Research Centre (IDRC) , 2003: http://www.eldis.ids.ac.uk/dbtw-wpd/exec/dbtwpcgi.exe?QB0=AND&QF0=DOCNUM@DOCNO&QI0=DOC12027&MR=15&TN=a1&DF=f1ict&RF=f1ict&DL=0&RL=0&NP=3&MF=eldismsg.ini&AC=QBE_QUERY&BU=http%3A%2F%2Fwww.eldis.ids.ac.uk%2Fsearch.htm

[87] see for example: Johnson, James H. and Snider, J. H*., Breaking the Chains: Unlicensed Spectrum as a Last-Mile Broadband Solution - Issue Brief, http://www.newamerica.net/index.cfm?pg=article&pubID=1258*

technology and content considerations, constraints, realistic scenarios and challenges. This is very important information for ICT strategy and investment decisions, and an area where *current* research/networking and knowledge dissemination are essential and are growing.

The Future Of Information And Communication Technologies For Development[88]

This paper reviews some of the main ongoing ICT technological trends that are closely related to the basic dimensions of the digital divide: access (in terms of connectivity and affordability), basic skills (i.e., digital literacy), and relevant content (i.e., information that allows better social and economic decisions). The time perspective is a medium-term one, since we try to focus on areas where targeted interventions in developing countries and transition economies can make a difference in fostering digital inclusion.

TECHNOLOGICAL TRENDS
THE LONG TERM: THE LIMITATIONS OF TECHNOLOGICAL DETERMINISM
A major technological driver of the "information revolution" has been the exponential growth of computer processing power…. this trend is expected to continue at least until 2010, when computing devices are expected to have 10 million times the processing power per dollar compared to the computers available in 1975. Economies of scale are also playing an important role in increasing the affordability of computing. Personal computers have become commodities and the very large scale production has allowed fixed costs to be amortized over larger and larger volumes of sales. The effect is also pronounced in many software applications, since dissemination costs are small with respect to initial costs, and the software development costs are shared over increasingly larger numbers of users.

Another major technological trend of the last three decades has been the expansion of communication networks. This growth has been fuelled by the declining cost of computing devices and communication infrastructure (e.g., optical fiber and wireless networks), the emergence of new communication protocols (the Internet), and the development of software (including the World Wide Web). Around October 1990 there were 300,000 computers connected to the Internet. By January 2003, more than 171 million Internet hosts were active. More recently, gr id computing initiatives making use of the underutilized capacity of networked computers have suggested future trends toward "computing and information utilities." Many kinds of software have become more available and affordable, especially through the Free and Open Software movements, suggesting that for many needs software may become an affordable service delivered online.

This growing connectivity will be further leveraged as wireless devices increasingly become Internet-enabled. "Today the electronics to hook up any device to the network cost about $1. In ten years' time, the price will be down to one cent." By some estimates, more than two billion people will be connected to digital networks by 2005. In short, while it took 100 years to connect the first one billion people via landline telephony, digital networks are expected to reach twice this number of people in a period of roughly only two decades. The economic and social implications of this expansion will be profound given its network effects… On the technological front, the pace of evolution of software, rather than hardware, is the main constraint for the revolutionary impacts often described in the literature. On the human/institutional fronts, the limitations include the ability to absorb and effectively use these new

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- The Wireless Internet Institute website: http://www.w2i.org/
- U.N. Wants Poor Nations to Use Wireless Internet: http://www.developmentgateway.org//ict/dg-contribute/item -detail?item_id=329396&version_id=196568&from=alert
- Is wi-fi good for developing nations?: http://www.developmentgateway.org//ict/dg-contribute/item-detail?item_id=329369&version_id=196550&from=alert
[88] Primo Braga, Carlos, Daly, John and Sareen, Bimal, *The Future Of Information And Communication Technologies For Development*, Presented at the ICT Development Forum, Petersberg, Germany, May 21, 2003: http://www.devforum.org/BackgroundPapers/Future_ICT.pdf

technologies (digital literacy) and to adapt the "rules of the game" to networked environments (e.g., how to regulate e-commerce and protect intellectual property rights in cyberspace).

On the economic front, challenges include how to derive tangible results from these innovations by building sustainable business models, while controlling for the costs of adjustment of displaced technologies (e.g., tensions between 3G and the expansion of wireless fidelity, Wi-Fi, in terms of wireless access to the Internet). These concerns are often brushed aside by technological optimists. The upcoming Semantic Web, for example, is expected by many to open new opportunities to manage information while allowing for new Web functionalities with significant economic potential (e.g., the operation of software agents as matchmakers, facilitating market transactions, scheduling, etc.). Artificial intelligence (AI) and expert systems are expected by many to gain new power and utility as standards for distributed computing evolve and grid systems (large-scale integrated computer systems) spread around the world. Infrastructure developments, in turn, will open new possibilities for regions with poor connectivity to leapfrog stages of development by entering the "broadband" phase via wireless solutions. The Wi-Fi phenomenon, for example, is a good example of the "law of unintended consequences" in action as a technology originally designed to support wireless local area networks is beginning to pave the way to the establishment of low -cost broadband telecommunications systems.

From these perspectives, the economics of Moore's and Metcalfe's Laws will foster ubiquitous computing across the globe. Even though poor regions may lag behind with respect to access to these technologies at present, it will be simply a question of time for them to catch up in terms of basic access and to begin to benefit more fully from these developments. Moreover, as children are increasingly exposed to these opportunities for learning, digital literacy will quickly expand, setting the stage for a "learning revolution" in education… Needless to say, there are dimensions of the IT revolution that will continue to be beyond the reach of most developing countries in the coming decades…

THE MEDIUM TERM: STEPPING STONES
Some of the new products and services that are currently reaching the market have the potential of significantly ameliorating the conditions of access/use of ICT in poor areas of the world. Examples of these potential "stepping stones" to facilitate digital inclusion follow.

Low-cost devices: Exploiting the implications of Moore's Law on the cost/performance envelope of hardware, companies like Via 20 are producing relatively low -powered processors targeted at the markets of developing countries. These processors are adequate for accomplishing basic functions like word processing, Internet browsing, e -mail, etc. Companies like Netcore 21 are developing "thickserver, thin-client" systems aimed at bringing down the average cost of networking… The shape of computers, as we know them, is also undergoing a major change. For years, the PC was the only form of computer known to the masses. Over the last few years, handheld computers have slowly come into the mainstream and have made computers more portable and affordable. The portability of these devices and the fact that they can run on batteries make them an attractive option for rural areas where power is not easily available.

Several organizations like the Jhai Foundation22 and the Simputer Trust23 are innovating computer technology to make it more appropriate for rural areas. The Jhai PC, for example, gets around the lack of power in rural areas by running low-wattage computers that are driven by pedal-power and that can survive harsh rural conditions. The Simputer Trust is building a multi-user computer that will be a shared device that can be personalized through the use of smart cards issued to individual users. These are early examples of applying ICT for Development, particularly in rural areas, and are therefore worth keeping an eye on. The key challenge for devices, including PDAs that attempt to target lower cost structures, is building a profitable business model that permits the pursuit of the emerging (rural) markets that they target. The target market is enormous, but unstructured, and has not been studied sufficiently to permit development of robust business plans… The opportunity for national governments or even international donors to fund detailed market segmentation studies required by

commercial organizations to help characterize the markets related to the digital divide may lower the barrier to entry of corporations interested in expanding to such markets, to actively pursue them.

Low-cost software (Free/Open Source Software, FOSS): Proprietary operating systems and applications are priced mainly for developed-world market conditions. The existing business models of software vendors are not designed for widespread usage in developing countries such as India, for example, where annual per capita incomes are around $460. One of the reasons for the growing popularity of FOSS in the developing world is the cost factor—FOSS costs can be a fraction of the cost of proprietary solutions and can provide an alternative model for developing countries. Moreover, as software programmers in developing countries have the freedom to modify and adapt the software to their local context, FOSS is becoming increasingly relevant . A few examples illustrate this point…

Wireless solutions to leapfrog infrastructure bottlenecks: Telecom services, especially in rural areas, are a key challenge for developing countries. Landline and cellular telecom systems work well in metropolitan areas and smaller cities where subscribers are located in dense clusters that justify the high cost of equipment and licenses. However, connecting rural areas is a bigger challenge because subscribers are geographically dispersed, sparsely located, and economically weak. Few telecom companies want to venture into remote villages because the purchasing power in these villages is not enough to recover the cost of connecting them. The three characteristics that are critical to sustainable deployment of telecom systems in rural areas, therefore, are affordability, ease of deployment, and appropriate business models. Wi-Fi technology offers the opportunity to be the one technology to address these issues. It has a few key advantages in its favor.

- Maturity: It is a proven technology for corporate local area networks and carries both voice and data. It is well understood.
- Affordability: This technology enjoys the advantage of being part of proven industry standards (IEEE 802.11b, a, g, etc.) and is an integral part of high volume commercial deployments. This has made the technology affordable.
- Pervasiveness: Although popular in most corporate environments, it is becoming even more pervasive. Technology advancements and market thrust of Wi-Fi as part of the future business plans of a market leader such as Intel Corporation is worth mentioning, as is Intel's innovation of integrating the Wi-Fi technology with its processor technology, which will automatically provide each new consumer of its products a Wi-Fi-enabled product. The incremental cost to the consumer is marginal. One could characterize this as a structural push toward "free Wi-Fi" – as far as availability of Wi-Fi-enabled products -- a key requirement for ubiquitous spread of a technology.
- Corporate interest: Other companies like Intel Corporation have demonstrated that they have active technology and business plans, including investment funds, that will further the spread of this technology. They are also taking an active interest in the spectrum de -licensing landscape.
- De-licensing awareness: Many countries are now taking a close look at their spectrum regulations and are working on deregulation of the Wi-Fi spectrum.

Some notable pilot projects are emerging, such as the Digital Gangetic Plain, pursued at IIT Kanpur as part of Media Lab Asia program. This project has established a multi-hop Wi-Fi network across 75 kilometres between the Indian cities of Kanpur and Lucknow. It offers the potential to provide a proof-point for enabling rural communications for both voice and data. Another technology project that has gone on to pilot stage is DakNet, in the Indian state of Karnataka, where it is attempting to extend the Bhoomi Land Records project to kiosks that do not have connectivity. DakNet offers Wi-Fi-based asynchronous broadband linkage where wired communication is not available. In many cases, telecommunications companies are required to fulfil a Universal Service Obligation to provide services to rural areas. Wi-Fi based technologies have the potential to offer a less expensive alternative to telecommunications companies in place of more expensive conventional telecommunications switches. More work needs to be done to help refine the technology for ease of deployment, while simultaneously pursuing business models around Wi-Fi ISPs in semi-rural and rural areas.

Content localization, relevance, and search technologies: The absence of content in local languages is a key limiting factor in the spread of the benefits of ICT to the underserved masses. Most people in poor nations don't speak a European language, and thus can't read most of the content on the World Wide Web. Technologies that convert content in one language to another provide an exciting area for research. Progress using UNL – Universal Networking Language -- for example, is underway. UNL allows storage of domain-specific information in a particular language in its semantic form. Technology advancements are now demonstrating access to domain specific information from a different language than that in which it was originally stored. This is enabled by new search technologies that allow the querying of information from these semantic representations in different languages. The Research and Training Center of the Development Gateway Foundation in India is involved in this research agenda.

The problem of availability of local content from the perspective of the poor is compounded by the fact that a lot of the locally relevant knowledge in developing nations is not published. OneWorld.Net, with a number of partners, has created the Open Knowledge Network. The initiative seeks to connect existing knowledge centers in developing countries into a new network to unlock the potential of the poorest communities to use ICT. It is based around key concepts such as: operating agreed standards for exchanging digital content worldwide with explanatory metadata, networking knowledge workers and translators across developing countries in a peer-to-peer architecture, and licensing for the common public good through new forms of "Open Knowledge License." Moreover, much of what has been published relevant to developing countries has been published abroad, sometimes in languages other than those of the countries that could best use the information. New technology to identify the location in which published information might be relevant is being developed, and should be deployed. Directories and search engines that find and warrant development information can
play an important role in this context.

In some cases the bandwidth of content must be changed to meet the needs of people in developing nations. Poor people have lower bandwidth access and often prefer information in a more stripped-down fashion than the average Internet user in developed countries. Moreover, inter-modal linkages are much more relevant in poor markets. Integration of the Internet with community radio, for example, and mechanisms to facilitate e-mail dissemination of Web content are some of the relevant areas for research in this context. Examples of such integration include "Strengthening Women's Leadership in Community Development through Radio-Internet in Brazil" 28 and the WorldSpace Foundation' s efforts to help African media and NGOs utilize its digital satellite multimedia service.

It also important to acknowledge that many poor countries are more verbal than rich countries and more dependent on face-to-face than print-mediated contact; indeed, far larger segments of developing country populations are functionally illiterate than one would find in developed countries. Cultural preferences may involve the structure of content presentation or many other features. Therefore, technological solutions that facilitate the presentation of content in forms that are adapted to cultural needs and preferences can be of great value. Interesting examples in this context are the use of same-language captioning on TV in India, where broadcast television is used as a culturally acceptable medium for teaching adults to read (or re-teaching them to read) or the use of "soap-opera" formats for educational programs in Brazil. Putting instruction in the context of music videos that are widely watched, even in rural areas, can make a difference.

REALITY CHECK: CHALLENGES FOR DEVELOPING COUNTRIES
The reality of the introduction of these new technologies in developing countries, however, remains quite distinct from the science-fiction like optimism of technology enthusiasts. Most developing nations don't have the human resources required to fully explore the technology future we have outlined. Nor will they unless there are radical changes to their educational systems. Needs for human resources exceed availability at all levels. Very large numbers of people will need to become ICT literate in a very short time. Large numbers of people will be needed to build and maintain the ICT infrastructure

and to create the ICT industries. Still larger numbers of people will have to become digitally literate to improve the productivity in agriculture, industry, commerce, resource conservation, mineral exploitation, health, education, financial services, and the rest of the economy…

Moreover, radical reforms are still needed in policy and regulation. While liberalization and privatization of basic telephone services have occurred in many countries, there are still numerous countries where regulatory barriers to entry constrain the ability of new entrants to deploy technologies and to contest the market of inefficient incumbents. The regulatory reforms required for proper operation of basic and value-added telecommunications services remain a priority. In the same vein, the development and adaptation of financial systems and institutions so that they can better support e-commerce and e-government transactions remain a major challenge.

Institutional, organizational, and cultural inertia are likely also to pose grave constraints to e-development. Consider, as an example, introduction of ICT in the educational system or the health system. To do so fully would require large numbers of professionals to change their professional behavior – teachers to teach differently, doctors and nurses to practice medicine differently. This means changes in the structure of their schools and hospitals, of professional organizations, of professional training programs, of licensure, etc. Many people can be expected to oppose such change, and even without resistance, planning and implementing such efforts is by no means simple.

Poor countries don't have the financial resources to make all the investments that would be required. The annual cost of providing computer-based instruction in primary and secondary classrooms , for example, was calculated to range from $78 to $104 per student per year in three Latin American pilot projects.32 This, in turn, is several times the value of the annual discretionary budgets per student available in most developing countries. And there are many other economic barriers. For example, there are few, if any, institutional mechanisms for the production of public ICT goods at the continental or regional level in Africa, Asia, or Latin America. Nor are there adequate mechanisms to allow use of high-end ICT infrastructure in rich nations to solve the problems of poor nations, even where such efforts would have high priority for humanitarian and other reasons. Thus it seems clear that there will be less than desired utilization of proteomics ICT systems for HIV/AIDS and diseases of underdevelopment for lack of such institutions…

A final point worth making is that a key ingredient for a high-performance networked economy is trust. Trust, in turn, depends on transparency and accountability. Similarly, knowledge for development relies on openness to information and willingness to change when new information suggests change is appropriate. Transparency and accountability are not necessarily welcome by those in power, be it governmental, business, or non-profit organizational power; and openness to change is often in short supply. Much less trivial reasons than corruption or reactionary traits exist for resistance to transparency, accountability, and openness. Elites may often be unwilling to trade the comfortable known for the uncertainty of new technologies and the changes that have to be made to fully utilize them. The expansion of modern networks puts in motion forces that promote transparency. Resistance to these forces, however, may further hinder ICT solutions targeted to the bottom of the economic and social pyramid…

LEADERSHIP NEEDED FROM NATIONAL GOVERNMENTS
- Active Regulatory Support: Bridging the digital divide should be part of the national agenda of each developing nation. Bridging the "communications divide" is a critical part of this. Pursuing regulatory approaches that foster the deployment of Wi-Fi solutions and facilitate the de-licensing of spectrum should be a high priority in this agenda.
- Sustained Funding for Digital Divide Research, Projects, and Pilots: Sustained political and bureaucratic support is required to enable this to happen. It is important to recognize that multiparty democracies have a larger challenge as to this commitment, and funding will need to be established and sustained across political boundaries and governmental changes.

- Leadership in Digital Divide -Related Technology R&D: The world has not focused in a sustained manner on the needs of the next five billion people who are the likely beneficiaries of ICT. It is imperative to strive for international and national awareness to establish a sustained focus and funding in educational and research institutions.
- Leadership, by Example, in E-government: This is an area where developing countries can effectively leapfrog stages of development by using ICT as a lever to reengineer the public sector. Programs in countries as diverse as Brazil, the Republic of Korea, and India concretely illustrate the power of these actions in setting the stage for public sector reform and greater transparency.

LEADERSHIP NEEDED FROM CORPORATIONS
- Allocating investments in financial, human, and organizational resources in ICT in developing nations, helping build local ICT industries, and exploring globalizing e-markets.
- Bringing ICT technologies that are relevant to the needs of poor countries and poor people to market; such technologies should be culturally sensitive, affordable, and scalable beyond pilot experiments.
- Increasing corporate social responsibility budgets for technology-based efforts to bridge the digital divide.
- Increasing investment in R&D efforts on technology related to addressing the digital divide . As markets develop, these corporations will be the early commercial beneficiaries of such efforts in these emerging markets, especially when many existing markets are becoming saturated for continued growth.

LEADERSHIP NEEDED FROM THE TECHNOLOGICAL AND SCHOLARLY COMMUNITIES
- Researchers will be needed to step forward and respond to the challenge to develop the technologies discussed above, exploring creative new institutional arrangements and networks.
- Researchers in developing nations will be especially important in assuring that technologies needed by the poor, but not being developed in rich countries, are indeed developed.
- The scholarly community needs leaders to radically improve the response of educational systems in developing nations to the challenge of the information revolution.
- These communities also need to show leadership in the development of content needed in developing nations, and the localization of that content.

LEADERSHIP NEEDED FROM CIVIL SOCIETY
- Leveraging the process of transforming ICT technology into weapons for transparency, with emphasis on benefits to the poor.
- Creating sustainable civil society mechanisms for ICT innovation and development by further engaging grass-roots communities in the delivery of these solutions .
- Facilitating the spread of open-source software solutions and ICT training tailored to the needs of poor communities.
- Experimenting with innovative mechanisms to magnify the reach of the Internet by coupling it with community radio and other conventional media.

In addition to leadership in the context of the "quad" framework, leadership from multilateral institutions and international agencies in their funding is also needed for:
- Living (research) pilots : In many cases, pilot projects are funded based on a specific approach with specific technologies. In many cases these plans, once approved, do not allow for the need to dynamically revise approaches, technologies, and other variables. The ability to dynamically adjust relevant financial and technological variables in internationally funded pilots should be encouraged.
- Pilots to scaled deployments: Pilots have to be actively managed to take to scaled deployments. Otherwise, pilots wind up as good reports for future pilots. Strong leadership in getting funding necessary to take pilot projects into formal deployments is critical for visible successes to occur.

- ֹ Continued support in mobilizing resources for roll-out of ICT infrastructure: This support should be based on appropriate policies and institution building efforts of developing countries to allow such roll-out and to appropriately regulate the developing infrastructure.
- ֹ Continued support for applications of ICT in all sectors: This is needed especially where such applications address key development constraints, and where they help efforts to alleviate poverty.

Leadership is also needed from these agencies to help create the regional and global institutions that can foster the development and application of these technologies. An example in point is the Development Gateway Foundation. Even though its resources are quite limited when compared with the challenges involved in bringing the benefits of the information revolution more fully to poor nations and poor people, it can play an important role in this process given its multi-stakeholder partnerships and reach. Most importantly, it can utilize ICT in new ways to promote sustainable development and can help in the reduction of poverty…"

India's rural masses have embraced latest wi-fi technology [89]
"Wi-fi, the technology that wirelessly connects to the Internet, is being used by many rural centres across India to access important information and facilities. In the Loni-Shirdi area of western Maharashtra, over 200 villages have formed a cooperative and raised Rs 2 crore to leverage information technology for their benefit. They have set up nearly 50 wireless `hotspots' to harness the latest wi-fi systems so that villagers can get agricultural access systems right at their doorsteps. The technology to wirelessly connect to the Internet has recently been legalised by the government.

Although many `mahithi ghars', or information kiosks, in Goa are right across the road from government offices, where application forms are free, villagers prefer spending Rs 15 to access application forms and dispatch them electronically. They say quicker action is taken this way. In Tamil Nadu, an innovative information kiosk operator has installed a Web camera on his PC. He recently took a photograph of some diseased vegetables brought in by a farmer. Within the day, experts at the Tamil Nadu Agricultural University had diagnosed the disease and suggested a remedy.

In Madhya Pradesh's Dhar district, India's most 'wired' rural reach has taken to wi-fi technology in a big way. Now women, shy of going to information 'dhabas', are able to access information from their homes. An 85 km stretch between Lucknow and Kanpur has become known as the `Digital Gangetic Plain', thanks to a Media Lab Asia project that has wired the area with wi-fi repeaters. Wi-fi technology, which was conceived in the West as a means of short-range communication over 100 metres or less, can be leveraged to provide Internet links of up to 100 km. The technology has helped take Net-based services right into the heart of 'unconnected India'.

A national conference on wireless networking, organised in Bangalore recently by the Manufacturers' Association of Information Technology (MAIT), held a panel discussion on how wi-fi could be used to bridge the digital divide. To the surprise of many in the audience the examples cited by the panelists clearly showed that India's rural masses were perhaps ahead of their more sophisticated urban counterparts in recognising and exploiting the compelling attractions of this new technology.

However, delegates were told that over 60-70% of the 350,000 km of fibre optic cabling laid throughout the country by BSNL (Bharat Sanchar Nigam Ltd) was idle as the 'last mile' link to customers was missing. It was suggested that state governments purchase the waste bandwidth at special prices and join hands with private providers to offer final connectivity."

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[89] The Hindu, May 4, 2003: http://www.infochangeindia.org/itandditop.jsp?recordno=2168&section_idv=9#2168
See also - Rural WiFi Point-To-Point Installation - NSW Australia: http://www.users.on.net/mra/

The other dimension of technologies and applications which is of extreme importance is that of the policies and market structures that enable them. Countries and regions differ; the following table and text indicate the nature of problems and challenges in many African countries.

"The Big Picture[90]						
Geographical reach	**Infra-structure**	**Owner-ship**	**Content**	**Use**	**Challenges**	**Risks**
Inter-continental	Fibre-Optic and terrestrial submarine rings Power line fibre optic	Consortia: public telcos & private through equity Regulation: by FCC, ITU, WTO	▪ High speed bandwidth ▪ Inter-national voice & data traffic ▪ Large data transfers ▪ VOIP	▪ Wholesale: speed, efficiency ▪ Facilities leasing ▪ International private networks	▪ Poor national infrastructure ▪ High cost of terminal equipment: eg Ghana, Nigeria High cost of bandwidth leasing ▪ National policy: PTC monopoly protection ▪ Single International Gateways ▪ Rights of Way	▪ Seabed disturbances ▪ Terrestrial disturbances ▪ Theft
International	Satellite	▪ Inter-national Public Utilities eg Intelsat ▪ National Public Utilities eg Sentech ▪ Con-sortia: Public & Private, Eutelsat ▪ Private: NewSkies	▪ Inter-national / National broadcasting ▪ Inter-national voice and data ▪ Private network voice and data ▪ Multimedia ▪ VOIP	▪ National International Broadcasters ▪ International telecoms gateways ▪ International and national private telecoms and data networks ▪ Some IXPs, Internet infrastructure providers ▪ Cheaper "Direct to PC subscription" services where regulation allows ▪ Fast roll-out with good reach in footprint	▪ Broadcast: Receive only National content issues ▪ Telecoms: National policy and regulation, ▪ High cost of space segment and terminal equipment ▪ Open vs Proprietary standards ▪ Frequency and spectrum management and licensing fees	▪ Equinox; eclipses ▪ Rain attenuation ▪ Regulatory risk and licensing costs ▪ Receiver power-outages ▪ Relay delay ▪ Introduce international exchange competition, loss of income to PTTs/exchequer Bypass PTT – regulation pricing/licensing
National	Long distance	PTT But could be PLC, VSAT (elec-tricity/ transport utilities/ any other network)	Internet, private high speed network content, eg research networks, private networks at firm or government level ▪ VOIP	ISPs, Educational High Speed networks,	▪ Uncompetitive pricing: tied to facilities leasing from PTT ▪ Pricing and business model on capacity not use! ▪ National networks not integrated	Could be best area to introduce competition: competitive pricing; monopoly resistance as revenue drops

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[90] Emdon, Heloise, *The Big Picture*, table presented at Towards an Open Information Society, UNDP Global Meeting on ICT for Development, Ottawa, 9-11 July 2003: http://www.sdnp.undp.org/it4dev/gpm/proceedings.html. Text from Heloise Emdon (IDRC Acacia Program), July 2003.

Geographical reach	Infra-structure	Owner-ship	Content	Use	Challenges	Risks
National	Cellular	Public, private, public-private partner-ships	Mainly Voice Growth in SMS GPRS and 3G integrating voice and data	Grameen National cellular	▪ Govts set unreasonably license fees, amortised over consumer base ▪ Regulatory failure on interconnection ▪ Uncompetitive pricing: tied to facilities leasing from PTT ▪ Data transmission very expensive, pay per MB transmitted	▪ Policy, Regulation, eg interconnection ▪ Poor national infrastructure ▪ Single telco ownership ▪ GPRS and 3G pricing renders it unattractive for use
Exchanges	Regional and Local exchanges	PTT, but with "unbundling of the local loop" could be munici-palities, smaller telcos	Voice Internet access	PTTs	▪ Opportunities for unbundling ▪ use of PLC ▪ Closer to the consumer	Regulatory, Policy risks, eg SA, Kenya

Last mile(s)	Local loop Copper Wireless WAN, WiFi	As above	▪ Voice and internet access, private networks ▪ Break-outs into the "cloud"	▪ Schoolnets, ▪ Healthnets, ▪ SMEs ▪ Public Access ▪ VOIP	▪ WISPs ▪ Broadens participation ▪ Loss of income to telcos	▪ Most expensive to big telco ▪ Loss of revenue ▪ Spectrum management, frequency commons ▪ Power outages ▪ Universal Service obligations ▪ Most likely to get consumer to invest in own infrastructure
Last metre	Fibre, copper, wireless, (WiFi) radio, PLC	Govern-ment, project, firm,	LAN network	Internal network communication, intranet	▪ Getting cheaper, following the trends ▪ Least cost connections (CPE, PABX)	High cost of upgrades, network management capacity-intensive Illegal
Last inch technologies	Wireless, PLC LANS	Consumer	LAN network	Own content, internet access	Innovation, cheaper access	Procurement, maintenance

| Applications | Programme, content Software | Consumer project | Local content, international collaboration | ICT4D | ▪ Open Standards
▪ Open source | Project implementation &management Software licenses, software upgrades rendering legacy hardware useless |
| Other interventions | Obligations | Govern-ment policy | ▪ Direct or indirect subsidies
▪ Market-related: asymmetric inter-connection
▪ Non-market subsidy: | ICT projects, programmes | ▪ Increase cost of service to all!
▪ Distribution into the "right" projects unlikely
▪ Market biases, non-market behaviour
▪ Tax = disincentive | ▪ Reverse subsidy bids
▪ Incentives vs obligations
▪ Require more regulatory capacity, not less
▪ Can result in innovation eg prepaid |

			Special funds eg Universal Service Fund			
Geographical reach	**Infra-structure**	**Owner-ship**	**Content**	**Use**	**Challenges**	**Risks**
Other intervention	Privatisation	Govern-ment consumer		Expand participation in the economy	▪ Liberalisation before private monopolies	▪ loss of market share for PTT, dividends to major shareholder

The point of the table is to demonstrate that ICT4D tends to focus on the level of the applications, the extreme end (bottom end) of the Big Picture, and yet sustainability at this level is extremely dependent on:

- the availability of access to the infrastructure
- the cost of this infrastructure

The latter is the outcome of the market segmentation (or non-segmentation) decisions that governments make. Effectively this means that the telecoms industry is vertically integrated in countries that have chosen to protect the incomes to their "cash cow" telco. That is, if the infrastructure is sufficiently well built out the law protects the incumbent through restricting others from building out infrastructure, forcing them to lease the infrastructure from the incumbent.

Bypassing the incumbent's infrastructure, in most African countries, is also illegal. This restricts, for instance, the use of VSAT (satellite) communications because this effectively allows bypass of the international exchange, the very point at which the incumbents interconnect with the international carriers. And this is one of the reasons countries keep their local call rates low and the international charges high (although if interconnecting with a US-based long-distance carrier the top limit for termination charges has been set at 23c (US) pm. In other words no international long distance carrier under the FCC need pay more than 23c for terminating a call in an LCD. In a case for some deliberation, one of the ITU-Development working groups worked very hard at trying to develop asymetric interconnection charges for LCDs to ensure revenue flow into the poorer countries. It is becoming an academic exercise, however, because in an internationally liberalising market, with intercontinental infrastructure increasingly being trunked via networks like fibre-optic, long distance is becoming a commodity and its costs are coming down. Mozambique is a good case study, purchasing international capacity on a commodity basis (either through South Africa or through international satellite carriers), but at the same time keeping the cost of international dialing extremely high.

This has implications for regional integration as well; calls into South Africa, Zimbabwe, Swaziland etc are all considered international calls, so calling across the border is extremely expensive. Mozambican's thus enjoy cheap local calls, but expensive international rates, which in turn affects the cost of delivering the Internet because an Internet Service Provider will have to lease capacity from the incumbent, into which the international call rate is amortised.

The unbalanced rate regimes have further implications: the business model that these African telcos chose to roll-out suggests that they would cross subsidise local calls with international incomes, but the motivation to build out the infrastructure to achieve universal access is not there, and the formula rules the day. Effectively this means that the capitals of these countries are well served (where there is government, international agencies, expatriates) and very little outside the capitals. The WTO in the late 80s managed to get some African countries to become signatories to correcting or 'rebalancing' rates. But it is difficult politically for countries to tell the local population and the poor they will pay more for their calls while international calls come down.

The excellent map on the Acacia website also demonstrates how many of the African countries are not interconnected, illustrates again the point about international settlements and, generally, legacy

relationships of the Public Telephone Companies with the colonial powers that established the international linkages in the first place - Britain, France, Italy, Portugal. The internet however pulls most of the traffic directly into the US via Satellite or via Europe onto the fibre backbones into the US. Also note on the map the few public VSAT licences allowed in Africa, meaning, that only the public telco will be able to provide this interconnection (for the obvious revenue stream). In some poor countries the public telcos are the single largest income earner of hard currency (again Mozambique is an example).

A phenomenon in Africa, however, has been the success of cellular roll out. Most African countries have licensed at least one cellular operator (and generally this operator is owned by the incumbent, which has other interconnection issues) or have liberalised this market allowing between 2 to at most 5 licenses per country. The roll-out of cellular has now exceeded the number of fixed lines in Africa. This is one of the reasons that the measure of fixed line density is no longer a good indicator of access.

Critical in "opening the market" here is the ability of the regulator to act as fair judge in particular in the area of facilities leasing (cellular companies are forced to use the existing trunking and exchanges even if the calls are between cellular operators) and interconnection (to ensure one service providers customer can originate a call on one network and terminate on another which results in settlement rates, and the cost of termination). Some African countries have failed in doing this (as has the Grameen Phone for that matter been a victim of the lack of interconnection, rendering it a internal telephone system to Grameen Phone customers only). This results in failure of the network effect. In Ghana people carry up to three cellular phones in order to call each other.

In order to provide level playing grounds for these new operators there is thus a need for regulation to manage scarce resources to ensure efficient use in frequencies and spectrum allocation, numbering and licensing of equipment use and standards - in order to ensure fair pricing through and network build out:
- low interconnection charges, and enabling interconnection between;
- fair accounting principles for facilities leased from the monopoly incumbent;
- fair accounting practice to ensure acceptable tariffs in a non-competitive market (the regulator in principle caring for the consumer).

This is a domain best managed by an independent regulator, and can typically only be achieved once the "separation of powers," the first step in the WTO agreements, is reached. The World Bank also prescribes this as the first approach to market liberalisation. There are usually no competition commissions in these countries to ensure that this most lucrative sector, in which there is extreme interest from the private sector ranging from suppliers to services providers, develops with a reasonable degree of competition. Effectively this means that policy, regulation and operations are separated and not dominated by government.

Generally the next step (as proscribed by World Bank for example) is to ensure privatisation of the incumbent. Generally the international equity partner that comes in gets some comfort that they will experience a "window" of protection from competition. Senegal went all the way to a publicly listed Sonatel, has successfully built out its network, and now has a new set of vested interests and shareholders, to continue to protect the market. In South Africa, the Texan monopoly SBC and Malaysian Telecom won the equity bid. The effects of privatisation without liberalization is that of replacing an inefficient public monopoly with and inefficient private monopoly, with all the protection from the policy maker (government) which is also still the majority share holder and thus enjoys improved dividends and starts to behave in other protective ways. To speak yet of competition in the local loop is too soon. South Africa is trying, but with great difficulty, as the cellular and incumbent company acts in typically majority player fashion.

Some policy mechanism that are often used to achieve network build-out to benefit the poor are obligations, universal service funds, e-rates and so on. More work is needed on these, because they have often resulted in market biases and non-market provision of services, rendering the whole system more expensive, poor in management of funds, and with no new build out of infrastructure to actually serve the poor.

Market failure also continues because the weak so-called independent regulators that are established in the separation of powers hardly ever enjoy "autonomy" from government, nor do they earn it! Botswana is a notable exception. Two countries in Africa that used different approaches to privatisation are Ghana and Uganda. The latter achieved far more successes, but has back tracked somewhat in terms of liberalisation, banning the use of VSATs where these would work perfectly to fill in the gaps where the cellular build out of the network has not been achieved.

In its purest form policy reform should allow for fair and equal participation in the delivery of services and ensure that the poor benefit, and ultimately improve the national economy. Regulators must interpret and enforce the law to ensure this fair participation, and improved economy, especially for the consumer. This is hardly ever achieved in developing countries because of the continued vested interests of government in its industry giant. It leaves regulators weak and unable to stand up to their governments (where they actually have some "independence from government).

Working as we do from below, at the poor customers level - the school, the clinic, the telecentre - it becomes more than evident that though governments have the desire to address these constituencies, they do not understand how to change the behaviour of their incumbents. Evidence suggests that the only way this happens is to break up the monolithic and vertically integrated sector.

3. Gender equality[91]

Gender is another fully cross-cutting perspective. There is a growing amount of evidence that poverty reduction is highly correlated with gender equality.[92] And gender equality comes into every aspect of the ICT-poverty picture, from education to livelihoods to government services to broader empowerment. Gender considerations are thus included often among experiences in the sections which follow this one. A forthcoming study for the UN Commission for Science and Technology for Development provides a good overview, and a policy/research workshop is intended as follow up.

ICTs, Globalisation and Poverty Reduction: Gender Dimensions of the Knowledge Society[93]
"Preparation for the coming World Summit on the Information Society has led to fresh assessments of the significance and relevance of gender issues in the technology policies of developing countries.

- Ballantyne, Peter, *eDevelopment, eCooperation: connecting the worlds of information and development*, Compare: A Journal of Comparative Education, Oct2002, Vol. 32 Issue 3, p365

[91] See also
- *Gender & ICTs Resources Annotated Bibliography*, and *Gender and ICT Evaluation Methodology*, IDRC Pan Americas website: http://network.idrc.ca/ev.php
Krishna V. Sane, *Women Empower Women, World Bank InfoDev project,* 2000: http://www.iicd.org/stories/
- Seminar: *Is ICT Gender-Neutral? A gender analysis of six case studies of multi-donor projects*, UN ICT Task Force: http://www.unicttaskforce.org/stakeholders/sources/

[92] The MIMAP program of IDRC (www.mimap.org) is one of many sources the view that the changes needed to address women's rights, resources and opportunities are about the same as those needed to spur development, growth and poverty reduction. Or, while gender equality goes beyond poverty reduction, there is very little in poverty reduction that does not require gender perspective, and equity objectives, to succeed. A recently issued book (March 2003) by Naila Kabeer, *Mainstreaming Gender Equality in Poverty Eradication and the Millennium Development Goals: A handbook for policy makers and other stakeholders (*Commonwealth Secretariat, IDRC, CIDA) provides much detail; the initial quote by Gita Sen is indicative: A gender perspective means recognising that women stand at the crossroads between production and reproduction, between economic activity and the care of human beings, and therefore between economic growth and human development. They are workers in both spheres – those most responsible and therefore with most at stake, those who suffer most when the two spheres meet at cross-purposes, and those most sensitive to the need for better integration between the two."

[93] Huyer, Sophia and Mitter, Swasti , *ICTs, Globalisation and Poverty Reduction: Gender Dimensions of the Knowledge Society,* the United Nations Commission for Science and Technology for Development, forthcoming

Recent international fora have stressed the importance of integrating gender equality considerations into ICT policy, programmes and projects at all levels to promote the social, economic and political empowerment of women. These include the DAW online conference and Expert Group Meeting on "Information and communication technologies and their impact on and use as an instrument for the advancement of and empowerment of women" and the INSTRAW Virtual Seminars on Gender and ICTs held July 1 – September 18. The UN Commission on Science and Technology for Development (UNCSTD) in its panel on "Technology development and capacity-building for competitiveness in a digital society" has also recognised the importance of integrating gender concerns into an agenda for supporting the entry of developing countries and countries in transition into the global information society. In his report to the Forty-Seventh Session of the Commission on the Status of Women, the United Nations Secretary-General stated,

"A focus on the gender dimension of information and communications technologies is essential not only for preventing an adverse impact of the digital revolution on gender equality or the perpetuation of existing inequalities and discrimination, but also for enhancing women's equitable access to the benefits of information and communication technologies and to ensure that they can become a central tool for the empowerment of women and the promotion of gender equality. Policies, programmes and projects need to ensure that gender differences and inequalities in the access to and use of ICT are identified and fully addressed so that such technologies actively promote gender equality and ensure that gender-based disadvantages are not perpetuated."…

In spite of the growing emphases on the theme, there is a visible lacuna of methodologically sound information to base policy making in these areas; as a result, discourse in ICTs for women's economic empowerment, poverty reduction and entrance into the digital economy relies mostly on anecdotal evidence. This paper aims to redress the situation by:

- synthesising the material already published in the fields, highlighting existing knowledge on which policy can be based;
- providing a conceptual framework that will facilitate collection of relevant material on a scientific basis, in critical identified areas;
- highlighting areas for further research and analysis.

This paper will focus on key areas identified as critical to alleviating poverty, contributing to community well-being and supporting national development in the knowledge society and digital economy:

– health   – food production   – SMEs and e-commerce
– education and literacy   – training and employment in the IT sector…

This approach shifts emphasis from ICTs as 'drivers' of change to a perspective where these technologies are considered tools which may provide a new potential for combining the information embedded in ICT systems with the creative potential and knowledge embodied in people. "These technologies do not create the transformations in society by themselves; they are designed and implemented by people in their social, economic, and technological contexts…

Barriers to women's participation in the knowledge society…
– a tendency of governments and development agencies to treat technologies as neutral, value-free tools without taking into account the social, environmental and economic effects of the technology being introduced;
– an assumption that adoption of technologies naturally leads to development;
– a tendency to overlook women's technological skills and use of technologies;
– unequal access of women to development resources – including credit, training and information

Specific Barriers to Women's Use of ICTs..
Lower levels of literacy and education…
Domestic and reproductive responsibilities…

Restricted access to training…
Cultural attitudes and practices…
Language… less proficiency in English…
Cost and access…
–   lower levels of access to financial resources
–   access at their place of work.. Women's high representation in low-paid, non-formal sector employment mitigates against this form of access…
–   public access is sometimes located in an environment where women do not feel comfortable.
–   geographical location… women tend to outnumber men in rural areas..
Value of Information available: the need for relevant content…

…existing analysis indicates that women will not be equal participants in the knowledge society, even in areas or projects which address their concerns, unless they are actively consulted and strategies are designed to integrate them fully into ICT projects and the IT sector. This involves:..

Access/enabling environment… Areas for further research:
–   Assessment of the use by women of telecentres and other kinds of community access points.
–   Further work is needed on telecentre sustainability, including analysis which takes into account a broader assessment of results than profit margins (such as value to users; increase in local production; participation of community in national governance, etc);
–   Models for information delivery systems which incorporate a mix of ICTs appropriate to local conditions and educational levels of the users.
–   Modes of training on the use of ICTs which are women-appropriate
–   Evaluation of ICT projects, including gendered opportunities to benefit and assessments of best practices and lessons learned.
–   Support to women to define and create content and information carried by ICTs…

Telecommunications policy… Key steps to be taken include:
–   Sensitizing policy makers to gender issues
–   Gender advocates need to familiarise themselves with ICT policy issues in order to more effectively influence the policy process
–   Developing a substantial body of evidence to demonstrate the links between gender and ICT for development.
Areas for further research include:
–   Collection of evidence and data to demonstrate the links between gender and development; and gender and ICTs for development
–   Analysis of the gendered effects of telecommunications policy and regulation, building on work done to date.
–   Effects on gender equality and social equity of telecommunications policy, regulation, and technologies such as GIS (footnote on GIS effects).
–   Research and packaging of guidelines on mainstreaming gender into ICT policy, including curricula development and information kits.
–   Research and analysis of strategies and approaches to integrate civil society consultation into ICT policy development and implementation.
–   Identification and incorporation of social elements of long-term goals into regulation frameworks.
–   Strategies for making low-income markets, including women, attractive to private sector providers and investors, including research on the opportunities in low-income markets…

Content… Further research and analysis in this area needs to be done on:
–   how ICTs can be used to ensure women's knowledge is not lost;
–   the role of ICTs in ensuring that women benefit from the proceeds (financial and otherwise) of this knowledge;

– dissemination of women's knowledge where it may be beneficial in ways that do not disempower them or allow the theft of this knowledge…

ICTs for Poverty Reduction: Supporting Women's Productive and Reproductive Activities…
Health: Research areas:
– What models of information and information technology transfer for local health projects are most effective in getting information to women users?
– What are the lessons learned from the introduction of ICT technologies to male and female health workers? What strategies are useful to ensure that both women and men have equal access and benefit equally from the use of these technologies?
– What are the most effective strategies for reaching young women and men around reproductive health and HIV/AIDS issues with ICTs?
– What kind of health information do women find most useful? What format and approach to content is most effective?
– What contribution can software and ICT-based data collection frameworks make to increasing the accuracy of morbidity and mortality assessments at national and local levels for decision makers? Assessments of software development models and approaches.
– Development and testing of new software models and data collection methods on health issues of important to women.

3.2 Agriculture… Research areas:
– the use of computers and the internet to provide information on 'appropriate' techniques and technologies for increasing yields, for increasing economic returns through primary processing of commodities, or through improving the quality of artisanal products.
– review of existing information on use of production technologies by women,
– research on how and why information remains a major constraint on the uptake of improved technologies by informal women producers/workers; and what approaches and strategies can be implemented to redress this situation
– research on supporting the creation and exchange of local and locally relevant content by rural women themselves, or customized to their needs, language and literacy abilities, and their interests.
– synthesis of existing and disparate work and research on gender, ICTs and agriculture for rural development. (Carr, 2003; Hambly et al, 2002)

Education… Areas for further research :
– Gender-differentiated effects and benefits of the use of technologies for education
– Feasibility, efficiency and reach of various strategies for using ICTs for education, particularly on the benefits and degree of participation of women and girls.
– Costs, efficacy and benefits of distance learning, including the use of computers and Internet, particularly related to the benefits for girls and women, at all levels of education.
– Collection of data and indicators on women's participation in computer sciences and IT in educational institutions and employment.
– Strategies to encourage the participation of women and girls in scientific and technological education and training at school and in the workplace…"

GEM: Gender Evaluation Methodology for Internet and ICTs[94]
"GEM is a guide to integrating a gender analysis into evaluations of initiatives that use Information and Communication Technologies (ICTs) for social change. GEM provides a means for determining whether ICTs are really improving women's lives and gender relations as well as promoting positive change at the individual, institutional, community and broader social levels. The guide provides users with an overview of the evaluation process (including links to general evaluation resources) and

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[94] GEM is a project of the Association for Progressive Communications (APC), supported by IDRC, UNIFEM and DFID: www.apcwomen.org/gem

outlines suggested strategies and methodologies for incorporating a gender analysis throughout the evaluation process. GEM does not contain step-by-step instructions to conducting evaluations. GEM is not simply an evaluation tool. It can also be used to ensure that a gender concerns are integrated into a project planning process. Finally, GEM is an evolving guide! In its practical use we encourage critical thoughts and creative adaptations. Throughout this web site you will find forms where you can submit your comments, suggestions, stories, strategies, or resources.

The Association for Progressive Communications Women's Networking Support Programme (APC WNSP) developed GEM to facilitate the process of learning about using information and communication technologies (ICTs) for gender equality. ICT use is increasing everywhere. In particular, women are using ICTs to strengthen their organization and movement building at the local, regional and global levels. ICTs, however, can also pose a potential threat to women. ICTs can be used in ways that replicate or perpetuate gender stereotypes and biases, and can have unintended negative impacts. Gender evaluation methodologies, therefore, can be used to investigate whether ICTs are being used in ways that change gender biases and roles and do not simply reproduce and replicate existing ones. As more and more of today's development work and money is channelled into projects that employ ICTs, their effects on women are of great importance. For women, the accessibility of ICTs requires adequate equipment, information, financing, organization, training and time."

Other cases samples found include:

Empowering homemakers to become homepreneurs and e-homemakers through a Gender Governance system[95]

"Gender Governance is both a goal and process which seeks to create a platform on which disadvantaged women take ownership of the management of networks and information sharing. Mothers For Mothers/Ehomemakers promotes demand driven gender governance through information sharing, networking and activities that enable and empower women to work from home. Combining the essence of working from home, the vigour to empower women, the opportunities of the Internet and ICT, and leveraging off the experience and knowledge share within a community, the research project will identify facilitating factors and barriers through needs analysis and indicators for 150 disadvantaged women in order for them to make milestone progress through ICT to improve economic self-reliance. This will provide the basis to develop a gender governance system for best ICT practices in effective networking. Poverty is taking on a more feminine face in Malaysia with increasing number of female-headed households in the urban area. The governance gap for disadvantaged women is the denial of basic human rights and legal rights to women. With ICT, a woman could balance her roles as homemakers and as homepreneur. The beneficiaries of the research project will be disadvantaged women, mostly Chinese and Indians:

- Single mothers who have lost their husband through divorce, widowhood, or
- separation/abandonment. Most have children under ten years old and other dependants such as
- elderly parents.
- Mothers suffering chronic illnesses like HIV, SLE or cancer.
- Physically impaired women with restricted mobility access.
- Homemakers, from low-income families, with home-based work such as baby sitting.

All of the above - with little marketable skills except very basic keyboarding skills, or are unemployed due to social stigma. All the above - do not belong to any formal assistance scheme due to certain barriers. 150 women in the Klang Valley will be selected from the 200 women being trained in IT and basic home-entrepreneurship awareness under the Salaam Wanita project (of Mothers For Mothers/Ehomemakers) in 2002. They will go through a two-day intensive computer course and IT

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[95] IDRC Pan Asia Networking grant-supported project, Mothers for Mothers/E-homemakers C/0 Corpcom Services Sdn Bhd, Malaysia, documentation from Maria Ng, IDRC-Singapore.

mentoring by other women throughout the year. A computer and fax donation drive to the corporate sector will be conducted in order for them to be ICT equipped at home.

Specific outcomes are:

- A network of 150 e-homepreneurs within 20 months period of time from start of project.
- Increased ICT and home-entrepreneurial skills, thereby increased income and economic self reliance
- in female-headed households.
- Improved family welfare especially those of the dependants. Those who are chronically ill will
- be able to buy medicine on their own without asking for drug donations that are unreliable (Due to
- the Asian economic crisis, the government has cut down subsidy on much needed drugs in
- public hospital.)
- A defined and documented Gender Governance for development and management
- of networking with disadvantaged women.

Asian Women's Exchange: A Strategy for Electronic Resource Sharing[96]

"AWORC seeks to contribute to the strengthening of women's movements in Asia through developing regional women's Internet-based information and communication channels. It was established in a way that would maximize the use of new information communication technology in the work of the network. All of its work, from the multi-lingual database search mechanism, the Internet-based information sharing strategy and its training workshops have all sought to examine ways in which networking and movement building can be enhanced through electronic communication means. One visible example of this is the AWORC's website which now highlights resources, activities and organizations of women in the region and serves as a channel for women's organizations to exchange information on the review process.

Currently, AWORC has nine member organizations. These are the Asian-Pacific Resource and Research Centre for Women (ARROW), Asia Pacific Forum for Women, Law and Development (APWLD), Association for Progressive Communication Women's Networking Support Program (APC WNSP), Asia Pacific Women's Information Network Center (APWINC), Gender Center for Sustainable Development (GCSD), Institute for Women's Studies (IWS), Isis International-Manila (Isis), JCA-NET and Korean Women's Development Institute (KWDI). Not all network members have been equally active in contributing to the growth of the network. This has prompted network members, in its last Face to Face meeting, to develop strategies for eliciting the commitment of non-active members while at the same time drawing in the energies of new organizations.

Outcomes of project

- a web site that contains multi-lingual resources and databases highlighting contemporary and critical issues of women in the region
  - the Beijing + 5 Follow-up Tool
  - multilingual database and search mechanism
- support for Asian Women's Electronic Network Training (WENT) Workshops
- a network of women trained in Asia on utilizing and developing internet based information services
- an electronic network of women's information providers and centers, communications organizations and other women's organizations
- a training module on Internet usage, web site development and electronic networking and an onsite training toolbox
- a library of web-based resources on all aspects of women and ICTs
- a regional information service
- research on women and ICT
- a pilot Internet-based News Digest Service for Women's Radio Programs in the region."

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[96] See http://www.aworc.org/

The IDRC-supported Acacia program is an ICT/application support program aimed particularly at communities including poor communities in Africa, with dozens of projects and stories documented at www.idrc.ca/acacia/. Several are referenced below, beginning with one on participation.

Promoting Women's Participation in Kenya's Governance[97]

"A research team in Kenya is training rural women to access information via computers. The team's ultimate goal is to help increase women's participation in the democratic process. "Because Kenyan women are poor, they get manipulated during voting," says Professor Shanyisa Khasiani, Executive Director of the Nairobi-based Family Support Institute, which is implementing the project with funding from IDRC.

Gender Sensitivity and the Acacia National Strategy for Senegal

Facilitating access to, and exploitation of, information and communication technologies (ICTs) for marginalized communities, especially women and youth: this is the main objective of IDRC's Acacia Initiative, which has launched a project to ensure massive representation of women in all aspects of the program, and to incorporate gender sensitivity into the design, implementation and evaluation of projects that are part of the Initiative."

Annex A, " There is a general concern that more focus should be given to women's role in ICTs and development, and in how ICTs can be used to empower women. There are very few studies on how women can be empowered to use ICTs to enhance their status since most are poor. The best case study examples are drawn from the constantly cited Grameen Bank example. However, there are other upcoming ones although the impact has not been assessed such as UNDP's (2002) project to empower women farmers using information technologies in 30 mandals of Andhra Pradesh in India. Both examples, evidently, are from Asia. The African studies deal with the potential and constraints of ICTs for women in general and not the poor specifically. What is apparent is that many women, even in this era of new ICTs, still rely on traditional sources of information."

For ICT policies and interventions, as for other initiatives, gender and age perspectives must include men and women, boys and girls. But there is often the need to focus on girls/women, boys and men - in this order - not because it is necessarily the pattern one wants ultimately to prevail, but because it is the (often stark) reverse of the pattern currently prevailing in most of the world.

4. Education and skills development[98]

Not surprisingly, this is an area abounding in initiatives of many different kinds.

Annex A: " The importance of ICTs and education is a topic that runs across all thematic areas on ICTs and development.. general argument is that an illiterate or poorly educated people cannot wholly absorb ICTs.. many argue that ICTs should be introduced into school curriculum so that children learn how to use these technologies from an early age."

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[97] IDRC *Acacia Program* www.idrc.ca/acacia/,
[98] See also
- European Union e-learning projects: http://www.elearningeuropa.info/
- ICT and Education, draft discussion paper, The Commonwealth of Learning, March 2003
- *ICTs in Vocational and Educational Training*: http://www.big-world.org/about/133.asp
- *ICT in Non-formal Education, ICT for Education in Asia-Pacific*, 2002 UNESCO Asia-Pacific Regional Bureau for Education, Bangkok, Thailand, http://www.unesco.org/bangkok/education/ict/resources/ict_nonformal.htm
- Jai-Joon Hur and Young Soo Lee, *ICT Diffusion and Skill Upgrading in Korean Industries*, WIDER, November, 2002: http://www.wider.unu.edu/publications/dps/dps2002/dp2002-111.pdf

Annex A "With direct reference to education, Hawkins (2002) writes about World Links for Development Programme's experiences in connecting schools to the Internet, in training teachers, and in grappling with curriculum and education reform issues in developing countries. He conceptualizes the story into ten practical lessons that policymakers and business and community leaders should consider as they plan to incorporate the Internet in the educational process. The lessons are:

- Computer Labs in developing countries take time and money, but they work.
- Technical support cannot be overlooked.
- Non-competitive telecommunications infrastructure, policies, and regulations impede connectivity and sustainability.
- Lose the Wires (basically wireless technology is most effective for connecting schools in developing countries).
- Get the community involved.
- Private-public sector partnerships are essential.
- Link ICT and education efforts to broader education reforms.
- Training, training, training. (Basically that the professional development of teachers sits at the heart of any successful technology and education programme.
- Technology empowers girls.
- Technology motivates students and energizes classrooms.

There are many similar projects aimed at 'connecting' schools in Africa and the rest of the developing world, such as SchoolNet but these are not covered in this review.' This is a research gap important to fill; it would appear that drawing together lessons and partnerships for primary education and ICTs could have a high global priority."

SchoolNet South Africa[99]

"My name is Thalitha George. I am 17 years old. I am doing my twelfth grade at a school based in one the most disadvantaged and largest townships in South Africa called Khayelitsha. I first learnt how to use computers in 1999. The organization called SchoolNet South Africa made that possible by installing computers in our school, which meant that I could learn how to use computers. Had this not happened I would not have known about the wonders of computers because I don't have a computer at my home like some people. Since then, I have learnt to use the Internet, email and how to design websites. In this way I have been able to interact with students in other countries such as Pakistan on issues related to my school work. I have been able to find information on the Internet to assist me with my school projects such as a Pilot Study on Physical and Sexual Abuse Among Teenagers. I have also been able to work with teachers in developing local websites. In my spare time I work with teachers in pulling together chemistry and physics lessons to be placed on the website to help other teachers and learners.

Since I have been using computers I have not only improved my results as such scoring good marks in Mathematics and Science, doing exceptionally well in school projects and assignments, I have also been engaged with the outside world and in this way opened up new avenues of learning for me. I am working very hard because one day I would like to become one of Africa's best brain surgeons. The computers, the Internet and emails give me the access to information that I can use to improve my work. It also allows me to produce information and knowledge for others to learn from. In this way I use the Internet and email to share my experiences. At this conference we spoke much about new ways of improving our lives as children of Africa. I think access to the Internet opens up new avenues for the African child. With this being the case, we have the right to be able to access it and use it in our best interest. We as children of Africa should be given the opportunity to explore the world through computers. The Internet offers the potential to provide a pathway to a better life. It has to be part of our future."

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[99] IDRC *Acacia* program: stories: www.idrc.ca/acacia/

SchoolNet South Africa: Accessing a World of Learning[100]
"Sizwe Ngcobo is a 17-year old special-needs student attending a school for the mentally disabled in KwaZulu-Natal Province, South Africa. He is Zulu-speaking and, until just over a year ago, had never seen a computer. Last year, Sizwe gained international recognition for the artwork he contributed to a collaborative student-designed web site that earned a silver medal in the ThinkQuest competition, an annual Internet challenge co-sponsored (SA), the Telkom Foundation, and Advanced Network and Services. A shining star? Perhaps. But there other bright lights in the new world opening up within South Africa and, indeed, globally: the world of information and communication technologies (ICTs).

Focus: In a country where almost 70 % of schools are still without computers, SchoolNet SA has carved out a niche not just by making technology more available, but by focusing on historically disadvantaged schools. "The environment that SchoolNet finds itself in is one where racial relationships are fractured as a result of South Africa's history," says Executive Director Denis Brandjes. "As part of our mission, SchoolNet SA has chosen to focus on the use of ICTs to redress some of these injustices of the past, in order to bring about equitable distribution of resources and knowledge." When teachers first articulated their dream of linking up South African schools, the notion of using ICTs for these ends was revolutionary. Three years later, in 1997, SchoolNet SA was formally launched, with the support of the national Department of Education.

Partnerships: Since 1997, SchoolNet SA has established partnerships with the private sector, government, non-governmental organizations (NGOs), and the donor community, strategically positioning itself to draw on a wide range of resources from different sectors, while ensuring that it works within government policy and implementation frameworks. The list of accomplishments is long and growing. Of South Africa's 28,000 schools, almost 3,000 are already involved in SchoolNet SA, and at least as many more are involved in various ICT initiatives throughout the country. The organization has trained more than 3,000 teachers and is currently developing an education content "portal" for use by teachers and students. And on an international level, SchoolNet SA is one of the leading projects in a broader SchoolNet Africa initiative, which involves school networking projects in up to 23 African countries.

To support its vision, SchoolNet SA has attracted funding from the Open Society Foundation for South Africa (OSF) and the World Bank. Through program initiative, the International Development Research Centre (IDRC) provides core funding and houses the organization. ICT companies such as the Telkom Foundation, Nortel Networks, the Internet Solution, Simeka TWS-IT, Sun Microsystems, and Microsoft provide in-kind contributions including computers, software, Internet connections, ICT training, technical visits to participating schools, free publicity, and the sponsorship of competitions. (Some of these companies also fund SchoolNet projects.) "

ICT-Supported Distance Education in Indonesia : An Effort to Enhance Student Learning Satisfaction and Course Completion Rates[101]
"Commencement Date 15 October 2001, Completion Date 15 October 2004, Abstract:
Universitas Terbuka (UT), the Open University of Indonesia has a current enrolment of 350,000 students, a high proportion of whom are dispersed throughout the country's poor rural areas. This Project will enable UT to:
- innovate and experiment with a new systems design for ICT-based distance education and generate related institutional policies
- generate and implement web-based teaching and learning processes
- deliver and manage ICT-based distance learning

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[100] IDRC *Acacia* program: stories: www.idrc.ca/acacia/
[101] ICT-Supported Distance Education in Indonesia : An Effort to Enhance Student Learning Satisfaction and Course Completion Rates, project of IDRC's Pan Asia Networking program, from Maria Ng, IDRC-Singapore. See also the powerpoint presentation at: http://www.panasia.org.sg/conf/lao2003/paper/d4-0900-hardhono.pps

- build a new public-private sector partnership with AWARI, the association of WARNET (district-level Internet Kiosks) for providing Internet access to UT's students and

research the impact of these project interventions on student motivation, course completion rates as well as socio-economic transformation within the pilot communities."

Annex A, section 4: "The 'Learning Without Frontiers' programme in Zimbabwe was to help teacher-training colleges contribute to educational reform by upgrading students' IT skills and establishing resource centres for teaching materials. The impact of the project was evidenced in schools that started using Internet resources for teaching - however, some of the problems faced were predictable, such as technical problems and participants' relative lack of experience in using computers."

The Lighthouse Project[102]
"The Lighthouse Project is a testing ground of even greater changes to the Thai curriculum, with the aim of finding mechanisms to bring knowledge of technological areas -as well as a more global and environmental consciousness- to the Thai people at all levels of education. The Lighthouse Project provides assistance to local communities in a variety of locations throughout Thailand by offering: improved educational techniques, access to new technologies, access to national and international information networks.

A crucial part of the Lighthouse Project is the rapid development of a pilot site that tests out new educational methods based on cutting-edge approaches and uses of digital technology including the Internet. In essence, to create a well documented model for other centres around Thailand to learn from, emulate and adapt."

The Human Development Resource Centre[103]
"UNDP India Country Office has established a dedicated virtual centre of excellence - the Human Development Resource Centre (HDRC). You can visit the centre at http://hdrc.undp.org.in. The HDRC's core objectives can be summed up as: help move HDRs from analysis to action; strengthen networks for HD advocacy and public education using IT; sensitize national/state/local leaders, especially women, about the tools and techniques for translating data and analysis in HDRs into policies and programmes; provide mechanisms by which citizens can be assured of transparency and accountability based upon right to information. Facilitate learning from diverse experiences."

Services Available from HDRC: Tools and techniques for preparation of HDRs; strategies for using HDRs to develop appropriate policies and programmes; curriculum for human development training courses to influence key constituencies in government and civil society; training modules for policy makers and programme implementers. databank of "best practices"; methodological and empirical knowledge base for analysis of issues pertaining to human development appropriate to different context.

Recent snapshots also indicate broader sector wide approaches to the use of ICTs in different education subsectors.. primary, secondary, technical, tertiary...

Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development[104]
"Use of rural radio and teleconferencing education has shown tremendous impact on the lives of children. In Mexico, over 700,000 secondary-school students in remote villages now have access to the *Telesecundaria* program, which provides televised classes and a comprehensive curriculum through closed-circuit television, satellite transmissions, and teleconferencing between students and teachers.

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[102] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/

[103] UNDP: http://www.undp.org.in/ictpe.htm

[104] B. Shadrach and Oliver Wakelin, *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development: http://www.bellanet.org/leap/docs/Shaddy'spaper.doc?OutsideInServer=no*

Studies have found that the program is only 16 percent more expensive per pupil served than normal urban secondary schools, while students benefit from much smaller student-to-teacher ratios. Rural students enter the program with substantially lower mathematics and language test scores than their counterparts at traditional urban schools, but by graduation, they have equalled their math scores and cut the language-score deficit in half. (Source: de Moura and others 1999)."

New Technology Tools for Human Development? towards policy and practice for knowledge societies in southern Africa[105]

"The paper explores the potential interface of technology and education for human development in southern Africa, drawing on the case of Mozambique, and the challenges presented by the global marketplace and by local policy. It links this to the ambitious vision of the New Partnership for Africa's Development (NEPAD) for reducing the digital divide for Africa. Four recent publications form the basis for the discussion in this paper, enriched through direct experiences of knowledge networking in southern Africa by the Southern African Research and Documentation Centre (SARDC), a regional information resource centre committed to the development of information access as a key strategic resource for sustainable socio-economic development."

ICTs in African Schools[106]

"Historic Pan African Workshop Attended by 200 delegates. Gaborone, the capital of Botswana was the site of the first historical meeting of 200 education policy-makers, practitioners and development agencies. The policy-makers and practitioners were from 28 African countries. In total, there were participants from 35 countries internationally. Speakers representing these countries and agencies focused on various aspects of using ICT in the education system in Africa. Key topics covered in this workshop included the potential and challenges of ICTs in African education, integrating ICT use into the curriculum, content and capacity building, appropriate educational technologies in Africa, achieving affordability and sustainability and Pan African initiatives for the future.

President Wade of Senegal, who leads the ICT program of the New Partnership for African Development (NEPAD)… highlighted the idea of "digital solidarity" in bridging the divide between the information-haves and information-have-nots in Africa. President Wade further called for the establishment of a global solidarity fund to support the digital solidarity process… Professor Peter Kinyanjui, the NEPAD Commissioner on e-Schools, reinforced this message. He outlined the thinking of NEPAD regarding the use of ICT in education and identified Schoolnet Africa and the work being done as an important part of the e-schools initiative. He indicated that NEPAD s e-schools program has set the goal of every secondary school leaver to be ICT-literate by 2014.

In closing this workshop, the Honourable Lephimotse Sebetlala, Minister of Communications, Science and Technology, Botswana challenged the workshop participants, as they ended the meeting, to develop sound educational and economic arguments for the use of ICT in the education system. He correctly noted that only with sound and well-argued reasons (with facts and figures), good policies and implementation plans would governments commit funds and the donor agencies and private sector invest. At the end of the five days, participants identified the following initiatives as important for follow-up by Schoolnet Africa and the partners involved in this workshop.

- Policy on ICT in Education with baseline studies - video documentary of continent-wide promising practices, policy documents and statements, implementation plans and research, capacity building seminars for development and implementation of policies.

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[105] Johnson, Phyllis, *New Technology Tools for Human Development? towards policy and practice for knowledge societies in southern Africa* Compare: A Journal of Comparative Education, Oct2002, Vol. 32 Issue 3

[106] Media Statement from *ICTs in African schools: A workshop for education practitioners and policy makers*, organized by SchoolNet Africa, The Commonwealth of Learning, the International Institute for Communication and Development and the World Bank, Gaborone, Botswana, 27 April-2 May, 2003: http://www.schoolnetafrica.net/IAS2003/Workshop.htm

- Building capacity in human resources - including building the pre and in-service teacher training system to use ICT, reports on effective models for teacher training, development of distance learning teacher training courses, training on establishment and management of schoolnet organizations, schoolnet champions and technical training.
- Information sharing via a clearing house - with Schoolnet Africa's Education Knowledge Warehouse being the 'clearing house' where ICT in education policy documents, teacher training models and resources, specifications for refurbished computers, using ICT for different subjects, subject based resources, research into issues like e-rates, using different technology platforms, open source software vs. propriety software, etc will be housed. Other documents and information will include annual reports on the current developments in ICT in Education on the continent.
- Gender - that attention is given to mainstreaming gender issues in ICT in education programs such as engendering ICT in education policy and that specific projects to advance women and girls in education be considered.
- Technology developments - for example the establishment of refurbishment centres as part of job-creation and support to the school system that uses refurbished computers. Also, global advocacy to lobby the private sector to donate refurbished computers at a greater quantity and reduced cost.
- Advocacy - working with governments, institutions and agencies to clearly articulate the value of ICTs to the education system and to the countries economy and society.
- Research - development of a baseline evaluation of prevalence of ICT in schools, evaluation of the impact of ICT on teaching and learning in the classroom, to include the development of open standards for educational software, identifying actual costs and benefits, how to assess and evaluate the use of ICT, using ICT to support learners with special needs, etc.

These projects will be shared by organizations represented at the conference and the conference proceedings and results will be shared with broadly with governments including heads of state."

A Distance Learning Application of the Solomon Islands People First Network (Pfnet) [107]

"This project aims to utilize an existing rural Internet connection through the rural-development and peace ICT initiative PFnet, to pilot a distance learning facility in one of Solomon Islands' rural Community High Schools in partnership with the University of South Pacific (USP) Centre of Honiara.

The People First Network, or PFnet, was conceived and initiated by the UNDP/UNOPS project Solomon Islands Development Administration and Participatory Planning Programme (SIDAPP) in the Ministry of Provincial Government and Rural Development. It has already established a web site development portal, a successful Internet Café, conducted research and field testing of a robust, proven and sustainable technology that permits remote locations on islands across thousands of square kilometres to have access to Internet emails using a simple computer, short-wave radio, and solar power.

Consequently, in October 2001, the PFnet Internet gateway base station was established and the country's first rural community email facility was opened at Sasamungga, Choiseul. This first station is well suited to develop pilot applications of the ICTs in various sectors, including education. It is later intended to expand this network to over 25 PFnet-managed and many more self-funding stations and therefore the pre-existence of good models will be invaluable.

This project will entail the design and application of a distance-learning programme especially designed to integrate with the PFnet facilities. It will create a computing centre at the community school close to the email station utilising existing solar power. Local capacity will be built to sustain the facility working in cooperation with the PFnet programme. The project will also study the impacts of the email station on the wider community, focusing on particular vulnerable groups such as women and young people. In doing so, this project will provide invaluable baseline data for the further

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[107] *Pan Asia Networking Small Grants P*rogram: http://www.panasia.org.sg/grants/awards/

expansion of PFnet to all rural areas of the country, and provide an excellent example of an application serving the needs of one information stakeholder group (i.e. education users and providers)."

Computers in schools: an unaffordable luxury?[108]
"Is there a role for computers in secondary education in the South? While most schools in the world still lack electricity and phone connections, should pedagogy precede technology? What are the costs of ICT provision? What should schools and education planners consider before trying to join the e-revolution? A report from the World Bank and the Department for International Development draws on the limited literature and newly gathered data from South Africa and Zimbabwe to look at the range of costs and other issues affecting computer provision, utilisation, maintenance and staff ICT training in secondary schools. It recommends careful analysis and planning in helping schools to tackle the digital divide.

Proposed benchmarks and ratios for usage and costs are designed to help schools monitor the efficiency of computer provision. The study suggests that if high levels of usage can be sustained the cost of basic computer provision, even where there is no mains electricity, need not be prohibitively expensive. Schools are warned that the cost of hardware and software accounts for only a fifth of the total cost of computer provision over five years. The expense of training teachers, building new premises to house computers, electricity, phone and ISP charges, toners and ongoing external support of servers and networks are often not factored in. Schools are often vulnerable to salesman pushing expensive, state of the art equipment. Schools 'income-generating' ICT activities may fail to make a profit when marketing, planning and management skills are poor.

A major problem pushing the per student cost to unacceptable levels is the low level of usage of existing computing facilities. Actual regular users as a proportion of possible regular users is often between 20-30 percent. School computer labs are generally only open for a few hours a day and community access is not always encouraged.

Case studies provide evidence that:
- Learning how to learn about ICT does not require the latest equipment. Refurbished equipment provided by the UK NGO Computer Aid International and the World Bank's World Links is also helping children become computer literate.
- New software applications can give new life to old computers.
- Telecentres which are open to students and the public increase usage levels.
- The annual cost per student user can be reduced to US$20.
- Wireless technologies have potential to local area networks and wide area networks at a much lower cost than existing wired technologies.
- Telecollaborative learning is a good way to integrate ICT across the curriculum to improve the overall quality of education."

Promoting ICT for Human Development in Asia: Realizing the Millennium Development Goals[109]
"Under the auspices of the Regional Human Development Report (HDR) initiative, supported by UNDP's Regional Bureau for Asia-Pacific (RBAP), the Human Development Resource Centre (HDRC) and APDIP have begun the preparation of a Regional HDR on ICT for Development. This multi-country study aims to assess the ways in which ICT's can be harnessed to best address the key issues of human development as reflected in the Millennium Development Goals. Countries from across the Asia Pacific region, namely, China, India, Indonesia, Malaysia, Mongolia, Pakistan, Sri Lanka, Thailand, and Vietnam will participate in the study."

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[108] A. Cawthera *, Computers in Secondary Schools in Developing Countries: Costs and Other Issues*, Education Research Serial #43, DFID, 2001, funded by: DFID; World Bank, 20 June 2002
[109] *UNDP Asia-Pacific Development Information Programme (APDIP)*: http://www.apdip.net/projects/projects.asp

Finalists from the World Bank managed InfoDev Program (1999-2002)[110]
- A "Vaccine" of educational material - what the doctor orders
- ICT and peace - How could it work in Colombia (Virtual School)
- Street children project
- The African Virtual Library Initiative (AVL-I): The strategy for information management for the Sub-Saharan Africa
- Children and the Internet: an experiment with minimally invasive education in India
- The Use of ICT in South African township schools

5. Science, hi-tech and ICT-sector growth[111]

There are many topics here. Examples start with the ICT sector itself - first national policy and infrastructure, then technologies and initiatives for extension to more remote and poor areas. Illustrations than come back to science and other hi-tech sectors.

Given the importance of ICT infrastructure to all aspects of ICT expansion and diffusion, regulatory and policy issues receive much attention and support.[112]

Liberalisation of Internet Services[113]
"Study on Liberalization of Internet Services" in the Maldives - to help the Government of the Maldives in the Internet service liberalization process by providing expert advice in analyzing the market situation, regulatory requirements, and identifying procedures for international bidding and licensing."

Participatory ICT Policymaking For Poverty Reduction[114]
"(Dr Ramesh VAIDYA) "The ICT policymaking exercise in Nepal was one of the six projects in Asia selected for review recently by the Canadian International Development Research Centre's Pan Asia Networking Programme… In Nepal, to ensure smooth implementation of IT policy, we adopted a participatory process in which the government, private sector and civil society shared a common discussion forum during policy design. In the course of our informal preliminary discussions with the stakeholders-leading IT personalities from the private sector, leaders in the fields of education and telecommunications, and leaders from civil society-we felt that prior to formulating an IT policy, we needed to document the vision and strategies that these leaders in IT and the related fields have in mind. Furthermore, with the increasing potential of ICT for poverty reduction, which is the principal goal of the national development strategy in Nepal, we felt that time has come to synchronize efforts in the ICT area with the national development strategy by developing the IT strategy papers.

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[110] *InfoDev ICT Stories*: summary descriptions areavailable at http://www.iicd.org/stories/
[111] See also
- Jensen, Mike, and Esterhuysen, Anriette, *The Community Telecentre Cookbook for Africa: Recipes for Self-Sustainability*, UNESCO, http://unesdoc.unesco.org/images/0012/001230/123004e.pdf
- Latchem, Colin, and Walker, David (eds.), *Telecentres: Case Studies and Key Issues*, The CommonWealth of Learning http://www.col.org/telecentres/
- *The Change Initiative*, a multi-donor project: http://www.comminit.com/communication-trends.html
- Walter T. de Vries and Sjaak J.J. Beerens*, Economic, Financial and Capacity Aspects of National Geospatial Data Infrastructures*, ITC: http://www.itc.nl/library/Papers/0006.pdf
[112] See also Anders Henton, Rohan Samarajiva and William H. Melody*, Designing Next Generation Telecom Reglation: ICT Convergence or Multisector Uility?*, January, 2003: http://www.regulateonline.org/pdf/wdr0206.pdf
[113] UN ESCAP: http://www.unescap.org/escap_work/ict/
[114] IDRC *Pan Asia Networking small grants Program* (http://www.panasia.org.sg/grants/awards/), article at: http://www.wsis-japan.jp/documents/ngo_02.pdf

However, IT may not be able to play such a role in poverty reduction by mere expenditures in creating the ICT infrastructure. For IT to play its role in the development process, we felt that it would be necessary to move simultaneously in three fronts: (1) to provide universal access to ICT infrastructure at least at the community level, (2) to develop human resources through IT-related education and training opportunities, and (3) to promote IT applications for conducting economic activities, providing social services and delivering government services. For the preparation of strategy papers covering these three areas of critical importance, we formed six consultative groups on (1) universal access to information, (2) information and communication technology infrastructure development, (3) human resources development, (4) software development and IT-enabled services, (5) electronic commerce, and (6) electronic governance...

Experts of international repute in their fields reviewed the strategy papers after they were completed. The review was aimed primarily at confirming the technical accuracy of the papers…All the papers were then published on an Internet website for public review and comment. After the six strategy papers were completed, these papers were carefully studied to see how the government could help to make these strategies a success. This review exercise produced the first draft of the IT policy. The strategy papers and the draft IT policy were then discussed at a National Stakeholders Workshop. 143 people representing a diversity of groups concerned with ICTs attended the meeting. They ranged from gender specialists and development workers Internet service providers and journalists…

After incorporating their comments, the final draft of the IT policy was then presented to the National IT Task Force, and upon its recommendation, it was submitted to the concerned agency, the Ministry of Science and Technology. Subsequently, the Nepal government approved the IT Policy 2000. For the implementation phase, the government has formed the National IT Development Council and the National IT Co-ordination Committee with representation from the government, civil society, academia and the private sector. We believe such a process based on the consensus of IT stakeholders would lead to a "goal congruence" among them and thus facilitate the successful development of the IT sector…"

World Bank Group's (WBG) strategy for the development of the information infrastructure[115]
"This note describes the World Bank Group's (WBG) strategy for the development of the information infrastructure (II) in developing and transition countries… For the purposes of this note, information infrastructure refers to the networks through which information (voice, as well as data or multimedia) travels; it includes telecommunications, the Internet, broadcasting and other information networks. Postal networks are also part of the information infrastructure; they provide a range of services from basic communications and financial services to the delivery mechanism for e-commerce; in many countries, postal systems are among the few public services accessible to the poor.

Strong, widespread and efficient II networks are the underpinning of any knowledge economy, and play an important role in economic development and poverty reduction. Information infrastructure: Is essential to growth; Is necessary to develop a country's productive capacity in all sectors of the economy; and links a country with the global economy and ensures competitiveness. Information infrastructure: Contributes to poverty reduction by increasing productivity and providing new opportunities; Is a vehicle for the efficient delivery of public administration, social and other public services; and Is important for transparency and good governance. The Bank Group supports efforts of developing countries to accelerate information infrastructure sector growth, introduce new services, improve performance, and extend services to more people.

The World Bank focuses largely on providing support to governments in the development of a pro-competitive policy and regulatory environment for the sector and in extending the boundaries of service provision. The Bank uses a range of instruments (primarily loans/credits, grants, learning and

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[115] *World Bank Group Support for the Development of Information Infrastructure, 2002*:
http://info.worldbank.org/ict/assets/docs/GPS.pdf.

analytical work) to, among others: (a) contribute to national ICT strategies and their implementation; (b) support policy reform, including competition and private participation; (c) strengthen the capacity of regulatory institutions; (d) finance, on a limited basis, subsidies leveraging private investment to extend access to ICT services; and (e) promote the use of ICT in the provision of public services, including health and education.

The Bank Group promotes increased competition and private participation in the information infrastructure sector by supporting entry of new service providers, privatization of state enterprises, and more generally by creating conditions that attract direct private investment and facilitate access to domestic and foreign capital markets. For many governments, privatization (or license) proceeds are an important source of fiscal revenue. Governments should, however, not underestimate the considerable direct and indirect revenues generated by increased competition in the sector. The fiscal benefits of increased competition will indeed normally exceed the possible loss of revenue that may result from the absence of protection or exclusivity granted at privatization.

There is no single model of regulation that can be applied to all II segments in all countries. Regulatory design depends in part on the degree of current and possible competition in the market and on political and legal traditions, among other factors. There are, however, some basic and common principles. One is the effective separation of policy and regulatory functions: regulators should be independent from the operators they regulate. The Bank also encourages the autonomy of regulators vis-à-vis government and policymakers. Financial autonomy implies resources that are independent from the vagaries of the budget process, typically through levies on operators. Operational autonomy implies protection from political interference, rules governing conflicts of interest, as well as measures to ensure the regulatory agency is able to attract and retain staff with the requisite expertise.

Regulatory entities typically have a significant role in the areas of licensing, numbering, interconnection and access (ensuring fair competition), protection of consumers, monitoring of operators, and settlement of disputes, to name just a few. Where markets are not yet competitive, regulators may also have an important tariff or price control function. The Bank supports the establishment and enforcement of clear, stable, and transparent regulatory rules and procedures, and encourages openness and public consultation. Telecommunications regulators are often also entrusted with commercial frequency allocation and management, as well as regulation of broadcast transmission and, in some instances, postal services. This broader scope, as well as the use of technology-neutral regulation, greatly facilitate the synergies between converging II segments and services. The Bank supports regulatory capacity building through policy advice, training, technical assistance, and other means.

The market alone may, however, not be able to meet all socially and economically desirable access objectives. The Bank is increasingly involved in advising governments on extending ICT services beyond the market. Services that are deemed necessary for social, development or security reasons, but that are unprofitable even under liberal entry and pricing policies, can be provided to low-income (including rural) population groups through communal facilities (such as telecenters) and/or rendered viable through limited, targeted subsidies. 2 Community involvement provides one of the avenues for reaching poor or excluded customers. Communities are increasingly involved in the design of public access programs (through surveys and participatory design techniques) as well as in the monitoring of such programs, and even in some instances, in the provision of public access through local non-profit organizations. The Bank Group also supports increasing involvement of the traditional (for-profit) private sector in the delivery of access services to excluded groups or communities…

Bank Group financing may be used as catalyst and comfort for private investment in the sector... Priority in supporting access schemes will often go to basic services. Indeed: (i) access to basic information infrastructure services, including broadcast technologies, may be more easily achieved than access to advanced services (such as Internet); (ii) basic services are more relevant to poverty

reduction as they can be more easily used by the excluded, including the very poor and the illiterate; and (iii) basic services have a strong record in promoting development objectives."

Building a Philippine IPv6 Research Network[116]

"The advent of the Internet opened up a rush of information exchange and knowledge sharing, initially to share computing resources between universities but nicely proved to be much more than that. This started in the late 70s but here in the Philippines adoption started only in 1993. Nevertheless, Internet usage in the Philippines now is "everywhere". The academe, government and commercial entities greatly benefit from its ubiquitous presence.

IPv6, the new Internet Protocol, was introduced in 1995, increasing the address size to 128 bits to solve address availability problems in the Internet today. It is a significant improvement to IPv4. At this point, the standard has reached maturity and new applications are just coming out or being developed. However, the Philippines had been slow to adopt this new Internet standard. Because it is a standard, everyone will have to follow it eventually. With the current showing of the Internet reception in the Philippines, we need to start building capability and the knowledge base on this standard now.

The Advanced Science and Technology Institute initiated IPv6 research in the Philippines through AI3. With more than a year of testing and research, the IPv6 group of ASTI are equipped with sufficient knowledge on this new protocol and hands-on experience. This project aims to initiate IPv6 usage and research in the Philippines by establishing test beds in schools particularly state universities supported by the PREGINET Infrastructure. With a test bed in place, transition mechanisms will be explored and the schools will pursue in-depth research on the protocol itself, while sustainability will be supported by PREGINET."

USAID: Madagascar[117]

"USAID continues to play a catalytic role in bringing the benefits of the Internet to Madagascar using past investments from Leland Initiative and additional resources from the Africa Regional Education for Democracy and Development Initiative. USAID helped to extend the capacity of the Internet gateway in the capital as well as to install a high-speed Internet Point of Presence in four of Madagascar's most important secondary cities over the last two years. Establishment of a local Cisco Networking Academy, a campus computer network and Internet connectivity to Malagasy civil society and other partner organizations will be completed in early 2002.

In collaboration with the Africa Regional Office of the Global Technology Network, a local branch for Madagascar was established, with 110 local firms expressing interest in the Global Technology Network program. One firm has concluded a contract with a U.S. company and seven Malagasy firms are actively involved in negotiations. With USAID/Washington funding, awareness workshops on regional and multilateral trading systems and the development of a strategic plan for the Madagascar-U.S. Business Council are underway. USAID/Washington funds also are supporting partial privatization and financial service improvements at the National Savings Bank. USAID will continue to implement cyclone rehabilitation and disaster preparedness activities, for which $20 million in International Disaster Assistance funds was received in FYs 2000 and 2001."

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[116] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/
[117] USAID website: http://www.usaid.gov/country/afr/mg/

Establishing Remote Area Networking through Wireless Radio Modems[118]

"Effective communication networks have facilitated rapid dissemination of knowledge and hence growth in urban areas when compared to rural areas. Even though the majority of the Indian population live in rural areas, the communication facilities in rural areas have still not been upgraded to be on par with urban areas. Due to the lack of exposure to developments in the field of social & sustainable development and cost-effective appropriate technologies, development organisations working in rural areas are conducting their activities through conventional practices with little or no technology input. Increasing the capability of networking between Non-Governmental Organisations and Community Based Organisations through electronic media is one of the options to achieve the goal of spreading development into remote areas.

However the establishment of electronic networks in remote areas has its disadvantages. Unreliable telephone lines and telecommunication infrastructure are some examples. To overcome the above hurdle, this project envisages the establishment of a remote area electronic networking using packet radio modems in 10 remote sites. This is done primarily to enable Community Based Organisations (CBOs), Non-Governmental Organisations and Development organizations working in remote, rural and tribal areas to network with like minded organizations within the region and with national and international NGOs and partner organisations.

The technology to be used will be wireless radios coupled with packet radio modems connected to a sub-host computer running TCP/IP host software. The packet radio network is used for accessing external databases, sharing data, electronic mail, bulletin board services, newsgroups, et cetera by interconnecting a series of such packet radio sub-hosts to the Internet gateway host in Madras. The objective of this project is to bring more development organisations working for the rural poor in remote areas under the fold of electronic networking to accomplish the following:

- Networking of development agencies in remote areas with limited or no access to electronic communications, thus facilitating communities to improve their quality of life for equitable and sustainable development;
- Strengthen the role of NGOs as knowledge brokers through its local, national and international strategic partners and development organisations;
- Promote collaboration in research and development through information access;
- Facilitate use and exchange of information through electronic communications and access to databases and databanks to enable NGOs and institutions to share knowledge across the world;
- Offer e-mail, bulletin board and conferencing services;
- Establish Internet Services and act as an Internet Service Provider;
- Concentrate on networking content for sharing and providing support for regional Internet information hosting in support of distribution and utilization of information arising from research carried out in the region;
- Work in partnership with remote organisations and institutions with relevance to their social development and sustainable development research programmes;
- Deliberate on ideas and contributions through wide consultation and information dissemination, using various means including the Internet, existing networks of individuals, group discussions, et cetera;
- Be receptive to action-oriented solutions to problems in Development Networking applications by utilising Internet and other innovative existing technologies;

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[118] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/. *(prize winning)*. **See also:**
- Establishment of Nepal Internet Exchange
- Standardization of the Nepali Font and Implementation of the Standard in Computers
- Nafees Nastalique-Character-Based Nastalique Font for Urdu
- The Nepal Internet Exchange
- Internationalised Domain Names System (iDNS) for Asian Countries

- Involve experimentations, pilot studies and other practical networking activities using wireless technology that could create replicable results and have potential for application throughout the region;
- Publication and dissemination of practical and accessible project documentation on a regional, national and international level.

Global networking is the strategic direction of most organisations. To some extent the wireless world has a stronger connotation of being global in coverage and at the same time giving local access in remote areas. Introduction of wireless technology for use in remote areas will give organisations access to a worldwide knowledge library and enable sharing of ideas and experiences."

Improving Access to Telecommunications in South Africa[119]
"The Universal Service Agency (USA) is opening telecentres in South Africa to improve access to phone, fax, and computer services among disadvantaged and underserviced communities. The USA is supported by two IDRC projects that aim to assess the impacts of telecentres on local communities, and evaluate their potential role in achieving universal access."

The possibility for countries to emulate India, and develop strong software industries, is a matter much discussed. "Every country's path seems to be different - the best course of action will depend on the resources available (including infrastructure and human resources), on the state of the global software industry at that particular time, and on the country's unique situation, such as languages spoken, regional or cultural ties with major markets, a tradition of entrepreneurship, or an expatriate business community."[120]

The Emergence of Software Exporting Industries in Dozens of Developing and Emerging Economies[121]
"Dozens of nations around the world are trying to be the "next India" – to launch successful software exporting industries. There is enormous excitement around this idea. As guest editor of this special issue, I am very pleased that we have assembled a "first" in this area. While many articles have been written on individual nations' software successes in recent years, this issue represents the first coming together of so many in-depth analyses on this new generation of software exporting industries. In this special issue we probably have the first thorough analyses of the nascent software exporting industries in Iran, Indonesia, Vietnam, and Bangladesh.

In order to attain high quality articles on this relatively new topic, roughly half the articles were written by practitioners. Shirley Tessler, Avron Barr, and Paul Tjia are consultants specializing in this area. Nagy Hanna is a World Bank economist who has been studying the intersection of technology and development for more than a decade. Norbert Bruell and Emmy Gengler live and breathe these issues as senior managers in two software exporting firms. The issue is laid out as follows. I begin with three articles that lay the foundations for the topic. "Taxonomy of New Software Exporting Nations" classifies the many nations involved in software export. "Impacts on National Well Being Resulting from Their Software Exporting Industries" addresses the question of why we care about the software industry more than we care about other industries. "Success Factors" enhances existing frameworks that deal with what nations need to have - or do - in order to succeed.

We then move to in-depth analyses of five nations' nascent software exporting industries. Bangladesh, by Paul Tjia; Iran by Brian Nicholson and Sundeep Sahay; Indonesia, by Norbert Bruell; Ukraine by Emmy B. Gengler; and Vietnam by Shyam R. Chidamber. Finally, the special issue includes two

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[119] IDRC *Acacia Program*: stories: www.idrc.ca/acacia/

[120] Tessler, Shirley, Barr, Avron, and Hanna, Nagy, *National Software Industry Development: Considerations for Government Planners*, in…(next footnote)

[121] Erran Carmel, *The Emergence of Software Exporting Industries in Dozens of Developing and Emerging Economies, Editorial Introduction to special edition, Volume 13* The Electronic Journal on Information Systems in Developing Countries: http://www.ejisdc.org/

broader articles on this phenomenon. The intersection of the software industry and broader ICT (Information and Communication Technology) issues is addressed by Shirley Tessler, Avron Barr, and Nagy Hanna. Christopher Coward shares results from his study of how decision makers in small- and medium-sized American companies decide to venture offshore for software."

Software Export Success Factors and Strategies in Developing and Transitional Economies[122]

"First-Tier Software Exporters: The '3Is'…

	India	Ireland	Israel
Demand	High external demand; weak domestic demand	High external demand; weak domestic demand	High external demand; strong domestic demand
National Vision and Strategy	Vision and strategy present: software services, then climbing the value chain	Vision and strategy present: product-related services for multinationals, then diversification	Vision and strategy present: home-grown product exports, then innovation and differentiation
International Linkages and Trust	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy
Software Industry Characteristics	Some competition; clustering and collaboration	Some competition; clustering and collaboration	Strong competition; clustering and collaboration
Domestic Input Factors/ Infrastructure	Strong, low-cost human capital; catching-up in telecoms; access to capital; limited R&D success	Strong human capital; strong telecoms; access to capital; some R&D base	Strong human capital; strong telecoms; access to capital; strong R&D base

..Assessing Second-Tier Software Exporters..

	Russia	The Philippines	China
Demand	High external demand	High external demand	High external demand; high domestic demand
National Vision and Strategy	*Vision and strategy absent*; some software services focus	Some government strategy present: IT-related services	Strategy present: software overall
International Linkages and Trust	Diaspora-based links. *Lack of trust and knowledge; high levels of piracy*	Diaspora-based links. *Lack of trust and high levels of piracy*	Diaspora-based links and Hong Kong interface. *Lack of trust and high levels of piracy*
Software Industry Characteristics	Some clustering	Some clustering	Some clustering
Domestic Input Factors/ Infrastructure	Significant, low-cost technical human capital. *Poor finance, marketing and telecoms; few English or higher-level skills*	Significant low-cost human capital; strong cluster-based physical infrastructure. *Weak general infrastructure*	Significant low-cost human capital; some physical infrastructure. *Poor finance; few English or higher-level skills*

..Conclusions

Having analysed the experiences of three major DTE software exporters, and three second-tier exporters, what can we conclude? In a general sense, the software export success model has proven

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[122] Heeks, Richard and Nicholson, Brian, *Software Export Success Factors and Strategies in Developing and Transitional Economies,* Development Informatics Working Paper No. 12, Institute for Development Policy and Management, University of Manchester: http://idpm.man.ac.uk/wp/di/di_wp12.htm

useful as a way of understanding the experiences of developing and transitional economies. It offers a template against which to analyse national strengths and weaknesses. It also offers some more general guidance for countries seeking to increase their software exports. This guidance will be summarised below, under four main headings. In all areas, the role of government is seen to be crucial. Some neo-liberals, of course, dispute this. They argue that governments should not intervene in industrial development, and they particularly identify the risks, costs and market distortions of having the state try to pick sectoral winners (O'Keeffe 1992, Jackson 1998). Others, however, see government as always having played an essential interventionist role in industrial development (Lipsey 2000). The value of such a role is emphasised by almost all analyses of software export development in DTEs (e.g. Press 1993, Correa 1996, Heeks 1999).

National Vision
The importance of vision in software export success has been identified above. Vision is not something that can necessarily be catalysed from outside. The most successful software exporters have had it – and sustained it for many years. The least successful have not.

National Strategy: Demand and Markets
Overall demand, as noted, is high in all the software export segments populated by developing and transitional economies. Nevertheless, the countries surveyed have tended to focus (at least initially) on particular market segments. To understand this, we need to move beyond the initial simplistic analysis that divided output markets into two: software products and software services. On the basis of the cases presented above (plus the work of Apte (1991) and Correa (1996)), we can now move to a somewhat more sophisticated model, as illustrated in Figure 2.

Addressing the other output market dichotomy – of exports and/or the domestic market – there are some who argue the importance of the domestic market; seeing, for example, that a strong domestic market should precede and link to software exports (Schware 1992). While true for *product* exports in the cases studied above, *services* exports seem able to grow with few domestic market linkages. This can also be turned around. Unless a DTE has a strong and demanding domestic market with viable international linkages, and some synergy between the domestic market and export opportunities, it should stick to service rather than product exports.

Early Entrant Strategies
To judge from the experiences of the 3Is, early entry into software export markets reaps considerable rewards. These first movers have been able to build up contacts, policies, knowledge, infrastructure, working methods, track records, etc. They therefore threaten to consolidate their position whilst squeezing late-comers. However, despite the benefits of early entry, countries that are already software exporters have latterly felt the challenge of competition, and other factors such as rising labour costs and the brain drain. For those countries that are already software exporters, then, what strategies are open? Their strategies may include:

Value Addition
Movement up the model in Figure 2, from data services through software services to software products, represents value addition, with ever-increasing earnings per employee. The importance of making such moves derives from competition. New company and national entrants tend to move in at the bottom end, putting pressures on existing countries and firms to move up. What we have seen from the cases is the capacity of national software industries – via individual firms – to move within market segments. India particularly has at least partly moved on from its bodyshopping origins to the management of whole software projects. What has been less clear is the ability of industries to move between segments. India's inability to gear up from services to products has been marked. Behind the presented image of software, Indian firms have also been widely involved in data services (The Economist 2001); but relatively few have crossed over into software. A question mark therefore remains over the ability of countries like the Philippines to move from low-value data services to higher-value software services.

Diversification
An alternative strategic option for established players is diversification – moving away from competition or growing constraints in existing market niches into new market niches. Examples of this can be seen in all of the countries surveyed – both diversification of output type and of market location – suggesting it is a viable approach. On the other hand, one may also be struck by the difficulties of diversification. Despite years of dependency awareness, India still relies mainly on service exports to the US market. Israel, similarly, still depends heavily on products. Perhaps diversification within market segments is easier than diversification into new market segments.

Innovation
As well as developing new niche products, countries involved in significant product exports have also tended to make use of innovation: bringing out new products in existing niches.

Late Entrants
The majority of developing and transitional economies are not early entrants into software exports. The strategies above therefore represent lessons for years to come. Instead, they are – or will be – late entrants that face the uphill task of competing against established players.
Some generic late entrant strategies – such as faster delivery or better quality or product differentiation/innovation – seem unlikely to offer a way forward. A few individual late entrant firms may use them, and they can give food for thought to particular exporters. However, they have not clearly been used by late entrants at a national level, and domestic input factors are unlikely to be supportive. Countries must look elsewhere, to two other generic late entrant strategies:

Low Cost
The three second-tier late entrants, and many late entrant firms within 3I and other countries, have at least partly adopted the low cost strategy. This strategy is rare in products – low labour cost advantages are eroded by high marketing costs. So low cost has worked mainly in software services through the use of cheaper labour than that offered by existing exporters, all of whom suffer from rising labour costs. For those whose wage structures permit, it is straightforward and simple. However, its effectiveness is questionable. As noted above, low costs typically rank below availability of skills and other factors in client rankings. First movers can also play the same game: when demand dropped in 2001, so did the prices charged by Indian firms, halving in some cases (Field 2001).

Market Niche
All three late entrants have also at least partly adopted the market niche strategy. They have identified areas in which DTE competition is weak and in which – thanks to domestic input factors – they are strong, and moved in. Examples include strong scientific and technical skills in Russia, work with Chinese language software for China, and offshore data entry work for the Philippines. Other budding entrants can therefore also scan both markets and domestic input factors (plus factors such as international linkages) to look for areas of potential strength. Moving into niches is as much a first mover as a late entrant strategy, and can bring with it many of the benefits of being first.

National Tactics: Infrastructure
No strategy will work unless the domestic infrastructure for software exports is supportive. Within their strategies, DTEs must therefore also devise a set of tactics to deliver that supportive infrastructure. These have been discussed above, and tactics specifically for national governments are summarised in Table 3.

Factor	Possible Promotional Interventions
People	General education at primary to tertiary levels; Specific further and higher education and training in IT- and software-related skills/knowledge; Investment/subsidies for research and development; Encouraging diffusion of best

	practice
Technology	Investment in telecommunications infrastructure; Encouraging/facilitating greater involvement of private and foreign investment in telecommunications; Reduction of tariff barriers on IT imports
Money	Investment in and facilitation of venture and working capital funds; Encouragement of foreign investment
Information	Investment in freely-accessible market research; Subsidised marketing activities
Innovation	Investment/subsidies for commercialisable research and development
Other	Investment in transportation and utilities; Reduction in bureaucratic procedures

Table 3: National Government Tactics to Support Software-Related Infrastructure

National Tactics: Linkages and Competitive Clusters
What can countries do to build the international linkages that are so vital to software exports? Four main actions suggest themselves:

- Make it easier for people to get out: reduce the red tape and other restrictions on movement of professionals to other countries.
- Encourage people and money and ideas to come in: this will particularly focus around creating a climate conducive to foreign investment, through tax incentives, liberalisation of financial controls and investment limits, and reduction in other bureaucratic overheads. It will also include stronger contacts with nationals overseas, and the use of workshops, seminars and the like to get ideas into the country.
- Facilitate relationships: investment in both general and specific meetings both in-country and overseas that can help build trade relationships.
- Build trust: address the perceived risks of software exports. Issues like regional instability may be outside institutional control. However, measures that can be taken include new legislation (e.g. on software piracy), and subsidies for ISO9000 accreditation.

What can DTEs do to encourage the competitive clusters that help software exports succeed? For some countries – akin to the India of the 1970s and the Russia/China of the 1980s – some liberalisation may be beneficial, freeing software firms from unnecessarily burdensome central restrictions and regulations. More important will be investment in specific locations. Ideally, this should follow the 'organic' rather than 'inorganic' model. That is, governments should seek to strengthen existing clusters and proto-clusters rather than create new, artificial clusters, some of which have a history of costly failure."

Not a great deal of literature has been found on the role of ICTs in stimulating science and other high-tech developments in less advanced countries, and somewhat more on ICTs in research more generally.[123] A few of the notable exceptions…

Biotech's yin and yang[124]
"The Beijing Genomics Institute's industrial-scale sequencing operations played a key role in the international Human Genome Project, making China the only country in the developing world to have joined in. As of December 2002, China's economy may be booming on the back of manufacturing. But the government wants future growth to come more from high technology and knowledge-based industries. So, between 1996 and 2000, the central government invested over 1.5 billion yuan ($180m) in biotechnology, as part of its main programme to kickstart the sector. Between 2000 and 2005, it plans to invest another 5 billion yuan. Biotechnology is flowering in 300 publicly funded laboratories and around 50 start-up companies, mainly in and around Beijing, Shanghai and Shenzhen."

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[123] See also Tilak, Jandhyala B. G.., *Knowledge Society, Education and Aid*, Compare: A Journal of Comparative Education, Oct2002, Vol. 32 Issue 3
[124] *Biotech's yin and yang*; Economist, 12/14/2002, Vol. 365 Issue 8303

Annex A, section 4: "A project has been documented, for electronic networking of the research community in Ethiopia, where the major challenge was in the selection of appropriate hardware that could work with poor telephone lines, and the major benefit was the development of a new 'tool' that would not attract the high communication costs associated with fax, telephone and other conventional systems."

Intellectual property and the Internet - new commission to explore the effects on developing countries[125]
The UK Department for International Development has set up a commission to study the role and impact of intellectual property regimes in developing countries with Internet related issues as one focal area of the work programme. An international panel of experts will undertake consultations with various stakeholder over the next months and present its findings in spring 2001. Meeting documents and background material are made available online and feedback is explicitly encouraged.

It is clear also that changes are taking place in research systems also, and that ICTs are both contributing and responding. For example, "Since 1981, a fundamental shift has occurred. A majority of all R&D in the United States -- a growing majority is now sponsored, financed, and performed by private enterprise. Currently, the private share is up to 70 percent of the national total." [126]

- While university and government departments are still prominent in the sciences underling the digital and molecular technologies, it would appear that the explosive development of both were mainly private, based on new business models (informal, entrepreneurial, venture-capitalized, scientist-poaching..).
- The biotech sector sprang up in the 1980s before the big pharmaceutical companies could appreciate and embrace the emergent technologies. [127] In many ways, the molecular technologies (basically biotech and nanotech/molecular engineering) are quite different from the ICTs. They are having and promise to have enormous impacts on the fundamental nature of things - living and inorganic. It would appear at this early stage that the diffusion may be mainly in the form of products, with the science and the main technologies (currently mainly medical, agricultural, environmental and computer) remaining more concentrated in private and public hands. They appear to lack the characteristics that caused ICTs to quickly become inserted into almost every area of social and economic activity (eg transactions-costs reducing, untrapping, liberating), but they are fundamentally transforming (of living and inorganic matter) in their potential, and could have greater economic impacts.[128]

6. Livelihoods: agriculture and rural development, SMEs, telework, e-commerce, e-business

Examples are abundant, and those included here are generally arranged from the most micro to more market or sectoral.

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[125] *Commission on Intellectual Property Rights* home page: http://www.iprcommission.org/index.asp
[126] Weidenbaum, Murray, *The Global Economy*, Vital Speeches of the Day, 1/15/2003, Vol. 69 Issue 7
[127] See Cynthia Roth-Robbins, *From Alchemy to IPO: the Business of Biotechnology*, Perseus Publishing, Cambridge Mass, 2000, for an insider's documentary of the sciences and technologies, and actual and soon forthcoming advances in human health, agriculture, environmental management, oceans and space.
[128] Foe example, among dozens of industry targets, "development of micro-organisms that ferment lignocellulose is a major research goal. Lignocellulose.. in wood and paper waste makes up a vast, widespread and largely untapped source of biomass that could be converted to fuel." Eric S. Grace, *Biotechnology Unzipped*, Trifolium Books Inc., 1997. The potential of this and other technologies to supply virtually unlimited and low-cost energy probably has transformative power parallel to and going beyond the provision of virtually limitless and free information; free energy, in economic perspective, is close to free everything.

a. Agriculture and rural/community development:

Annex A: "From Asia, UNDP (2002) gives examples from India on how information technologies have been used in poverty eradication especially in connection with the needs of women farmers. These range from information concerning agronomic practices and farming methods, to information on how to access and use new technologies, or market news and agricultural commodity prices. Other information is on weather predictions and rainfall patterns, recommended crops for the season as well as information on meetings and workshops on relevant issues."

Sustainable Dryland Agriculture by Mahila Sanghams: Andhra Pradesh[129]

"A major area of focus in this sub-programme is in evolving appropriate methodologies to meet the information needs of women farmers. These range from information concerning agronomic practices and farming methods, information on how to access and use new technologies, market news and agricultural commodity prices, weather predictions and rainfall patterns, recommended crops for the season and information on meetings and workshops on relevant issues. Women farmers generally remain isolated from the mainstream of agricultural training, research and development. Their limited literacy levels make it difficult for them to use printed materials and they lack opportunities to participate in formal training programmes. It is proposed to address this issue by processing and disseminating information through a computerised network. In view of the policy support for the development of information technology in Andhra Pradesh, this will be taken up as a pilot initiative in 30 mandals, with UNDP providing funds for 15 centres and the Government of Andhra Pradesh or other donors financing the remainder. If successful, it will be possible to mobilise additional resources to expand the experiment.

In addition to information related to dryland agriculture, the information centres will also maintain a gender-disaggregated village database with basic demographic information, land-holding patterns and income profiles. In addition, the information centres will provide a platform for distance learning through centrally developed interactive learning packages on specific technologies. The centre will also provide simple services like filling in and printing out applications for various government schemes in the required formats, at a small charge. The possibility of building up a computerised biodiversity database at the village level will also be explored."

From the Rural Village to the Global Village[130]

"Of all the projects under the umbrella of the Acacia Initiative in Senegal, the Village Land Management and Rehabilitation Project seems best to merit the label 'revolutionary'. This is not so much because of the technical resources employed, but because of its target community — rural people — and the effort to bring information and communication technologies within reach of people generally left out by traditional modernization policies."

HoneyBee Network in India [131]

"Honey Bee network was established in Ahmedabad with a view to collating information on the ongoing grass-root level knowledge initiatives in India. The network comprising of appropriate technology experts in India now has a database of over 10000 records with information on rural appropriate and useful technologies in an Indian setting. This network of grassroots innovators demonstrates how technological and institutional innovations developed by indigenous and local communities can provide a new way of thinking about issues such as conservation of diversity, generation of sustainable livelihoods and natural resources management, and augmenting income generation and livelihood strategies. As a model of poverty alleviation and conservation of natural

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[129] UNDP: http://www.undp.org.in/ictpe.htm
[130] IDRC *Acacia Program*: stories: www.idrc.ca/acacia/
[131] B. Shadrach and Oliver Wakelin, *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development: http://www.bellanet.org/leap/docs/Shaddy'spaper.doc?OutsideInServer=no*

resources, this programme aims at capitalising on poor people's knowledge, in many cases local innovations that have the potential to lead to inventions of modern science. This programme demonstrates the applications of ICTs in local people's lives by encouraging remote access online multimedia databases of technology innovations through local touch screens for people in remote corners of rural India."

Finalists from the World Bank managed InfoDev Program (1999-2002)[132]
- Nile Perch - Information at the Source of the River Nile; Lake Victoria
- Technical and Commercial Information Centers of the Ecologic Agriculture Sector in Bolivia
- AKASHGANGA - higher profits for the rural milk producers
- TaniNet: An Internet-based System for the Agricultural Community

FOOD/IndiaShop: [133]
"To explore whether E-commerce can prove to be a source of income for women cooperatives and non-profits working in rural areas. Through this to also see if they can train educated unemployed youth to function as E-marketers to promote products online and obtain a sustainable source of income for themselves. The project has explored using "e-marketers" to set up a mechanism for ecommerce of handicrafts. While the project has made sales through e-channels, it faces many of the challenges of e-commerce faced by the world in general. The case is an interesting study on how new intermediaries can assist the rural poor."

Nine states to get Internet kiosks with cotton focus[134]
"The Hyderabad-based ikisan.com and the Electronics Corporation of India Ltd will set up 100 Internet kiosks in nine cotton-growing states in the country. The Electronics Corporation of India Ltd (ECIL), along with ikisan.com which is being promoted by the Hyderabad-based Nagarjuna Group, is planning to set up 100 Internet kiosks in nine states under the Technology Mission on Cotton (TMC). The kiosks are specially designed to facilitate agribusiness portals, with cotton as its main focus. The project, which has the backing of the World Bank, will be completed within 18 months. ECIL will provide voice interactivity and other technical inputs. ikisan.com will play a major role in developing content and training technical personnel to manage the agribusiness portals.

The Internet kiosks will be set up in the cotton-growing areas of Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Gujarat, Madhya Pradesh, Haryana, Rajasthan and Orissa. www.ikisan.com is contributing Rs 1.4 crore out of an estimated cost of Rs 2 crore. According to officials of the Nagarjuna Group, ikisan.com has already set up around 100 Internet kiosks in Andhra Pradesh. These agribusiness portals deal with various crops grown in the state. The kiosks to be set up under the TMC will focus only on cotton. The officials said that ikisan.com, launched three years ago, had extensive data on various crops and had developed a suitable model for Indian conditions. The model is based on direct interactions with farmers to understand their needs for viable agricultural operations."

Annex A, section 4: "A project has been utilised in Ghana with a focus on how ICTs can support small and medium scale farmers to increase their revenues and improve their farming practices by making it possible for them to access information on regional market developments and international agricultural know how."

Annex A: "… Chaparro (1999) reviews the initiatives and plans of the Global Forum on Agricultural Research (GFAR), an initiative to promote a *Global System for Agricultural Research* based on cost-effective partnerships and strategic alliances among the key players involved in agricultural research.

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[132] *InfoDev ICT Stories*: summary descriptions areavailable at http://www.iicd.org/stories/

[133] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[134] The Hindu Business Line, April 25, 2003: http://www.digitalopportunity.org/cgi-bin/index.cgi?root=2822&url=http%3A%2F%2Finfochangeindia%2Eorg%2FItanddItop%2Ejsp%3Fsection%5Fidv%3D9%232152

The forum states that in order to take advantage of the opportunities created by the new ICTs, it is necessary to develop an ICT capacity in the NARS (National Agricultural Research Systems) of the developing world. It includes some complementary aspects which are widely listed in most references, such as: infrastructure development, Internet access, acquisition of ICT skills and human resources (training). The author believes that the most important ingredient in building up an ICT capacity has to do with strengthening information management know-how and addressing cultural changes."

Application of Distance Learning Technologies to Human Capital Development in National Agricultural Research Systems[135]
(International Rice Research Institute) "The world will need a great deal more rice-about 60 percent more than today's global production-to feed the extra billions who will rely on it within the next 3 decades. Highest growth in demand will be in areas of pervasive poverty and malnutrition, predominantly South and Southeast Asia. Such an increase in production simply cannot be achieved with today's rice-growing technologies and farm management practices.

Those responsible for the development of these urgently needed technologies of tomorrow are the agricultural scientists of today. Their success will depend upon the knowledge, skills and attitudes that they can bring to bear on the problems and their ability to work collaboratively with international research organizations as well as colleagues in other countries. Properly applied, modern information and communication technologies can greatly increase NARS's access to information and training resources. To adequately apply these new tools, however, will require major efforts in the development of suitable training materials, improving the availability of appropriate hardware both at IRRI and in the training units of our partners, and training of NARS and IRRI staff.

Information technologies used/tested:
Channels and approaches to be evaluated include Internet video-conferencing and Web-based training applications. NARS would increase their abilities to utilize existing Internet infrastructure and technologies for training and information/resource sharing.

Expected results:
- A model for the utilization of Internet-based technologies to support training activities and improved communications and information sharing between IARCs (International Agricultural Research Centers) and NARS.
- Capacity within IRRI and NARS to conduct two-way video and audio lectures and meetings using PC-based (desktop) video-conferencing technology.
- Capacity for IRRI to develop and then offer asynchronous Web-based training courses.
- Opportunity for NARS to take advantage of learning resources available through the Internet.
- Capacity at IRRI for web-based publishing."

There are in addition massive resources on every aspect of agriculture on the Internet.[136]

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[135] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/. See also
- Info-Country: ICTs Serve for Agricultural and Rural Development in a Prototype County (China)
- Beijing-FarmKnow
[136] For example CGIAR/FAO/Hunger-Web/SAN/USDA/WFO at http://users.erols.com/jonwill/farming.htm

b. SMEs, telework, e-commerce, e-business and other[137]

TABLE 1. GLOBAL B2B AND B2C E-COMMERCE SPENDING BY REGION, 2000 AND 2005

Country Region	2000 B2B Value ($B)	Share (%)	B2C Value ($B)	Share (%)	Total Value ($B)	Share (%)	2005 B2B Value ($B)	Share (%)	B2C Value ($B)	Share (%)	Total / Value ($B)	Share (%)
United States	117	41%	44	60%	161	45%	1,561	36%	256	36%	1,817	36%
Western Europe	57	20%	13	18%	70	20%	1,465	34%	253	36%	1,718	34%
Japan	69	24%	6	8%	75	21%	504	12%	75	11%	579	11%
Asia/Pacific	13	5%	6	8%	19	5%	516	12%	83	12%	599	12%
Canada	11	4%	2	3%	13	4%	135	3%	23	3%	158	3%
Latin America	5	2%	1	1%	6	2%	71	2%	9	1%	80	2%
Rest of the World	10	4%	1	1%	11	3%	77	2%	8	1%	85	2%
Worldwide	282	100%	73	100%	355	100%	4,329	100%	707	100%	5,036	100%

Source: International Data Corporation

Annex A, section 4: "The most oft-cited example of a success story is that of the Grameen bank, where village pay phones VPPs can turn telephones into production goods, especially by lowering transaction costs, so that services originating from telephones in villages are likely to deliver significant benefits to the poor; VPPs have perceptible and positive effects on the empowerment and social status of phone-leasing women and their households, and also offer additional non-economic benefits such as improved law enforcement and more rapid and effective communication during disasters."

Annex A, section 4: "Small-scale artisans from the remote parts of Middle East and North Africa Region who have traditionally crafted high quality products using traditional techniques, faced the problem that their knowledge is disappearing and attempted to reverse the trend by using Virtual Souk, an e-commerce initiative that has created opportunities for these artisans."

India Shop website with full e-commerce on-line transactions capabilities[138]
"Project outcome 100 e-marketers comprising 22 to 30-year-olds who have just completed college education. Women make up 40 percent and men 60 percent of this total.
Sales of an average of $2,000 USD per month at the India Shop website.
About 1,800 products crafted by 40 artisans being offered for sale worldwide at India Shop.
• Ericsson Internet Community Awards 1999 Finalist, Golden Web Awards 1999."

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[137] See also:
- the DFID funded *Big World* website, *eg An annotated list of key on-line sources which focus on how ICTs are being used to benefit SMEs*: http://www.big-world.org/links/57.asp
- Richard Duncombe & Richard Heeks, *Information and Communication Technologies and Small Enterprise in Africa Lessons from Botswana: http://idpm.man.ac.uk/ictsmefa3.html*
- Heeks, Richard, and Duncombe, Richard, *Information, Technology and Small Enterprise: A Handbook for Enterprise Support Agencies in Developing Countries,* IDPM, University of Manchester, UK: http://idpm.man.ac.uk/esahbk.htm
- Narayan, Deepa, and Shah, Talat, *Connecting the Local to the Global: Voices of the Poor*, World Bank Institute http://www.worldbank.org/poverty/voices/globcoal/dec00/narsha.pdf
[138] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/. See also:
- Direct Marketing From Artisanal Clusters Through Internet
- Leveraging Information Communication Technologies (ICT) Through Weekly Market Centres for Tribal (Indigenous) Communities.

Finalists from the World Bank managed InfoDev Program (1999-2002)[139]
- Creation of job opportunities for the economically & socially deprived women in the IT Industry
- Rwanda Rural Rehabilitation Initiative
- Sole Comfort Dot-Com: Bridging the Global Income Gap Through Hard Work, Quality Sandals, and ICTs
- CESAR - The enterprise factory
- Computers and Cakes give Confidence and Cash to Peruvian Housewives
- The Virtual Souk: e-commerce for unprivileged Artisa

Annex A, section 4: "The Digital Economy event (UNCTAD, 2001) focused on the new opportunities that ICTs are opening up for economic diversification and growth in the LDCs, and includes a series of presentations on successful e-business initiatives developed in LDCs in three sectors, namely products and services, teleservices, as well as e-commerce infrastructure facilities; the presentations were from Canada, Ethiopia, Uganda, Togo, Ghana, Nepal and Bangladesh (Grameen Bank example)."

Annex A, section 4: "One of the only researched studies found, which relates to ICTs and small enterprises (Annex I, section 4) was conducted by Duncombe and Heeks (1999). The study was done in Botswana, where the authors found that investment for Internet access was significant in terms of initial financial outlay, running costs, time and skills. Such investments need to be accompanied by significant benefits in terms of the frequency of use and the quality of the information provided. It was clear that only in specific sectors – such as technical services, the IT sector, and travel and tourism – could benefits of information access be achieved. These are all sectors that require regular access to information and/or software across borders."

Big World[140]
"Big World is currently being funded by the UK Government's Department for International Development (DFID) to conduct two pilot research projects. The first focuses on how young men and women in the South African townships of Soweto, and shanty areas of Mexico City, can benefit from Internet access from community telecentres to help them find jobs, develop skills, and empower their communities. The second is working with two networks of craft producers in India and Bangladesh (representing over 5,000 individuals) to see how they can use the Internet and e-commerce to sell their goods and support their families."

Digitally Empowered Development[141]
"If a rural telephone program can work in Bangladesh, one of the world's poorest countries, why not everywhere? And why stop with simple phone service, when a digital network can also provide e-mail or Internet access or a host of other services? Other experiments are already exploring such possibilities. They include LINCOS, a joint venture of the Massachusetts Institute of Technology Media Lab and a Costa Rican foundation, which transforms abandoned shipping containers into digital community centers with Internet access and places them in remote villages throughout Central America. The centers provide education, health, and financial services, as well as access to entertainment and telecommunications. Many of the services are supplied by commercial partners. Meanwhile, TARAhaat, an ambitious business start-up organized by a widely praised Indian group called Development Alternatives, aims to create jobs and provide a broad suite of services for poor communities in rural India through village kiosks and Internet-based information systems linked to a digital network.

E-commerce can also be tapped for social purposes. In Argentina, a novel public-private partnership will soon supply affordable Internet access and educational services from the Education Ministry,

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[139] *InfoDev ICT Stories*: summary descriptions areavailable at http://www.iicd.org/stories/
[140] http://www.big-world.org/projects/
[141] From Hammond, Allen L, *Digitally Empowered Development,* Foreign Affairs, Mar/Apr2001, Vol. 80 Issue 2

bringing the country's schools and some ten million students on-line. The costs of the system and of student access are being financed by a new private company that will raise money from advertising and e-commerce rights. The combined effort will train the workers (Internet-savvy college graduates) that Argentina needs to enter the virtual economy and jump-start the country's e-commerce marketplace, all without massive public investment. Such a program could be cloned rapidly in many emerging markets.

Other experiments abound. Viatru is an Internet commerce site that pairs artisans in developing countries with commercial retailers in the United States. The venture helps artisans match colors, styles, and products to retailers' needs, while helping retailers find reliable suppliers and facilitating the transactions between them. By aiding artisans in finding markets, Viatru is helping create sustainable livelihoods and boosting incomes. Similarly, an e-commerce Web site called Greenstar sells digitized music and paintings by indigenous artists in developing regions. By providing information about local musicians or artists, the site helps record and preserve local cultures, many of which are endangered. Revenues from the venture support a solar-powered digital community center in a village within the region."

E-Commerce And Poverty Alleviation In South Africa[142]

"In short, e-commerce does hold potential for supporting local economic development, but only if issues of trust, support and business growth are dealt with as well as technical infrastructure and skills. However, this will have little impact on those in the greatest poverty in the short term."

A report on *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development*,[143] provides a range of examples in other sectors as well as enterprise development, and reviews many impact evaluation approaches and methods. Some examples:

*InfoDes in Peru: "*In Peru, the central co-ordinating unit of the InfoDes project in Cajamarca hosts a customised database containing information about a range of locally appropriate technologies and on trade and business issues. Local entrepreneurs and people coming to market are able to drop in to search these databases for information with help from trained staff. Users of this facility believe that InfoDes demonstrates how the information potential of the Internet can really improve their livelihoods. As most Cajamarcans live in far flung rural communities remote rural access points have been linked to the centre, and a mobile information unit with video links and internet access tours villages to introduce the service. It is through this unit that many poor women and men have got their first taste of modern ICTs and discovered how they can be used to improve their livelihoods."

*InfoBus in Zimbabwe: "*An information systems and needs study conducted by ITDG among small-scale producers and manufacturers of Zimbabwe in early 2000 led to the piloting of two information resource centres, one in a peri-urban locality and the other in a rural location in Zimbabwe. Located in the peri-urban Willowdale area of Harare, the first resource centre, a "BU\$INE\$\$ BU\$" of ITDG aims at identifying and meeting the information needs of small-scale entrepreneurs and manufacturers. Operational since September 2000, this fully mobile BU\$ has facilities such as TV, video, fax, typing, photocopying, telephones, and computers for emailing and Internet browsing. In addition, this BU\$ has a small library containing a database on Appropriate Technology, technical briefs, publications on how to start, run and manage small businesses, and databases and directories of micro-finance institutions."

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[142] Aki Stavro, Julian May and Peter Benjamin, *E-Commerce And Poverty Alleviation In South Af*rica: http://docweb.pwv.gov.za/Ecomm-Debate/myweb/greenpaper/academics/stravrou.html

[143] B. Shadrach and Oliver Wakelin, *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development: http://www.bellanet.org/leap/docs/Shaddy'spaper.doc?OutsideInServer=no*

Technology Development Centres and Technology Resource Centres[144]

"The sub-programme provides a unique opportunity to test, refine and demonstrate projectised models which seek to bring technology and people together. In two States (Madhya Pradesh, Chattisgarh and Jharkhand), a local technology- based institution in each , a CSIR laboratory (RRL Bhopal) and an NGO (SRI Ranchi) act as pivots and mother centres and support a network of twenty block level technology resource and dissemination centres. These centres in turn, provide a functional and participative interface for communities, SHGs and NGOs to acquire and utilise technologies relevant to their needs. Cementing this interface is the use of IT which facilitates and enables rapid exchange of information within the network and upstream between the TDCs and the wider scientific establishment of laboratory and institutions. Under each TDC, there will be ten Technology Resource Centres each, which will all be interconnected through the internet. The activities per se of the TDCs and TRCs are not likely to be IT-related but the IT connectivity will help to exchange and disseminate information."

S&T Entrepreneurship Parks (STEPS) and Technology Business Incubators (TBIS)[145]

"Under this sub-programme, UNDP will support two of the 13 STEPS already established by the Department of Science & Technology in different parts of the country. These are the Indian Institute of Technology, Kharagpur and the PSG College of Technology, Coimbatore. There will also be two TBIS, one at IIT Delhi and one possibly at Annamalai University, Chennai (not finalised as yet). The TBI at IIT Delhi will be heavily IT oriented. Also, all the 13 STEPS, the two TBIS, DST and APCTT will be linked on the internet. APCTT, which implements the sub-programme will create a web site for this purpose. Two NUNVs have been recruited to operate this S&T database."

Developing Countries Meeting E-Business Challenge[146]

"Last week, I participated in a meeting at the Inter-American Development Bank (IDB) to evaluate funding proposals for the Information and Communication Technology (ICT) Innovation Program for E-Business and SME Development, popularly known as ICT-4-BUS, an initiative sponsored by the Multilateral Investment Fund and the IDB's Information Technology for Development Division. As part of the broader regional (and indeed worldwide) effort to create a viable "information society," the ICT-4-BUS program and other pilot plans like it aim to increase the competitiveness, 0productivity and efficiency of micro-, small and medium-size enterprises (SMEs) in Latin America and the Caribbean through expanded access to and deployment of ICT solutions. The hope is that the initial projects to receive funding will serve as a test bed for developing and a means of disseminating region-wide best practices.

As eMarketer has noted before, micro-, small and medium-size enterprises represent an overwhelming percentage of the business population in Latin America and the Caribbean. Yet, they lack critical access to credit and financing, which they need in order to successfully implement e-business solutions. In addition, they require coordination and training, which is in part why the ICT-4-BUS program has targeted non-profit organizations such as trade and professional associations with experience in SME development. Computer literacy and training programs are vital elements that must accompany any infrastructure build-out in order for the pilot e-business projects to have tangible, lasting effects on economic activity and productivity. In addition, governments must do their part to ensure that appropriate legal and regulatory structures are in place.

Although e-business development among Latin American SMEs is still at a relatively early stage, there are some indicators of the market's potential. According to the figures below from AMI-Partners, a research firm that focuses on the small enterprise market, e-business revenues could reach as high as $23.51 billion this year among Latin American SMEs. This is a somewhat optimistic projection, given

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[144] UNDP: http://www.undp.org.in/ictpe.htm
[145] UNDP: http://www.undp.org.in/ictpe.htm
[146] Noah Elkin *Developing Countries Meeting E-Business Challenge[146]*, 5 February 2003, eMarketer. Noah Elkin is a Senior Analyst with eMarketer and the author of the Latin America Online report.

the economic uncertainty that has now gripped much of the region, but it does serve as a reminder that opportunities do exist for micro-, small and medium-size enterprises in the region.

The ICT-4-BUS initiative has emphasized the need to rationalize and integrate the value chains in which micro-, small and medium-size enterprises participate, raise workplace productivity and increase the access of small firms to new markets around the world. It must be noted that even with the most judicious application of best-of-breed technology, a small beef producer in rural Argentina is unlikely to develop into a competitor to ConAgra. However, increased access to ICT can do much to improve quality, raise speed to market and promote collaboration and information-sharing along a given firm's value chain. This, in turn, can have salutary effects in terms of spurring local development.

If an initiative in one small corner of a country, city or industry seems as if it will barely make a dent in the region's tremendous problems of poverty and inequality, remember that it does constitute a starting point which, it is hoped, will produce multiplier effects over time. Information and communication technologies will not provide the solution to every problem, but they are powerful tools, particularly when combined with a quality product or service offering, a sound business strategy and a targeted marketing plan, both on- and offline."

Trade And Investment[147]
Information Technology Development in the Greater Mekong Subregion - To promote the development of the private sector through application of ICT – Main activities
- Trade and Investment Promotion in Pacific Island Countries through Effective Use of ICT - to promote export and attract export-oriented FDI through use of ICT.
- SME-e-commerce - introductory training in various aspects of e-commerce for SMEs in the GMS. A series of national training workshops in the six GMS countries… 2002.
- Capacity Building for Managing Globalization - To build capacity in the area of trade and investment through enhanced application of ICT (for Central Asian republics… 2002)
- Study on cross-border E-services (Mongolia)"

The Reality Of E-Commerce With Developing Countries[148]
"This project report examines the expectations and assumptions behind the drive to invest in B2B e-commerce. It investigates what actually happens in Internet-based e-marketplaces and how developing country firms use the Internet for business. The overall finding is that the main effect of B2B e-commerce is to enhance the relationships between existing trading partners. It provides very few opportunities for firms to find new suppliers or customers."

7. Public sector management and performance, poverty reduction strategies/policies/interventions

E-government systems (eg Malaysia above) are a well developed part of the ICT-development knowledge base. Some countries want to build their own, but there are also many products available, and for less advanced countries, this appears usually to be a more incremental and appropriate approach. Supplying countries can be to some extent chosen from the top e-government countries.

Many countries still lack basic capacities in government, particularly the poorest, and those in conflict and post conflict situations. But after two decades of public sector reform programs and donor support projects, there should now be many countries which could usefully adopt and adapt e-government systems. There is no magic

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[147] UNESCAP: http://www.unescap.org/escap_work/ict/
[148] Humphrey, John, Mansell, Robin, Paré, Dan and Schmitz, Hubert, *The Reality Of E-Commerce With Developing Countries,* March, 2003: http://www.gapresearch.org/production/Report.pdf

in these, but a lot of knowledge and experience embedded in them. Many top e-government countries are knowledge/systems exporters, and have development cooperation programs with grant financing.

Whether built or bought, central e-government systems need to be adapted to the specifics of each case. At the national government level, though, many public functions (tax collection, customs, budget management, human resource management..) are similar in nature across most countries, and it is here that systems can be adopted/adapted from more advanced e-government countries. There is often a 'transparency dividend' also, as information becomes physically much more accessible.

Also at the national/sector level, but much more diverse among countries, are systems for public and social services delivery. Most cited with respect to poverty reduction are education (covered above), health and social protection/security. But more economically oriented public services (infrastructure, transport..) are also important for economic development/growth and poverty reduction.

There appears to be much less development in ICT-government mechanisms for state/provincial governments, and even less for local governments. The community-based mechanisms sketched below, in the areas of health and poverty-monitoring-local-development, are in some ways substitutes and early stages of local government systems where local governments are new or weak. The major decentralization and devolution processes going on in many developing countries suggests that much more attention to ICT support in local government operations would be very valuable.

The lack of well functioning local governments, services and budgets (water & sanitation, utilities, schools…) is a basic difference between more and less developed countries, and is central to the range of poverty reduction investments and interventions that are more finely targeted, and rely on the detailed understanding of poor people and their circumstances that is possible only at local levels.

The following examples look first nationally oriented e-government mechanisms, then at social services - principally health - then at poverty reduction and local development mechanisms.

a. Economic, fiscal, financial, legal etc. management

Estimates and Rankings of e-Government Maturity by Country[149]

Country	Rank*	Country	Rank	Country	Rank
Innovative leaders		Steady Achievers		Platform builders	
Canada	1	New Zealand	9	Japan	17
Singapore	2	Hong Kong	10	Brazil	18
USA	3	France	11	Malaysia	19
Visionary followers		Spain	12	South Africa	20
Norway	4	Ireland	13	Italy	21
Australia	5	Portugal	14	Mexico	22
Finland	6	Germany	15		
Netherlands	7	Belgium	16		
UK	8				

* e-government maturity index ranging from Canada (44%) to Mexico (14%)

- *The tiger and the tech*.; Economist, 02/05/2000, Vol. 354 Issue 8156

[149] Huff, Toby, *Malaysia's Multimedia Super Corridor and Its First Crisis of Confidence*, Asian Journal of Social Science, 2002, Vol. 30 Issue 2 (Figure 2)

ASEAN e-Government Seminar Series[150]

APDIP (UNDP Asia-Pacific Development Information Programme) and the e-ASEAN Task Force, along with ITU's Asia-Pacific Centre of Excellence and the Government of Singapore, are collaborating to organize a series of seminars/workshops on e-Government. At the regional level is the "ASEAN Executive Seminar", which includes representatives from all ASEAN countries. At the sub-regional level, the emphasis is on the Least Developed Countries (LDC) of ASEAN - Cambodia, Lao PDR, Myanmar, and Vietnam (CLMV) - for which there are two seminars, the "e-Government Workshop for CLMV", and the "CyberLaw Seminar for CLMV". At the national level, are "e-Government Strategic Planning Seminars" for Myanmar, Indonesia, and Brunei Darussalam.

Macroeconomic management faces an increasing variety of external and internal shocks. Structural change and adjustment referred mainly to the collapse of public debt and credit in the 70s and 80s, as well as the restructuring of major global markets (OPEC), but now would include financial crises (the 80s and 90s (financial liberalization and the collapse of private debt and credit), trade liberalization, technology change and knowledge transfer, including ICTs, disease (HIV/AIDS) and natural disasters, global conflict and the rise of terrorism. All these impact on the poor in their own right, and managing macroeconomic impacts of all together is very demanding on a core capability in central government agencies and line/operating agencies, timely and accurate data and statistical systems, and good information management and analysis techniques. The cost and poverty impact of mismanaging shocks, or creating them through policy mistakes, are so large that more concerted efforts are no doubt worth mounting in many countries whose capacities remain weak.

Economic Policy Formulation[151]

"UNESCAP Project: Use of ICT in macroeconomic policy analysis and modeling in the economies of Central Asia – to enhance the capacity of member countries to use models such as SAM, SHD and RMSMX for generating policy scenarios or simulations."

Impact Assessment Of Appropriate And Innovative Technologies[152]

"ICTs can improve the efficiency of government through public finance processes by reducing opportunities for corruption. The Automated Systems for Customs Data (Asycuda), developed by UNCTAD, is now used by over 70 developing countries to manage tariff collection and reduce frontier corruption. The system speeds up goods movement, reduces transport expenses, and only costs US$ 2 million to install. (Kenny *et al*, 2000)."

Vital Statistics [153]

"Application of New Technology in Population Data Collection, Processing, Dissemination and Presentation is a UNFPA-funded project executed by the Statistics Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). The project aims at promoting effective utilization of modern technology in population data collection, processing, dissemination and presentation in the countries of the ESCAP region."

Bean counters without borders[154]

"United Nations officials asked Steven Symansky, an adviser in the International Monetary Fund's fiscal affairs department, to assemble a team and assess Kosovo's financial management needs. In situations like Kosovo, a common missing piece is some kind of accounting system--a finance ministry needs one to draw up a budget and manage its finances. FreeBalance workers spent far more time teaching fiscal authority employees how to use not only its software, but also computers-and about the underlying importance of accounting principles."

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[150] http://www.apdip.net/projects/projects.asp

[151] UNESCAP: http://www.unescap.org/escap_work/ict/

[152] B. Shadrach and Oliver Wakelin, *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development: http://www.bellanet.org/leap/docs/Shaddy'spaper.doc?OutsideInServer=no*

[153] http://www.unescap.org/stat/pop-it/index.htm

[154] Mcclearn, Matthew, *Bean counters without borders,* Canadian Business, 12/9/2002, Vol. 75 Issue 23

The New Economy and the Challenges for Macroeconomic Policy[155]

"Abstract: The accelerated introduction of information and communications technology into the economy has created numerous challenges for policymakers. This paper describes this New Economy and then proceeds to examine difficulties created for policymakers. The increased flexibility of the new economy argues against trying to use fiscal policy for stabilization and creates both immediate and long-term difficulties for monetary policy. Immediate difficulties concern the problems associated with estimating potential output when the productivity trend is shifting. During periods of transition, it is extremely difficult to distinguish permanent from transitory shifts in output growth, and adjust policy correctly. In the long-term, central banks must face the prospect of a significant decline in the demand for their liabilities, and a resulting loss of their primary interest rate policy instrument. The disappearance of the demand for central bank money for interbank settlement seems very unlikely, and so this concern seems unwarranted."

Diffusion of Information and Communication Technologies in India: Labour Market Implications for Developing Countries[156]

"Firms, by and large, are yet to realise the full advantages of ICTs in the automobile industry…

- Use of ICTs in the automobile industry has led to reduced need for jobs in certain areas like documentation, inter-departmental communication, data processing and similar clerical work apart from losses due to automation in the shop floor.
- However, this reduced need has not resulted in lay-off of employees due to strong institutional protection to employees in these firms.
- As a result, different firms, depending upon their growth, product market conditions and management, rely on different strategies to offset the changing labour requirements.
- While some jobs do require more skills with the use of ICTs, some have witnessed reduced skill content hinting at a possible skill polarisation.
- Given the lack of codification of business processes and procedures, in all the firms studied, the possibility of disintermediation, ie, removal or decline in size of middle management in the near future is remote.
- The marginal presence of women employees in the auto industry implies that ICT diffusion in traditional manufacturing really does not affect them.
- In the call centre industry, women are employed in almost equal numbers. The age profile is however mostly confined to the 18- 25 group, with almost all of them unmarried.
- In terms of salary levels, employee respondents opine that given their formal qualifications, employment in call centres is a better option compared to alternate sites of employment.
- Though some report fatigue and symptoms of Repetitive Strain Injury (RSI), many claim to enjoy their work as it gives them an opportunity to interact with other human beings. All of them concur that constant monitoring of their work induces lots of stress.
- No obvious differences in career mobility or salaries drawn between men and women are observed. Nevertheless, many women respondents state that it will be difficult for them to continue with such work after change of marital status.
- Scope for mobility is however restricted due to the small number of high-end jobs in the call centre industry."

b. Sectoral policies (especially health) and social services delivery

As for education, initiatives to diffuse ICTs in health and medicine have been numerous and diverse, and directed to varying degrees at poverty and the poor. Examples are again arranged approximately from the more

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[155] Cecchetti, Stephen G., *The New Economy and the Challenges for Macroeconomic Policy,* National Bureau of Economic Research Working Paper 8935 Issued in May 2002: http://www.nber.org/papers/w8935

[156] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/

to the less micro. It is recognized that health and education services are not all public; but the focus of most of the cases/examples found is on the public sector side.

HIV/AIDS and Information and Communications Technologies [157] The IDRC funded report on HIV/AIDS and ICTs reviews literature and 6 projects involving learning centres, meeting information needs of organizations fighting AIDS, public discussion and knowledge bases for it, telemedicine or the delivery of quality diagnostic and consultative services at distance to disadvantaged communities, community health development and networking among communities, and training of field workers. The report suggests many further ways in which ICTs could support efforts to HIV/AIDS and deal with its consequences.

New Challenges and Opportunities? Communication for HIV and Development[158]
"Description: This paper challenges the conventional wisdom in sectoral communication strategies by pointing out the opportunity for communication experts to collaborate with development sector and HIV/AIDS experts in devising effective communication that addresses root causes related to HIV epidemics and development. By creating effective and innovative ways to communication the development links with population movement and HIV vulnerability, hopefully it would effectively advocate the need for truly development responses to complement current programmes and responses."

Annex A, "ICTs are seen as a potential tool in the global response to the HIV/AIDS pandemic because they offer the feasibility, at relatively low cost, of providing access to information and knowledge for those working on the problem and for those who are suffering from the disease or its effects. Those who need to take preventive actions can also benefit from the information. However, there are some who are concerned that scarce resources will be spent on technology rather than on the critical needs of basic infrastructure and that inappropriate attention to ICTs may actually be negative for developing countries and for the poor."

Is the Internet Relevant to Addressing HIV/AIDS in Poor Countries? [159]
Abstract: Iss*ues*: Addressing HIV/AIDS requires delivering timely, multidisciplinary, credible information to a multisectoral audience living/working in some of the world's poorest, least-wired countries. Low- and middle-income countries account for about 81% of the global population, 95% of those infected with HIV, but just 5% of the world's Internet users—constrained by poverty; high connection charges; limited bandwidth; online monitoring/censorship; and language, literacy, gender, and cultural barriers.

Description: Despite these constraints, many working in HIV/AIDS in poor countries are already benefiting from the Internet and e-networking. Cheaper email-only services, falling dial-up costs, and burgeoning numbers of cybercafes/public kiosks are increasing the number of subscribers. The number of African computer users grows by 20% each month, and high-speed, broad-band service is being piloted in China, India, Indonesia, and Thailand. Initiativesto provide poor countries access to online scientific data are growing.

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[157] Libbie Driscoll, *HIV/AIDS and Information and Communications Tech*nologies, IDRC, November, 2001: http://www.idrc.ca/ACACIA/HIV_AIDSfinaldraft.PDF. The projects are World Links (World Bank), Centers of Disease Control Zimbabwe, Health InterNetwork, IDRC Telemedicine Project, Uganda, AfriAfya, RAISA South Africa.

[158] du Guerny, Jacques and Hsu, Lee-Nah, *New Challenges and Opportunities? Communication for HIV and Development*, The Drum Beat, an email and web network from the Communication Initiative Partnership (Rockefeller Foundation, BBC, Panos, WHO, etc.): http://www.hiv-development.org/publications/Challenges.htm

[159] Lisa Garbus, Manju Chatani, Laurence Peiperl, Tim France, *Is the Internet Relevant to Addressing HIV/AIDS in Poor Countries?*, AIDS Policy Research Center, University of California San Francisco and Health & Development Networks, Chiang Mai, Thailand: www.ari.ucsf.edu/pdf/Posters/barcelona/garbus.

Lessons Learned: Information and communication technologies are facilitating South-South/South-North knowledge sharing, increasing the number of people involved in HIV/AIDS policy dialogue, promoting partnerships and networking, improving access to and quality of information, and increasing accountability and transparency in decisionmaking. E-networking, CD-ROMs, and wireless technology may bring millions more to the same virtual international HIV conference table.

Recommendations: Pursuing a multimedia approach and ensuring creation/management of online HIV/AIDS content in the South are vital. In pursuing connectivity and the freedom/ability to access high-quality information, the South is confronting many of the same issues the HIV/AIDS epidemic poses: socioeconomic development, governance, and participation of civil society and marginalized communities. Rather than wait for connectivity and access to reach critical mass in poor countries, one must address them in tandem with HIV/AIDS."

A Voice Portal for health[160]
"This project will test and evaluate a pilot public health voice portal for Peru, a practical, sustainable means to communicate with and gather critical information from remote and dispersed health care professionals and populations and thereby strengthen maternal health, immunization and other public health programs. The portal that Recipient has developed integrates a telephone-based technology with web-based IT systems to address one of the critical challenges facing immunization, maternal health and other public health programs – how to communicate with and gather critical information from remote health care workers and populations. By making services accessible from any telephone and piggybacking on rapidly expanding telecom infrastructure, Recipient's technology can reach a much wider group of users than the Internet or current IT systems.

This innovative application of technology has the potential to bring significant benefits to poor populations across the developing world by improving the effectiveness of public health networks and programs. Recipient will be responsible for implementing the Project in Canete-Yauyos working in cooperation with the Ministerio de Salud de Peru, the Fundacion Telefonica, the VIGIA project, the Markle Foundation and other organizations as is appropriate."

Development of ICT Based Telemedicine System for Primary Community Healthcare in Indonesia[161]
"This project proposal describes the development of a pilot internet & communication technology-based telemedicine system for primary community health-care in both urban and rural area in Indonesia. As a large archipelago country with more than 202 million population, Indonesia has relatively very complicated health care problems to solve, due to shortage of human resources, health-care facilities, and financial resources. Our maternal mortality rate is among the highest in South-East Asia; it should therefore be reduced through systematically implementing well planned policy and appropriate technology-based infrastructure.

The proposed development project will utilize the existing internet technology, to further develop PC-based medical stations, and to do field testing in at least eight locations. The pilot telemedicine system will consist of 6 medical stations for community health centres, and a station for each referral hospital, health office, and a test laboratory. Both hardware and software development, as well as system/network integration will be conducted and the system will gradually be expanded to cover larger numbers of stations.

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[160] *A Voice Portal for Health*, a project (of some 250) supported by the World Bank managed *InfoDev* program: http://info.worldbank.org/ict/
[161] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/ and see also
- Pioneering Blood Bank Network System in Sri Lanka
- Development and Integration of Web-based Technology in Distance Education for Nurses in China: A Pilot Study
- Automatic Translation and Management of ICSCs and Local Chemical Information on the Internet (Vietnam)
- Developing Web-based Knowledge Site for Bio Medical Waste Management in Bangalore City

After the completion of the pilot system, it is expected that a series of systematic clinical/field experiments will be conducted. They should include testing the following functions, namely: recording & reporting, improved diagnosis, limited tele-consultation, tele-coordination, and tele-education. It is also expected that during the implementation of the project, we could disseminate and recommend an "ICT policy and infrastructure for social and community usage, especially in improving the primary community health care in Indonesia".

Using digital assistants to meet rural healthcare needs[162]
"The Andhra Pradesh government and a local software solutions company have designed a package that will use mobile computing devices to help meet the healthcare needs of rural people. The Andhra Pradesh government and the software solutions provider CMC Ltd have designed a novel healthcare project to tackle issues relating to rural health in the state and eventually, the country. The project is part of the India Health Care initiative and is being funded by the World Bank. As part of the project, auxiliary nurses and midwives (ANMs) working in primary health centres (PHCs) in the remotest villages will visit rural households equipped with personal digital assistants (PDAs).

Important healthcare information on pregnant women in the villages, infants and children, eligible couples, incidence of diseases and the relevant treatments, planning preventive and remedial measures, etc will be keyed into these digital assistants. After the ANMs return to the primary health centre this information will be fed into the desktop computers and then transferred to the district-level and state health commissioner's office using the available network. There, data compilation and report generation can be done in a couple of minutes, enabling the authorities to mobilise the personnel and materials required to attend to the needs of specific villages needs within hours.

The commissioner of family welfare, Neelam Sawhney, said: "The data collected by the ANMs was downloaded onto the desktops, rectified and updated." "Changes were notified to the revenue authorities. Accordingly, services were extended to pregnant women, new-borns and eligible couples and the data was again captured on PDAs and transferred onto the desktops in PHCs once a month," she said. The project has already been implemented in two divisions of Nalgonda district, covering a rural population of over 1.5 million spread over 33 PHCs, where 225 ANMs have been taught how to use these gadgets. The Andhra Pradesh health minister Dr Kodela Siva Prasada Rao, said, "The presence of an ANM at the doorsteps of people in our villages with a mobile computing device is now enhancing the quality of healthcare for rural masses apart from improving the productivity of the health service providers." "

Improving Healthcare and Education through Shared ICT Resources (Nigeria) [163]
"The project seeks to increase women's access to ICT facilities in the southern Kaduna area of Nigeria. IT training and equipment upgrades are provided for Central Community Learning Centers (CCLC) and Mobile Community Telecenters (MCT) located in rural communities. These facilities are primarily used by community health workers and nurses (most of whom are women), students and staff of health training institutions as well as the local college of education."

Finalists from the World Bank managed InfoDev Program (1999-2002)[164]
- Harnessing ICTs for Community Health - The AfriAfya initiative
- Health Information Project: Using Handheld Computers for Surveys
- Healthinf-ethiopia and ethiohealth discussionforum

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[162] The Hindu Business Line, April 16, 2003: http://www.digitalopportunity.org/cgi-bin/index.cgi?root=2822&url=http%3A%2F%2Fwww%2Eindiasocial%2Eorg%2Freseult%2Easp%3Fid%3D2862
[163] A project supported by the World Bank managed *InfoDev* program: http://info.worldbank.org/ict/
[164] *InfoDev ICT Stories*: summary descriptions areavailable at http://www.iicd.org/stories/

The spread of local monitoring mechanisms is proving very important for current identification of health needs and better targeting of health delivery systems. The Tanzania Essential Health Interventions Project, TEHIP, has been one pioneer, and is also part of a global network.[165]

Linking Demographic Surveillance and Health Service Needs-the AMMP/TEHIP Experience in Tanzania[166]

"Presented at the Multilateral Initiative on Malaria Conference, Durban, South Africa, March 15-19, 1999 Don de Savigny, Philip Setel, Harun Kasale, David Whiting, Graham Reid, Henry Kitange, Conrad Mbuya, Leslie Mgalula, Harun Machibya, and Peter Kilima.

In Morogoro Rural District, the Tanzanian Ministry of Health's Adult Morbidity and Mortality and Tanzania Essential Health Interventions Projects (AMMP and **TEHIP**) work to support the use of evidence in health service priority setting and resource allocation. Since 1992, AMMP has maintained a demographic surveillance system (DSS) among more than 300,000 people in three locations, including Morogoro. The DSS, which uses `verbal autopsies' to determine cause of death, will form one part of a national surveillance system to track the burden of disease. AMMP records over 2,000 deaths per year in Morogoro among a population of over 100,000. 85% of residents live within 5 km of a health facility, yet over 80% deaths occur at home; in 41% of cases, there is no contact with the formal health sector before death. DSS has shown that acute febrile illness (query malaria) is responsible for 44.7% of years of life lost (YLLs) among under fives.

Health facility data have routinely indicated malaria as the leading cause of facility attendance, admissions, and in-patient mortality. Despite this, malaria was not given prominence in district health plans or budgeting. In 1997 **TEHIP** introduced evidence based planning to Morogoro. This allowed more detailed analysis of the disease burden by District Health Management Teams, who used it to influence priority setting, budgeting and selection of cost-effective interventions. This led to the selection and delivery of interventions targeted largely at malaria cure and prevention: the Integrated Management of Childhood Illnesses (IMCI) Package, and the social marketing of insecticide treated nets (INTs). To date, these programs have reached 75% and 28% of the targeted population for IMCI and ITNs respectively. AMMP and **TEHIP** will continue to monitor this trend toward evidence-based planning, and monitor its impact. The Tanzanian case suggests that sentinel DSS could be a sustainable part of evidence-based health in developing countries."

Technology simplifies health surveys in rural Africa[167]

"In rural Africa, health information on diseases such as measles, HIV/AIDS and malaria is critical in public health planning. Project SATELLIFE created a test of new technology, in the form of handheld computers or PDAs (Personal Digital Assistants) in order to provide rural areas with means to conduct field surveys in an efficient and timely manner." .

Selected major risk factors and global and regional burden of disease[168]

"Summary: Background: Reliable and comparable analysis of risks to health is key for preventing disease and injury. Causal attribution of morbidity and mortality to risk factors has traditionally been in the context of individual risk factors, often in a limited number of settings, restricting comparability. Our aim was to estimate the contributions of selected major risk factors to global and regional burden of disease in a unified framework. Methods: For 26 selected risk factors, expert working groups undertook a comprehensive review of published work and other sources--eg, government reports and

[165] See http://www.idrc.ca/tehip.

[166] From www.ncl.ac.uk/ammp/mimabs.pdf

[167] Hinas, Maria, *Technology simplifies health surveys in rural Africa*, June 2003: URL: http://www.challenge.stockholm.se/feature_right.asp?IdNr=26

[168] Ezzati, Majid; Lopez, Alan D; Rodgers, Anthony; Vander Hoorn, Stephen; Murray, Christopher J L., Lancet, *Selected major risk factors and global and regional burden of disease,* 11/2/2002, Vol. 360 Issue 9343

international databases--to obtain data on the prevalence of risk factor exposure and hazard size for 14 epidemiological regions of the world. Population attributable fractions were estimated by applying the potential impact fraction relation, and applied to the mortality and burden of disease estimates from the global burden of disease (GBD) database. Findings: Childhood and maternal underweight (138 million disability adjusted life years [DALY], 9.5%), unsafe sex (92 million DALY, 6.3%), high blood pressure (64 million DALY, 4.4%), tobacco (59 million DALY, 4.1%), and alcohol (58 million DALY, 4.0%) were the leading causes of global burden of disease.

 In the poorest regions of the world, childhood and maternal underweight, unsafe sex, unsafe water, sanitation, and hygiene, indoor smoke from solid fuels, and various micronutrient deficiencies were major contributors to loss of healthy life. In both developing and developed regions, alcohol, tobacco, high blood pressure, and high cholesterol were major causes of disease burden. Interpretation: Substantial proportions of global disease burden are attributable to these major risks, to an extent greater than previously estimated. Developing countries suffer most or all of the burden due to many of the leading risks. Strategies that target these known risks can provide substantial and underestimated public-health gains."

Community based monitoring systems (CBMS), more general in coverage, also produce evidence important for health planning and delivery, and some of the CBMS are very oriented to health evidence gathering and use. The CBMS in the Province of Palawan, Philippines, is a good example of a system now spreading country-wide[169], and an international CBMS network website will soon provide cross-country comparisons.

The combination of information and communications systems for use more broadly in health systems reform, management and service delivery is another area of potential, but relatively little documented experience has been found from the perspective of ICTs.

Employment of People with Disabilities (Central America) [170]
"This project originated in the World Bank's Development Marketplace 2000 competition in which *info* Dev participated as a co-sponsor awarding $50,000 to this project. This project aims to combat poverty by using information technology training to reduce the obstacles to employment faced by people with disabilities in the Americas."

Community-Oriented Primary Care (COPC)[171]
"The task of community definition has, likewise, been made far simpler, more graphical, and more useful by the advent of geographic information system (GIS) software GIS programs are increasingly inexpensive and user friendly. When geo-coded patient information on users of a practice, for example, is entered into such systems, the software is able to produce locality maps that show characteristics such as intensity of use by geographic area or patterns of disease. Patients in a practice can be mapped by demographic factors such as levels of education, income, or age. GIS provides the COPC practitioner with a powerful tool to define and describe a practice and do it in a graphic fashion that promotes discourse between clinicians, health service managers, and community leaders. GIS capabilities coupled with Web-based data resources create powerful techniques for accurate characterization of small population areas in ways that will be of enormous value to practices and communities in analyzing their health problems and planning for future re source use. In many parts of the world, however, resources remain limited, and innovations in information technology will mean little for primary care practice unless and until investment is made in these enabling technologies. This technology gap in itself can present a barrier to the adoption of COPC processes."

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[169] See www.panasia.org.sg/mimapph/

[170] A project supported by the World Bank managed InfoDev program: http://info.worldbank.org/ict/

[171] Mullan, Fitzhugh; Epstein, Leon., *Community-Oriented Primary Care: New Relevance in a Changing World*, American Journal of Public Health, Nov2002, Vol. 92 Issue 11, p1748

Big World[172] "is currently working with a number of collaborators around the world to develop multimedia content to help meet basic information needs of poor communities. We are currently in the process of creating the following resources in local languages, accessible via vcd (video compact disc) and dvd formats:

- Bangladesh: Mother & Child Health (Bangla, English)
- Cambodia: Mother & Child Health (Khmer, English)
- India: Mother & Child Health (Hindi, English) HIV/AIDs (Hindi, English)
- Romania: Mother & Child Health (Romanian, English)"

ACISAM, Honduras:[173]

"To enable members of a community to acknowledge their human capacity and address common mental health problems in order to improve their social, economic, cultural and ecological environment. The community use audio and video to capture their local problems (on mental health) and feed the outputs back to the community via loudspeakers, radio, cable television. This case makes interesting use of audio and video technology to empower local communities. While it is not using the latest technology it is proving how ICTs can give a voice to a community and bring a community to a common understanding of their problems."

A World Bank Institute website on "Gender, Health and Poverty, Training of Trainers Workshop, Internet-Based Learning Component" provides Internet and website learning materials, and many website resources on this subject and more broadly on health and gender.[174] Many other organizations provide valuable web-based health resources oriented to poverty.[175]

c. Poverty monitoring/understanding and alleviation

For effective and sustained focus on poverty reduction, regular intelligence on poverty is needed, on both poverty profiles and poverty dynamics. These need to be based on information which is rapidly collected and processed, useful to everyone, as clear as possible on who is poor and why - or in what ways - and supportive of policies and programs in employment, trade, fiscal policy, health, education, social protection, targeted and local poverty alleviation etc. etc.

These consist of people and institutions in government and civil society (including independent research), and information gathering and processing processes, with support from many donors. Principal components would include:

- participatory monitoring or survey activities of civil society organizations and means of networking and assembling information and its implications nationally;
- government census, national and sectoral (health, nutrition, education, employment etc) accounts and surveys, other (more single-purpose) data gathering;
- consumption/expenditure and income-expenditure surveys, in particular the LSMS (World Bank living standard measurement survey) family, done approximately every 3 years by governments with World Bank or other donor support;
- periodic multi-dimensional surveys which are simple, quick and useful for design and management of policies and programs - from national to local; to be timely and cost effective, these normally need to focus on poorer areas rather than universal country coverage;

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[172] Big World is funded by DFID: http://www.big-world.org/projects/20.asp
[173] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm
[174] see: http://www.worldbank.org/devforum/tutorial.htm, and its links to website resources for Reproductive Health Africa-specific, Health and Poverty, Gender, HIV/AIDS, Development Issues and News, UN Agencies and Information, Population, Web Tutorials and Tools, Online Facilitation
[175] See for example *the International Poverty and Health Network*, organized by WHO from 1995, at http://www.iphn.org/bulletin5.htm.

- participatory or community-based poverty monitoring systems (CBMS), sketched above - perhaps the lowest cost and most effective in terms of empowerment and altered public budget allocations.

A Philippine multi-indicator poverty monitoring system (PMS): indicators[176]

Survival:	Health	1.	Infant mortality rate
		2.	Child mortality rate
	Nutrition	3.	Prevalence of acute and chronic malnutrition
	Water & Sanitation	4.	Proportion of households with sanitary toilet facilities
		5.	Proportion of households with access to safe water
Security:	Shelter	6.	Proportion of households in makeshift housing
	Peace & Order	7.	Crime incidence
		8.	Incidence of armed encounters
Enabling:	Income/Livelihood	9.	Proportion of households with income greater than the poverty threshold
		10.	Employment
		11.	Underemployment
	Basic Education & Literacy	12.	Elementary enrolment
		13.	Secondary enrolment
		14.	Basic literacy
	Participation	15.	Proportion of households involved in at least one community organization
		16.	Proportion of households who participated in formal electoral processes

IDRC[177] and several major donors support the strengthening of poverty measurement, monitoring and analyzing/understanding capabilities in countries, and the overall (political) process of bringing together information from different sources and facilitating public discussion.[178] These 'systems' are still weak in many countries, and are very information/knowledge-intensive. More ICT support for the community based systems is needed; from very simple technologies for village enumeration and use to Internet-based GIS systems to have pictures available to people and policy makers of the comparative situations of villages in terms of income, health, education, security, gender equality etc.[179] More support is also needed in many countries for the survey components and capacity, and there would appear to be continuing room for innovation in 'poverty analysis' networking among the many stakeholders and interests within countries. A few other examples…

UN Disaster Management[180]
"The UNDMT initiative in Orissa has facilitated collection, coordination and sharing of data -- using computer and internet -- on all aspects of relief and rehabilitation at the block and district level by the provision of a computer and dedicated human resources for the purpose."

CARDIN, Caribbean: [181]
"To strengthen the capacity within the Caribbean community, for the collection indexing, dissemination and use of disaster related information serving as a sub-regional disaster information centre. This is a network of institutions across the Caribbean using ICTs to archive and retrieve data which is vital to their disaster preparedness planning. The inclusions of IC Technology brought

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[176] From *Building Capacity to Reduce Poverty (An Overview of the MIMAP Experience in Asia)*:
http://network.idrc.ca/ev.php?URL_ID=6726&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1048351807
[177] MIMAP/PEP (Poverty and Economic Policy) program: www.mimap.org
[178] See for example Shaffer, *Paul, Integrated Approaches to Impact Analysis in MIMAP*: www.mimap.org
[179] The *MIMAP Philippines* site contains the maps and processes for the Province of Palawan:
http://www.panasia.org.sg/mimapph/palawan/palawanmap.htm
[180] UNDP: http://www.undp.org.in/ictpe.htm
[181] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

together a number of related institutions who had previously only weak linkages. The ICTs have enhanced the overall planning of this disparate network."

Software to Manage Vital Statistics and Municipal Budgets[182]
"Municipalities in Senegal will soon have the solution to a puzzle: how to manage their budgets, an area where their performance has sometimes been deficient. Using budget and vital statistics management software developed by SAFEFOD, a Senegalese NGO, local communities will have the means to efficiently keep track of their financial resources and to manage vital statistics records."

African PRSPs - human and institutional requirements[183]
"Step 1- Identification of the Poor and Causes of Poverty
- Well trained data enumerators to collect the necessary data.
- Well trained data analysts to summarise the data collected and organize it in a form useful for decision making.
- Well trained poverty researchers and analysts to design the questionnaires useful in capturing information on poverty, design poverty lines (absolute and food), construct poverty profiles and determine the causes of poverty.
- Frequent gathering of information on living standards.
- A statistical agency to coordinate data collection and analysis.
A poverty working group to coordinate the setting of poverty lines, construction of poverty profiles and determination of the causes of poverty.

Step 2- Setting Targets for Poverty Reduction
- Well trained Economists to determine the required changes in the social indicators of development, to construct macro-models that can aid in the setting of realistic growth rates both at sectoral and national level and the required tradeoffs.
- Well trained poverty researchers/analysts to determine which areas/sectors of the economy should be targeted for growth so as to achieve poverty reduction.
- A macro-working group to coordinate the activities of the economists.
- Poverty working group/research and analysis institution to coordinate the activities geared towards poverty reduction.

Step 3- Prioritizing Public Actions for Poverty Reduction and Growth
- Well-trained Economists to design macroeconomic models for pro-poor growth, to measure participation in markets by different socio-economic groups, to analyse the tax policy, to determine the possible sources of finance for public actions to reduce poverty.
- Well-trained poverty researchers/analysts to carry out poverty impact assessments of various policies/public actions.
- Economic planners to aid in the costing of projects
- Macro-working group to coordinate the work of the macro economists.
- Poverty working group/policy analysis institute to coordinate policy analysis and poverty impact assessments
- Planning unit to coordinate the costing of projects.

Step 4- Implementation of Programs and Policies
- Well-trained economic planners and policy analysts to help in the development of project implementation matrix.

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[182] IDRC *Acacia Program*: stories: www.idrc.ca/acacia/
[183] Mwangi S. Kimenyi, *African Poverty Reduction Strategy Papers: Existing Gaps And Role Of AERC*, paper for the African Economic Research Consortium (AERC) Board, March 2003.

- Planning unit in government or a policy analysis institute to coordinate the development of project implementation matrix.
- An efficient government to implement the policies

Step 5- Monitoring and Impact Evaluation
- Well-trained policy analysts/researchers to determine the extent to which poverty reduction objectives are being met.
- Monitoring unit to closely monitor the implementation of all projects/ policies aimed at poverty reduction."

8. Environment and natural resources management[184]

As sketched in II above there are, among others, focuses on ENRM-livelihoods, ENRM-health and recently biotechnologies and environmental remediation. A lot of new materials have appeared recently, and many are not captures here.[185]

Towards a Regional Geographic Information Infrastructure (RGII) in the Hindu Kush-Himalayan (HKH) Region[186]
"The mountains and their ecosystem have been constantly gaining the attention of the world community for their contribution towards life support. To enable sustainable decision making in the Hindu-Kush Himalayan region, there needs to be a realistic assessment of natural resources and socio-economic conditions through the systematic generation of data indicating the present situation and changing status through time. The availability of consistent spatial databases from local, national to regional levels will improve our ability to investigate key issues in the region. However, the region faces with the isolated development of databases due to the lack of a proper framework. As a result information is often dispersed, heterogeneous, and inaccessible and the available information is not sufficiently relevant in term of continuity, reliability and the nature of parameters. ICIMOD through its Mountain Environment and Natural Resources Information System (MENRIS) program has been focussing on GIS capacity building and networking of the national institutions in the region to promote the development of geographic information, its sharing and effective use of GIS and RS in the region since early 1990.

The project is aimed at capitalising the recent developments of Internet mapping technology such as ARCIMS (www.esri.com) and the generic database technology such as SQL server for sharing spatial data. A special care will be taken to design and develop a GIS metadata system in adhering to international standards for compatibility with other regional/global partners. The vast network and databases created by MENRIS and its strategic partnership with the key technical vendors such as ESRI* and their support will be the key to the project. The project will also have the active partners from Bangladesh, Bhutan and Nepal to contribute to this effort.

The project intends to develop an Internet based system to offer a one-stop experience in the region to increase the availability and accessibility of relevant geographic data and to enhance the exchange of geographic information within the region. The system, once developed, will be a step ahead in the use

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[184] See also:
- Hall, Brent, *The Information Age, Capacity Building, and the Use of Spatial Information Technologies in Developing Countries*, Cartographica, Winter2000, Vol. 37 Issue 4
- Simon, David, *Dilemmas of development and the environment in a globalizing world: theory, policy and praxis*, Progress in Development Studies, Jan2003, Vol. 3 Issue 1
[185] See, for example, The Development Gateway (http://www.developmentgateway.org/node/133831/?), section on ICTs and Environment
[186] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/

of Internet by ICIMOD for its networking and outreach objectives and the information available will support sound decision making. The researchers, development projects and agencies working for the mountain communities in the region shall immensely benefit from such system and will be an important step towards a Regional Geographic Information Infrastructure (RGII) in the region."

Annex A, section 4: "CICEANA created a distribution network, in order to access multidisciplinary data and information on environmental concerns and found that access to this type of information increases the understanding and awareness of those causing impacts, helps to empower those affected, and intensifies public scrutiny of the public agencies charged with environmental protection responsibilities."

"ICTs can have a major role in reducing the impact of natural disasters on the poor in low-income countries. The World Bank's hazard management programme in high risk areas of Andhra Pradesh, India involves ICT components in cyclone warning, communication and response, awareness raising, education and community involvement in hazard reduction activities." [187]

Development of a web-based learning resource on environment for schools in India[188]
"Though the importance for environment education in schools has been recognized and accepted, it lacks in an integrated approach to understand complexities and inter-disciplinary approach, required to address environmental problems. Hence there is a need for resource material on environment for teachers and interactive learning tools for students which would make learning easy and interesting.

EduGreen (http://edugreen.teri.res.in), a web-based learning resource on environment for schools is developed under this project to support the formal environment education in schools by providing an interactive way of learning. The project has been developed and implemented by involving participation from schools in Delhi. Inputs from the school children and teachers gathered during various workshops spread over the design and development phase were carefully implemented to ensure a user friendly, useful, and an interactive knowledge base.

The online resource, which is a unique information repository on environmental topics and issues, is being used not only by the schools that participated in the project but also by students around the world. Apart from serving as an information repository, the web site has also promoted dialogue, networking and community building among students and teachers.
Based on the encouraging response received from schools that contributed to the development of the site, it is felt that we need to involve schools from other cities of India in building this resource further. There is also a need to translate this resource in other major Indian languages for the benefit of schools where the medium of education is not English."

Regional Space Applications Programme for Sustainable Development
"(RESAP) and RESAP II – RESAP II is aimed at promoting applications of space-based ICT for sustainable development and improved qualty of life through regional cooperation. Includes environment and natural resources management applications."[189]

GIS-Based Technology For Local-level Development Planning[190]
"The Government of India has encouraged programmes aimed towards development and induction of appropriate tools of science and technology in local level planning. Use of remote sensing, Geographical Information System (GIS) and modern data communication facilities form the backbone of the emerging thrust of local level planning. The UNDP-assisted project on GIS-Based Technology

[187] B. Shadrach and Oliver Wakelin, *Impact Assessment Of Appropriate And Innovative Technologies In Enterprise Development: http://www.bellanet.org/leap/docs/Shaddy'spaper.doc?OutsideInServer=no*
[188] *Pan Asia Networking Small Grants Program*: http://www.panasia.org.sg/grants/awards/
[189] http://www.unescap.org/escap_work/ict/
[190] UNDP: http://www.undp.org.in/ictpe.htm

For Local-level Development Planning was executed and implemented by the Union Department of Science and Technology during November 1996 and December 2000, in association with leading academic institutions, data generating agencies and Non-Governmental Organisations (NGOs) in the country. Some of the tools and techniques developed under the UNDP-assisted initiative include the Geo-referenced Area Management or the GRAM++ GIS package and Decision Support Modules for selected sectors of local level planning. Water resources management, land use planning, energy budgeting and infrastructure development were identified as the key focal themes under the project."

KUMINFO, Ghana: [191]
" To make data available and accessible to stakeholders involved in natural resource management. This is an GIS information gathering activity on a province wide scale. The case study offers an insight into the challenges surrounding provision of information from a institution to the local level."

MIGIS, China, Cambodia: [192]
"…to make a significant contribution to the quality and effectiveness of participatory planning; by introducing the use of GIS and advanced graphic techniques into the PRA process; and, using the images produced in a way that would enhance the presentation and therefore the authority and impact of information collected in and provided by communities in which development intervention was planned. The project uses computer GIS systems and enhanced graphics to validate and present information gathered participatorily from illiterate and semi literate communities. The project strengthens participatory processes and gives a voice to the community to government officials. It is interesting how the use of "computer presentations" can overcome the bias of some officials that the poor are ignorant of their situation."

Our Environment: Part 2, Governments, Laws, and Organizations[193]
"Part II. Provides information on Web sites and other information sources on environmental topics operated by international organizations, non-governmental organizations and governmental agencies."

A Global Network? Transnational Cooperation Among Environmental Groups[194]
"Abstract: A rich literature theorizes about the development of transnational networks among social movements that may signal the emergence of a new global civil society. This article presents empirical results from an international survey of environmental groups. We find evidence of a relatively dense network of international action by green groups, and a substantial resource transfer from green groups in the OECD nations to those in the developing world. At the same time, the patterns of exchange within this network raise questions about the more optimistic claims of the global civil society literature because participation in this transnational network is largely an extension of the factors that encourage domestic political action. In addition, power inequalities and value differences that exist within this international environmental network may limit transnational cooperation among environmental groups."

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[191] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[192] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[193] Kaiser, B. E., *Our Environment: Part 2, Governments, Laws, and Organizations*, Searcher, Nov/Dec 2002

[194] Rohrschneider, Robert and Dalton, Russell J., *A Global Network? Transnational Cooperation Among Environmental Groups,* Journal Of Politics, Vol. 64, Pp. 510-533, 2002

9. Transparency, accountability, engagement, empowerment; local to global[195]

As mentioned earlier, empowerment runs through all the areas above. At the community end, it has been a particular motivation of the multipurpose telecentre movement. Some further examples…

Annex A: "Opoku-Mensah (2000) gives specific examples from Zimbabwe, Uganda, Ghana, South Africa and Tanzania on how ICTs have been used to promote women's rights. In Zimbabwe, women have created and used alternative communication channels to support their efforts, defend their rights and diffuse their own forms of representation. In Uganda, women have used the Internet to support their contribution to parliamentary debates."

Annex A, section 4: "Quipunet, in Peru, is a global virtual network, using mostly e-mail to communicate, financially self-sustaining, and aimed channelling resources, materials and knowledge available all over the world to people in need in South America, with emphasis on Peru (eg development of affordable communication networks, development of educational programmes, support for indigenous medicines)."

Annex A, section 4: "The Village Well' was a project aimed at exploring the power of the Internet and to assess the extent to which ICTs can be a useful part of CIDA's assistance programmes for international development - the main lesson was that "the World Wide Web is not only a means of accessing and publishing information; more importantly, it is a powerful tool for creating and stimulating dialogue."

Making waves: participatory communication for social change, [196] part of the UNDP supported Asia Pacific Development Information Program, provides 50 further case studies from around the world.

At a more meso and national level, ICT have been important in public accountability frameworks. Action is typically initiated by public interest groups, either via the Internet or, more often, drawing on ICT/Internet for their coverage and feasibility (eg access to information).

IT-based Networks for Citizens Groups for Access to Information (India) [197]
"This initiative aims at capacity building of public authorities for improving citizens' access to information for achieving transparency and accountability in governance at all levels. It will demonstrate the use of IT for efficient information management and dissemination to strengthen the supply side of information and at the same time it will use ICT based initiatives to strengthen the demand side of information (through mass media campaigns, networking of decentralised institutions etc) that is pertinent to a broad array of services citizens expect of government departments, including performance of poverty reduction programmes."

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[195] See also
- UNDP Asia-Pacific Development Information Program (APDIP), *Internet Governance Information Service*:
http://intgov.apdip.net/
- Dieter Zinnbauer, *Internet, Civil Society and Global Governance: The Neglected Political Dimension of the Digital Divide*, Information & Security. Volume 7, 2001, pages 45-64
- World Bank, *Empowerment and Poverty Reduction: a Sourcebook*, May 1, 2002, Chapter 5 on ICTs (p. 73):
http://www.worldbank.org/poverty/empowerment/sourcebook/draft.pdf
- Helen Watchirs, *Review of Methodologies Measuring Human Rights Implementation,* Journal of Law, Medicine & Ethics, Winter2002, Vol. 30 Issue 4
[196] Gumucio Dagron, Alfonso, *Making waves: participatory communication for social change*, The Rockefeller Foundation, 2001, http://www.rockfound.org/Documents/421/makingwaves.pdf
[197] Kaiser, B. E., *Our Environment: Part 2, Governments, Laws, and Organizations*, Searcher, Nov/Dec 2002

Global Trends in Access to Information[198]

"…Take the poverty-stricken state of Rajasthan, for example. Seven years ago, the Indian freedom of information movement began there, in 120-degree heat, when a mostly-illiterate village held a public reading of government records. Activists led by a former top civil servant had used their connections in the bureaucracy to get a copy of the local government account books for all the money spent on the village that year, and were holding a first-ever public recitation. They had invited a pro from Delhi to come, a professor of public management who had filed some of the first legal actions for environmental information. Envious of the local turbans and loose robes, the professor was roasting, and the villagers looked around for some shade. There was no town hall, only mud huts, and finally the group sat down alongside three mud-brick walls of an unfinished structure, where, as the afternoon wore on, the walls would at least cast a shadow.

First came the muster roll, the list of names of those paid to work on the various road repair and building projects in the area. Everyone listened solemnly until about the fourth name, when chuckling broke out. The Delhi professor looked puzzled until someone explained that the person named had died three years before—"dead souls" littered the muster roll. Then the reader started on expenditures made: "30,000 rupees [about $800] to repair the roof of the school." The villagers guffawed: "This is the school building that we're sitting in!"[3]

Now, six years later, the state of Rajasthan has passed a formal freedom of information law, guaranteeing its citizens the right of access to state records—as have five other Indian states. The professor from Delhi, Shekhar Singh, co-founded the National People's Campaign for the Right to Information, intended to combat corruption and strengthen civil rights; and the Indian congress is currently debating a national freedom of information law. India is just the latest example of a phenomenon sweeping the world, changing the entire governance paradigm for democracies—the international movement for freedom of information."

Application of Empowerment Principles: Improved Local Governance: Access to Information[199]

"Fed up with unresponsive, poorly performing, and corrupt government agencies, citizens' groups in Bangalore, India, conducted surveys of government performance and made the information available to the public and the press to create pressure for reform. In 1993 the Public Affairs Centre in Bangalore initiated citywide citizen "report cards" for public services. Citizens were asked to rate the quality, adequacy, and efficiency of services such as water, transport, electricity, the municipal office, and police, and the findings were publicized in the media. This led to discussions with heads of agencies about needed reform, and in some cases services improved. The methodology has spread to other states and was recently administered countrywide in India (see Tools and Practices 16).

Bangalore is also becoming known for its Swabhimana initiative, in which volunteer engineers and architects, tired of shoddy public construction, monitor the city's public works directly at the site, providing public information on all aspects of the contract-thus increasing contractors' accountability.

Municipal governments are beginning to create websites that enable citizens to interact with government, access certificates, register property, and give governments feedback on their performance. In Latin America, the World Bank is interconnecting the municipal websites of 10 capital cities to encourage exchange of experiences as well as public engagement. In Argentina, the Cristal project uses the Internet to disseminate in an easily understood format all information concerning the use of public funds in different programs. The site is audited externally by Foro Transparencia, a group of 15 nongovernmental organizations concerned with government transparency."

[198] Blanton, Thomas S., *Global Trends in Access to Information, March 2002: http://www.pcij.org/accessinfo/blanton.html*
[199] World Bank Poverty Net, *Application of Empowerment Principles: Improved Local Governance: Access to Information:* http://www.worldbank.org/poverty/empowerment/principles/locgov/info.htm

Global Voices: [200]

"1.Globally: to inform Oxfam in its strategic review process so that it could be more effective in alleviating poverty; 2. Locally: to give people a tool that would give them a voice so they could be heard expressing their concerns and possible solutions on issues that affect them. Born from a strategic review process in Oxfam, this is a case of communities using video to increase awareness among government and their fellow community of the community needs. This is a case where ICTs have been used to articulate and analyse community needs. It is an example of ICTs being used in advocacy."

Gyandoot, India: [201]

"To improve the efficiency, effectiveness, accountability and transparency of local government through increasing access to services, information and policy documentation by the public. To enhance the livelihoods of the public by providing better access to agricultural information, commerce, education and training facilities. After a consultation on information needs, this project has set up a network of financially self standing kiosks which offer various services including gateways into local government. There is considerable evidence that the availability of the kiosks is enabling villagers to access government services far more effectively than in the recent past. There are clear examples of an increasing transparency."

REVISTAZO, Honduras: [202]

"To provide an alternative communication media source to inform the public about issues surrounding corruption and social injustice in order to promote Good Governance within Honduras. Using a web site, Revistazo is an online magazine that tackles sensitive political issues. This case demonstrates the potential of ICTs to inform the public and encourage good governance."

Enhancing Access to Information through Document Delivery Systems - INFLIBNET's Approach[203]

"Abstract: Due to diminishing library budgets, coupled with information explosion, academic librarians in India are finding it difficult to meet the insatiable demands of their clientele. For a country as vast geographically as India, having many universities located in remote places, this problem is compounded. Efforts were made in the past to provide document delivery services through a few documentation centers, set up by the Government in different disciplines. This paper focuses on the initiatives launched by the University Grants Commission of India in last few years, through INFLIBNET Centre, to provide this service through electronic means by computerizing university libraries, establishing a network and setting up of document delivery centers."

Global Gender Responsive Budget Initiatives Program[204]

Several websites provide networking and training materials for gender-responsive budget initiatives in over 50 developing (and developed) countries. The initiatives are aimed at changing public budgets - from local to national - in ways which remove biases against women in most sectors (health, education, infrastructure etc) or address their particular needs. The global programs supporting these initiatives have helped to add 'resources' to 'rights' in the many agendas of gender equality.

Digitally Empowered Development[205]

"Access to new technology and credit will not be enough to ensure a more secure future, however; poor communities also need simple justice. Such justice must include protection from the dangerous or

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[200] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[201] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[202] A DFID funded project: case study link at: http://www.sustainableicts.org/Casestudies.htm

[203] Salgar, S. M. and Murthy, T. A. V. *Enhancing Access to Information through Document Delivery Systems - INFLIBNET's Approach*, 2002: www.ifla.org/IV/ifla68/papers/036-132e.pdf

[204] See for example the *Gender Responsive Budget Initiatives (GRBI)* global partnership supported by UNIFEM, Commonwealth Secretariat and IDRC: www.gender-budgets.org

[205] Hammond, Allen L, *Digitally Empowered Development*, Foreign Affairs, Mar/Apr2001, Vol. 80 Issue 2

unlawful actions of private interests or corrupt governments -- especially in developing countries, where regulations are often weak or unenforced. One way to achieve this protection would be for NGOS and community groups to form global networks, linked through the Internet, and then work together with leading companies or trade associations to establish environmental and social standards. These groups could then monitor corporate performance against those standards, even in developing regions, exposing companies that employ child labor, cut down old-growth forests, or defy other social and environmental expectations. These networks could also root out and reveal corrupt officials or help protect poor farmers from land grabs. Such efforts, and the greatly enhanced transparency they would bring, would be less expensive, more flexible, and more effective than government regulation, especially in developing countries.

Such ideas are already rapidly becoming a reality in the forest sector, with the creation of Global Forest Watch (GFW) by the World Resources Institute. GFW is a worldwide network of local forest groups linked via the Internet and equipped with advanced software tools. It combines satellite imagery with detailed on-the-ground data collection, compares actual forest practices with lease agreements and established standards, and posts the resulting data and maps on the Internet, naming the companies and countries involved. GFW has also demonstrated a novel model for partnership between the private sector and civil society, a model that is changing the market for forest products. Ikea, Home Depot, and other major retailers of forest products have committed to using wood that comes only from properly managed forests, and these companies are working with GFW to implement those commitments, using the network's growing country-by-country and company-by-company databases. Similar global networks to monitor fisheries, other extractive industries, and the environmental performance of governments are all under consideration…

The Internet has already begun to make censorship virtually impossible, as governments around the world are discovering. When Yugoslav President Slobodan Milosevic tried to shut down the Belgrade radio station b-92 in 1999, its journalists simply broadcast their reports over the Internet, giving Serbs and the world at large access to firsthand accounts of the protests that eventually toppled the Milosevic regime."

Activists Without Borders[206]
"Use of the *Internet* to mobilize support, raise money and exert influence; Power of virtual organizations; Examples of activists' circumvention of government obstructions; Examples of activist organization via the *Internet* in Mexico, Indonesia, China, Yugoslavia and *Malaysia*; United States political candidates' Web sites, … Japan."

Democracy in the Dark[207]
"Access to the nation's laws is critical to the success of our democracy. Thanks to the Web, legal information is readily accessible by more people today than at any other time in history.
Facilitating the flow of information from courts and lawmakers is a vibrant tradition in which we at West are proud to have played a key role. Today, West's attorney-editors read more than 200,000 judicial opinions annually, working with the courts to make more than 100,000 corrections to these rulings.

In addition to using the bound volumes in their local or firm law library, thousands of legal professionals now access the National Reporter System, as well as statutes, regulations, and business news and information via Westlaw. Services such as Westlaw provide innovative research tools that are specifically designed for use by legal professionals. These professionals balance the cost of using services such as Westlaw with the time they save and the comfort they gain from knowing they are

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[206] Engardio, Pete, Dunham, Richard S., Dawley, Heidi, Kunii, Irene, Malkin, Elisabeth, *Activists Without Borders*, Business Week, 00077135, 10/04/99, Issue 3649
[207] Barr, Melissa, *Democracy in the Dark*, Searcher, Jan2003, Vol. 11 Issue 1

using the most authoritative, current, and accurate information. West employs over 7,000 full-time legal, software, and business professionals dedicated to providing the information and technology that makes Westlaw possible. Of course, the Web encourages healthy competition from new businesses as well as from the various governmental organizations. Users are benefiting from a continuing, rapid innovation of services and a broad diversity of offerings.

West is vigorously and creatively responding to the new world enabled by the Web. For example, in January 2001, West acquired FindLaw [www.findlaw.com], the leading legal information portal on the Web. By providing a wealth of legal information, related analyses, and legal data without charge, FindLaw attracts businesses and individuals seeking legal advice and directs them to appropriate legal professionals. Recent statistics indicate that FindLaw traffic is five times that of its nearest competitors as measured by its user base. Through FindLaw, West has expanded this commitment to the larger community."

e-Parliaments: the Use of Information and Communications Technologies to Improve Parliamentary Processes[208]
".....this paper primarily looks at how e-parliaments-the use of ICT to improve parliamentary processes-have developed, considers possible future directions and advocates the adoption of a three-stage model of e-parliament, which will relate strongly to both e-government and e-democracy"

All of the discussion in the country case studies, on activism and the political impact and control of the Internet, could also be reiterated here.

Observations

From the growing wealth of developing country experience, what observations might be suggested regarding the main questions posed at the outset? ie
- *shorter- and longer-term economic and social implications of ICTs expansion - theory and knowledge, from micro to macro;*
- *which are presently and potentially more and most significant for development and poverty reduction efforts (including the negative);*
- *factors that determine, and policy or interventions that influence, the most important ICT-development-poverty-reduction linkages.*

And more operationally,
- **Depending on a country's circumstances, where do ICT-related investments have highest returns? Where are returns so high or important that domestic or donor resources should be shifted from other development and poverty reduction activities?**

On the question of the diffusion of ICTs to poor communities, it is happening innovatively but fairly slowly in much of the world, led by communities, development and business organizations, and supported typically by gradually expanding ICT infrastructure (broad definition). How much more development organizations and donors should try to speed diffusion processes - and how - is not answerable on hard evidence, but experience appears to suggest…

Broad approaches, notably that of Grameen, are very appealing in their scale, early/quick financial viability, social development dimensions, scope (market and non-market social entrepreneurs) and economies of scale (eg solving ICT connectivity and energy problems nation wide), and vision. They provide economic and

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[208] Kingman, Tess, *e-Parliaments: the Use of Information and Communications Technologies to Improve Parliamentary Processes*, WBI Working Papers, 2003, Series on contemporary issues in parliamentary development: http://www.worldbank.org/wbi/publications/wbi37210kingham.pdf

social architecture, beyond conventional 'market and government,' which is designed for poverty reduction and equity, in the context and processes of globalization.[209]

Extending ICT access to poor areas and people is very intensive in effort and local knowledge, literacy and skills development etc, as well as technical capability and effort. To reach the poor, in addition to those who assist in poverty reduction, some level of subsidy is usually needed, and may be needed for a fairly long initial period. There are *lots* of exceptions, from village phones to e-commerce, and probably the subsidy period is declining as access and innovation lead to more commercially and economically valuable applications for poor communities - and as lower-cost technologies are developed. In this connection, it would appear that there is unmet demand for actual small production technologies, relative to services and support mechanisms, and particularly from organized women's' groups.[210]

Put another way, there are growing numbers of successful pilots, different approaches to 'scaling up,' and some notable successes in scaling up.

> Grameen, at the front of one broad approach, scaled up its poverty-related lending in advance of (and now along with) adoption of ICTs for its own operations, and for livelihoods and education. It focused on poor communities and only on infrastructure needed, and designed its initiatives for early self-financing. Similar experiences are expanding in number, but it appears that not all poor countries or regions can presently succeed with similar approaches at similar scale.

> Many of the poorer developing countries are following a more familiar and chaotic pattern of development of markets, national and local governments, public services, ICT infrastructure, telematics sectors, micro finance, community development capabilities… and there are ongoing scaling up problems in all of these areas. How to increase the poverty-reduction impact of ICT-related initiative and investment is not answered by experience, in any simple way, and appears very dependent on country context.

There is (arguably) a strong case for public and international-donor subsidy of ICT access, for poorer populations in particular, beyond the bounds of commercial and even socio-economic benefit-cost calculation, as a matter of human development, equity, poverty reduction and not excluding a large part of humanity from the knowledge shared by everyone else. For this, there is no substitute to the presence and accustomization of ICTs in poorer communities. How much and how fast are difficult questions, which again appear quite country-specific given conditions, resources available and competing priorities.

> As mentioned at the outset, many factors make these ICT (pro-poor) *access* investments difficult for benefit-cost calculations, including: the relatively short life of the investment boom so far; the familiar problems quantifying health, education and other (part) public-goods benefits; the cumulative effect of investments in a new-technology wave (national railways would not have been built on at-the-time realistic benefit-cost calculations); the rapid changes in technologies (broadly defined, elaborated below), which make today's micro analysis not very applicable to tomorrow's investments.

> Nevertheless, ICT (pro-poor) *access* investment decisions are made and re-made continually, and the body of evidence cited here would suggest, I believe:

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[209] See Muhammad Yunus, *Halving Poverty by 2015 -We Can Actually Make IT Ha*ppen, Commonwealth Lecture 2003, Delivered at the Commonwealth Institute, London on March 11, 2003: http://www.grameen-info.org/bank/Commonlth.html. IDRC's PAN program worked with Grameen in the early-mid 1990s on introducing computers into Grameen rural offices, for both large-volume loan processing and demonstration/use to villagers. Energy problems were tackled through a Grameen company, initially via solar panels which were sufficient for computers. Current programs of Grameen Shakti (energy) are at: http://www.grameen-info.org/grameen/gshakti/programs.html

[210] See in particular the website of the global network *WIEGO (Women in the Informal Sector Globalizing and Organizing)* at http://wiego.org

Universal ICT access (say universal broadband Internet as a proxy) is a strong and important motivating force for ICT4D practitioners and supporters, and could be for poverty reduction initiatives.

ICT access is desired by virtually all poor people and communities that are at all aware of it, and its advent most often creates excitement, energy and dynamism which is difficult to generate otherwise and often lacking in poverty reduction efforts.

Most poor countries simply do not have the resources to invest more heavily in speeding universal access; but there is a good case here for substantial **additional** donor finance, particularly given the poor performance of many donors in meeting ODA commitments and targets.

At this point in time, with such great international focus on poverty reduction, a major push on universal ICT access could be very effective, and would be greatly assisted by technological advance, notably the emerging advent of low-cost, relatively easy wireless broadband Internet, as well as mobile phone and PDA technologies.

Easier said than done? Absolutely, but experience and evidence:
- indicate how much knowledge, capacity and activity has been developed in poverty reduction from a wide range of approaches, organizations and initiatives including social/equity, gender, IC technology, economic, governance.. including many international coalitions; and
- suggest some possibilities for further momentum, for accelerated pro-poor access and utilization/services, in the context of existing and emerging initiative. These possibilities are taken up in the concluding section just below.

Information and Communication Technologies for Direct Poverty Alleviation: Costs and Benefits[211]

"Abstract: Information and communications technologies (ICTs) are powerful tools for empowerment and income generation in developing countries. The cost-effectiveness of different ICTs does vary between developed and less developed countries, however. This article reviews the potential efficacy of radio, telephony and the Internet as tools of direct poverty alleviation in the latter. While the requirements for their successful utilisation make radio and telephone far more suitable technologies for the poor, traditional ICTs can act as a sustainable intermediary for them to gain indirect access to the power of the Internet. Governments should concentrate on opening up private and community provision of broadcasting and widening access to telephone services, so that they can effectively play this intermediary role."

Moving from universal or pro-poor access to the more **systemic** ICT development and poverty reduction investments and strategies, the case material for poorer and less advanced countries also contains many insights and lessons; some observations...

The case for public subsidy of ICTs in education, health and other social services, and how to apply this in practice, appears to be important and to need work. If ICTs can deliver some services or parts of services more efficiently, or are otherwise fundamental to a service, they merit inclusion in services programs and budgets of governments and civil society organizations. They seem highly likely to be included in the investments and operations of privately financed education and health providers. Case studies do provide a lot of insight for practitioners in government ministries and civil society organizations to both re-orient service delivery to capture efficiencies and advantages of ICTs, and add programs or replace existing programs with more ICT-based delivery, where these are better and/or more cost-effective.

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[211] Kenny, Charles, World Bank, *Information and Communication Technologies for Direct Poverty Alleviation: Costs and Benefits*: Social Science Research Network: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=312189

More current and very accessible experience/evidence would be valuable, and networking operations like the Development Gateway and others are important in this respect. Ongoing efforts at synthesis, review and better microeconomic and country-sector analysis would seem quite important.[212]

For example, some study of schoolnet experiences, in a long-term perspective and in comparison with alternative approaches to various services delivery, would seem valuable. At the level of community initiatives, particularly multi-purpose ones, it is harder to be precise about the 'public good' (collective consumption) elements and benefits of the education, health etc. applications which telecentres support.

And this highlights a key issue, for private, public and civic sectors. Because some large part of ICT infrastructure (hardware, software, technical and content capacity..) is collectively consumed, private provision is a combination of too little and too expensive in terms of economic efficiency. Similarly, some considerable part of ICT infrastructure investment is consumed by future generations and, for this reason also (the technology wave problem), investment will be too low. In short, some part of ICT infrastructure should, by accepted public finance theory, be publicly financed or subsidized.[213]

> This is done routinely in developed and advanced developing countries, but poorer countries typically just don't have enough revenue base to do it. Donors do, and are very focused on poverty reduction; again an argument for finding effective ways for donors to finance an appropriately large part of poor countries' connectivity and infrastructure as part of poverty reduction support.
>
> How to do this, and do it best, is not an easy question. One could consider some range of broad poverty oriented access subsidy mechanisms, but I can think of none which would work in the political and governance contexts of many poorer developing countries. So one is brought back to the finance of ICT-poverty investments of two main kinds:
>
> - ICT *access and services for poor communities* - ie the donor-financed country, regional and international programs which support champions and innovation in (pro-poor) connectivity, and the range of key sector/issue applications most valuable to those connected. Most of these are competitive grant programs, and their scope has expanded recently into regional connectivity initiatives.[214]
>
> - ICT *systemic investments* which aim at or support poverty reduction - typically donor government-to-government programs in ICT infrastructure, and public services including education, health, poverty reduction programs and, more broadly, economic and public sector management.
>
> Experience says that both approaches continue to be needed and valuable, are increasingly connected through networks of organizations and individuals, and may be able to be strengthened in several ways - reflecting more and less advanced country experience - which are picked up again in V below. In this context, current experience suggests that ***both will get more donor support if they have strong poverty-reduction components and dimensions***. And both, particularly the former, will develop and benefit greatly from emerging low-cost wireless and broadband technologies.

With respect to the systemic investments, and the perspective of those in governments preparing and managing poverty reduction programs and public services (education, health..), micro analysis and

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[212] See in this context UN APDIP, Information and Communications Technologies for Governance and Poverty Alleviation: Scaling up the Successes (new research program: http://www.apdip.net/documents/Indiastudy2.pdf

[213] This statement is made from a national economy point of view, and does not include arguments for ICTs as global public goods; see for example: Stiglitz, Joseph E., Knowledge as a Global Public Good: http://www.worldbank.org/knowledge/chiefecon/articles/undpk2/index.htm

[214] See for example the Institute for Connectivity in the Amaricas: http://www.icamericas.net/index_e.html

thinking should be based on 'economic' costs as well as actual commercial costs. In theory, I would argue, they should be based on:

- connectivity costs (mobile phone, Internet dialup, broadband..) similar to those of the advanced countries - reflecting that the 'collective consumption' part of ICT infrastructure should be subsidized; and

- a low or zero discount rate (expected rate of return on investments) - to the extent this is not built into the lower connectivity costs - reflecting that the 'future generations' part of ICT infrastructure merits public finance.

Comparing economic costs, so derived, with actual costs provides, in principle, a good measure of the ICT subsidy (grant finance) needed for any particular program - such as public health education or distance technical education - and thus a strong case for donors to provide this grant financing.

> Major sector policy choices - such as resource allocations to public health, health education, water and sanitation, curative health etc. are of course not amenable to this kind of approach, and need to be made mostly on other evidence, constituencies and judgement.

> What this approach says is that within these broader decisions, if ICTs improve service quality and/or efficiency, use them. And in making this calculation, however formally or judgementally, use low ICT connectivity costs and a low or zero expected return on investments, and seek/use donor grant funding to bridge the resulting gap in public services budgets.

> For this to work well, donors would need to commit **additional** dependable (long term) grant finance for public services provision. The economic rationale is there, and this should reassure donors, but it is again *poverty reduction* that is motivating donors, and so strong poverty components and dimensions of public services will be most effective in mobilizing grant finance.

On a more macro and strategic level, case material also suggests several insights or lessons for ICT strategies. Perhaps most striking are that strategies have to be country specific, that no major component (below) can be ignored, and that countries generally succeed by giving highest priority to areas exerting the most binding constraints.

> One robust conclusion from case studies is that ICT infrastructure is very poor in many developing countries, and thus improvement of ICT infrastructure quality and price will have a key role in all aspects of improving the application of ICTs to poverty reduction. Within infrastructure, priorities will again depend on binding constraint questions among:

- *'physical' and technical infrastructure*
  - *policy/regulatory regimes*
  - *technical supplier/provider industries*
  - *hardware and software/applications*
- *knowledge and networking infrastructure*
  - *content providers and content - WWW, programs, knowledge networks/networking..*
  - *attitudes and technical capacity of users - ICT literacy*

> Every country needs a strategy; this is a lesson from all successful countries. In some countries, for example emerging from civil war, strategies could be quite limited, such as fostering technical education/training and capacity building. But they are still needed, however rudimentary, to provide a way of identifying and mobilizing investment priorities, as well as public support and awareness.

Challenges in de/re-regulation, foreign investment and ownership are quite well known, and good policy advice available with support from a variety of donor agencies.[215] The developed and rapidly expanding country cases provide a sufficient range of good alternatives. Main constraints include genuine concern about foreign domination, defensive political and commercial interests of governments, and lack of capability and resources in public sectors. Given the importance of a country's ICT policy frameworks and vision, more concerted and sensitive policy assistance from advanced country donors and corporations is an area of initiative worth considering.

Re policy, hardware and connectivity:
- it is very important for policy making to have a good grip on emerging technology - at present, for example, Wi-Fi and wireless mobile/PDA in particular;
- older technologies including radio, television and telephone communications systems are effective in many specific applications and also in introducing broader networking technologies to poorer areas;
- mobile phones are particularly important in many countries, for livelihoods and political/governance activities among others. Texting and cash cards are important for poor people, who have low income and no credit, particularly for on-call (construction, personal services..) work.

Telematics sectors in poorer countries are "characterized by small, vulnerable organizations with committed employees; the main threats are in the weak telecommunications infrastructure, limited/intermittent energy supply, restrictive laws, low purchasing power, computer illiteracy and lack of awareness."[216] Implicitly, they are expected to develop commercially, with whatever broad public support (skills training) and donor financing that is provided. The top-down approach (of governments and development agencies) to ICT expansion thus extends only little into the telematics sector. And the bottom-up support reaches back from poor communities to national ICT infrastructure, or circumvents it, as needs and options dictate. This appears to be a quite reasonable combination of strategies, but may often lead domestic telematics sectors very thin 'in the middle.'

Breaking this down a bit more, good applications in livelihoods, education, health, governance etc - particularly those oriented to poorer people whose literacy and language skills are weak - need good content. Some can and should be borrowed from other countries, but even these need to be adapted. This typically requires a combination of content and technology providers working together - from a range of educational, private, public, civil and foreign sources. In many countries, it appears that domestic tertiary education sectors could be more mobilized to help provide good content. Country strategies and donor funding would benefit from more complete pictures of telematics sectors in each country.

Similarly, good applications often come from economic and social innovators and entrepreneurs; ICT policy that motivates these, along with (competitive) grant programs that support them, are both important.

Community development capacity will need to expand in most countries if the emerging technologies and lessons from experience are to be scaled up into a broad and accelerated pro-poor access endeavour. Training and capacity building in community development would appear an ICT strategy priority for most poor countries.

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[215] Note also here the discussion of the reform of the international accounting rate system (Annex A, section 3.2), an important issue in general and to many countries for whom completing international telephone calls provides major export revenue.
[216] Annex A, section 3.2

V Priorities for Further Research and Action: Some Suggestions for Discussion

Different people interpret experience very differently. This last section makes some personal suggestions, just for discussion, and generally in relation to the principal countries and areas surveyed.

1. multipurpose community access;	2. access technologies amenable to poverty reduction;
3. gender equality;	4. education and human resource development;
5. science, high-tech and ICT-sector growth;	6. business and livelihoods development and support:
7. public sector, services & poverty management	8. environmental and natural resource management;
9. transparency, accountability, empowerment	

As just argued, this would be a particularly good time for a drawing together ICT4D/knowledge-economy and poverty reduction interests and agendas, from the perspective of poor villagers all the way to the perspective of global fora. Starting with the former, the 'faces' of poverty are almost limitless, but there are recurring images (and a growing volume of data and synthesis).[217] For illustration, a fairly extreme composite..

Many villagers, in almost any poor country depend mainly on agriculture, and if lucky some money from family members in a city; both are volatile. War, or the threat and remains of conflict, may be there and insecurity or actual loss of food, health or safety, particularly for women, is always at hand. Famine persists because both government and rebels gain from this.[218] The food-for-work program is giving a lot of its money to people who do no work, because they are conspiring with those in charge. A movement for access to information and public hearings has been started. But young people, particularly men, have learned that success does not come from being honest, in spite of efforts of NGOs and concerned citizens to convince them otherwise. Schools are open, but teachers are often missing because of conflict and AIDS, and they are paid little enough that absenteeism is very high. Many of the students who are allowed and able to attend are too undernourished to stay awake or concentrate. [219] Married women are the largest group of HIV/AIDS victims, but are blamed for AIDS because they go to clinics and are diagnosed, while getting it mostly from their husbands. Humanitarian and poverty reduction efforts of government and relief/development organizations, such as they are, focus on establishing some stability, security, nutrition and sufficient health services. National budget decisions and money reach District authorities by the middle of the financial year, with luck, but by the time the funds are siphoned off and spent, there are only a few sporadic public poverty reduction programs.

You might expect ICTs **not** to be high in many people's priorities, in this picture, but along with many other things, **they are!** Experience of the past decade is quite clear that poor people and communities are increasingly aware of ICTs, eager to have access, committed and hard working to gain it and help others, and with hopes around livelihoods, education, health and empowerment in particular. Children absorb and

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[217]for example, Kabeer, Naila *The Geography of Gender*, Chapter 3 in Kabeer, Naila, *Mainstreaming Gender Equality in Poverty Eradication and the Millennium Development Goals: A handbook for policy makers and other stakeholders (*Commonwealth Secretariat, IDRC, CIDA

[218] There is much recent literature on the political economy of hunger, and evidence that famines and hunger are very often caused or greatly exacerbated by the interests of those who gain (politically, economically..) from them. See for example Jean Dreze (Editor), Amartya Sen (Editor), *The Political Economy of Hunger: Famine Prevention,* WIDER Studies in Development Economics, September, 1995.

[219] Why girls or boys don't go to school**…**
- there are no schools close enough
- they are needed for working in fields, carrying water, carrying wood, caring for others in the household...
- families can't afford the fees, or transportation
- teacher absenteeism or poor teaching and content/resources quality makes it useless to go
- there are unacceptable security risks
- malnutrition and ill health make it useless to attend
- family/kinship, gender or cultural barriers prevail.

learn very quickly if able. There is a demand and a dynamic coming from poor people for ICT access - and to livelihoods, education, services, gender, empowerment etc. activities in which they are central or involved. And this kind of energy and commitment is very valuable.

Jumping to the global end, it is hard for anyone to argue that having the poor excluded from global connectivity/networking and knowledge is an acceptable part of our vision of poverty eradication in the end. The questions are mainly 'how fast' and how best'? It is hard to imagine Poverty Reduction Strategies and Millennium Development Goals being achieved only by systemic investments, and without a strong dynamic 'from the bottom.' Development and trickle down will not accomplish poverty reduction or knowledge society inclusion rapidly or even predictably in many poorer countries. *Trickle up* has some real merit when the focus is poverty reduction. With investments to bring ICTs and applications to the poor, additional resources flow to poor communities and to a range of intermediary institutions, and have an economic multiplier effect similar in kind but different in detail to other real resource injections. Pilots have become self financing faster than expected, overall, and on a large scale in Grameen like situations. Domestic content/education and telematics sectors are drawn in and built up. The systemic investments in ICTs and public services gain added demand and become more driven more by the poverty reduction considerations.

> Pro-poor development can of course exist as a concept without ICT connectivity as a main part - and appears to do so in many countries' poverty reduction strategies - but this is changing as countries and donors see the value of closer alliance between ICT and other investments. The schoolnet program needs the school milk program *and vice versa*. ICTs for their part bring clear motivation, and efficiencies, in most of the cases surveyed.

The logic of greater alliance and integration of ICT, poverty reduction and overall development strategies has huge components and challenges at each level - global & donor, country and local. Starting this time at the global level…

> The WSIS - World Summit on the Information Society - will be held in two parts, Geneva, 10-12 December 2003 and Tunis, 16-18 November 2005. It's structure includes many important topics including Access, Development (ICT4D), E-commerce, Education, E-government, Environment, Gender, Humanitarian, Knowledge Societies, Rights/Law/Ethics, Security, Special Focus Africa, Success Stories - but not Poverty Reduction.[220] One could argue that poverty reduction is an over-riding and cross-cutting issue, but it isn't, really. Nor is it in the other major global fora, really - eg the G8 Digital Opportunity Task Force (Dot Force), UN ICT Task Force, Global Digital Divide Initiative (GDDI) of the World Economic Forum (now concluded), and Global Knowledge Partnership (GNP) - which are profiled briefly at the end of this chapter.

> These may sound like harsh judgements, but I think it is fair to say that specialists in poverty reduction, involved in these fora, and examining their websites, find fairly little detailed knowledge about poverty.[221] There is a tendency to view good ICT investments as good for development, and development as good for

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[220] WSIS website: http://www.itu.int/wsis/documents/background.asp?lang=en&c_type=dt

[221] On a personal note, I was an early supporter of the past decade's ICT for development boom, beginning with Pan Asia Networking Program in 1993. This program was created by Maria Ng, with Phyllis Lim, from IDRC-Singapore. I was Regional Director, and fought many battles to keep this kind of very applied 'where's the research?' programming on th agenda, even in IDRC which has had information sciences and ICT4D programs for 30 years now. Some of the initial support was, indeed, purely connectivity and ISP support in countries without Internet - Mongolia, Laos, Cambodia, Vietnam, Mongolia. It became quickly development-application oriented, and responsive to growing within-countries innovation and demand for ICT use. I also spent the past 12 years managing or involved with a program on poverty and economic policy, MIMAP, or the Micro Impacts of Macroeconomic and Adjustment Policies, which supports national projects and international networks in poverty measurement/monitoring analysis, modeling and poverty impact assessment, community-based monitoring systems, gender, gender-responsive budgets, health, microfinance: www.mimap.org

poverty reduction. This is right as far as it goes, but is not enough to attract substantially more resources aimed at poverty reduction. Most of the development community now regards development as a necessary but not sufficient condition for poverty reduction.

Politics matter. Many of these fora are UN and inter-governmental, and it needs to be recognized that the global poverty reduction agenda is quite donor driven. Poor populations, even in a democracy, would not dominate politically in most developing countries. Developed and more advanced developing countries addressed equity and poverty in their ICT and other strategies, but poverty reduction did not drive their development strategies to the degree expected today from poorer countries. Nevertheless, donors are focusing on poverty reduction in MOST of their resource commitments. Developed country populations are not very interested in the middle and upper income people in the South, and support ODA mainly for humanitarian and poverty reduction purposes.

To the uninitiated, the information-society and knowledge-economy movements - the WSIS as a case in point - would benefit greatly from quickly developing persuasive poverty reduction objectives and components/agendas/platforms:

- because the same kind of ICT-development-poverty integration is needed at donor, country and local levels;
- because this will attract funding; if done well; and
- because the funding and resources mobilized will go a long way to supporting knowledge economy objectives beyond those of poverty reduction.

Major actors in poverty reduction movements need also to more fully absorb implications and opportunities of ICTs, and it appears that movement is taking place in both directions. So most of what follows is admittedly in hope of reinforcing and intensifying processes already in motion.

If the WSIS and major ICT/knowledge society coalitions adopted poverty reduction explicitly and substantially, what would this look like? I would argue along these lines…

Develop a strategy or global program focused on least developed countries, centred on accelerated pro poor access and utilization, and with substantial additional development resources to achieve this.

Have two main and related components, one more purely connectivity oriented, and one oriented - more strategically than at present - to key applications and services for poor communities.

Both involve a continuation and substantial scaling up of the competitive connectivity-oriented initiatives of the past decade. These have generally worked well, and emerging low-cost technologies make a big pro-poor push potentially feasible in the near future. The generally non-government orientation of these grant mechanisms has been very effective in piloting, and scaling up of best approaches and technologies is now needed and possible in many countries and local areas, Accelerated pro-poor access won't happen quickly if left to developing country governments, for the many reasons mentioned earlier. And the major international Connectivity Initiatives are ICT4D/ICT4P venture capital operations.

More of the needed (and gradually occurring) increases in these leading edge programs should arguably be provided for poverty reduction. And experience suggests at this point that the ICT4D pro-poor access initiatives could very usefully have one major focus/program/window for connectivity - access technologies, and multipurpose community access, for poorer populations in poorer countries. This is an area where ICT4D pioneers and innovators are particularly strong, and I believe could collectively propose and manage processes of speeding up the development, piloting and to some extent widespread application of low-cost, largely locally manageable wireless and broadband access in poorer communities.

Access isn't useful without application and content, so the other main focus/program/window of an ICT4P pro-poor access approach remains that of a range of livelihood, gender, education, health, empowerment etc. applications. Given the lessons of the past decade AND the current focus on poverty reduction, it is suggested that these initiatives can/should now become more strategic and selective (by country and overall). This is not easy, for the reason that there are many leading-edge connectivity/application programs, and each has built connections and alliances with development organizations (including some government) more focused on livelihoods, gender, education etc. It is important not to lose the dynamism of these ICT4D initiatives, but also important that they become more strategic in terms of the scaling up needed.

Again, I think the good leading-edge connectivity programs and their partners can handle this, and merit a lot more resources to do it. A more demanding set of grant criteria will be needed, leading to somewhat less funding of 'everything that looks productive,' and somewhat more of scaling up successful pilots in countries and substantive areas.

It could also use one or more strong leading areas of initiative and, here, I would put my money on girls education. Again, much easier said than done, and very country/situation specific. But there are international coalitions focussed on girls' education, with donor and private support, with partners, experience and progress in many countries. (Support is for primary education and is not restricted to girls, but is aimed at girls and secondarily inclusive of boys). The development and poverty reduction reasons for targeting girls' education are well known and accepted. For the ICT community to mount/increase/intensify ICT initiatives and support in alliance with girls' education initiatives could bring it added resources and momentum. It has much momentum, but it is diffuse and at some risk of losing coherence. Coming out strongly and substantively in support of education of the world's poorest girls would be potent.

Both connectivity and content/application components or windows would also need research support, preferably also competitive in nature - eg:
- more, more frequent and better synthesis of technical knowledge, and lessons and good practices, including country by country reviews across sector and issue areas;
- support for connecting and building coalitions among ICT, community development, gender, livelihoods, education, health etc oriented organizations internationally and within countries.[222]

Moving away from ICT access and use by poor people, and toward the more *systemic* investments and developments which target or contribute to poverty reduction, some suggestions also emerge from my reading of experience, and a lot of the argumentation is similar.

The leading edge pro-poor access efforts, above, both need and stimulate systemic improvements. Poverty reduction is the result of a lot of things, from growth to targeted programs. Countries and their institutions are unique, but experience surveyed here indicates that ICT and knowledge economy initiative has been important to developed and more rapidly advancing countries, and that most have developed innovative ICT-oriented initiatives for social inclusion, social equity and poverty reduction. Country strategies and sectoral programs are also the stuff of most bilateral and multilateral (government-to-government) ODA.

What could poor countries do?

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[222] In this context, see for example: Forum on ICTs and Gender: Optimizing Opportunities, Kuala Lumpur MALAYSIA: This meeting scheduled for August 2003 will be a multi-stakeholder initiative, bringing together public, private and not-for-profit stakeholders to examine issues surrounding gender and information and communication technologies: http://www.developmentgateway.org//ict/dg-contribute/item-detail?item_id=332200&version_id=198449&from=alert

Develop ICT/knowledge society game plans, however sophisticated, and integrate them with sectoral, poverty reduction and feasible overall development strategies. This is a challenge to capacity and government institutions in many countries, so donor assistance may often needed. (Progressive) donors are increasingly asking for this to be done, and supporting it - both through a lot of training and capacity building in government central and line ministries - finance, planning, information/telecomms/ICT, education, health, women's' affairs, rural and community development etc. - and through funding the strategies themselves once developed.

Decide ICT infrastructure investment priorities, in terms of what are the most binding constraints among components of infrastructure (hardware, software, technical and content providers, user literacy and community development capacity), and get as much support from donors as possible and useful in financing priority investments.

Decide public ICT-related sectoral investment priorities on two sets of grounds:

1. Binding constraints and lessons from experience; for example…

   In countries where health sectors are a mess, this is usually a serious or binding constraint to poverty reduction. There has been a lot of effort to ***reform health systems***, particularly from the 1990s on, and this is one public sector where the information structure of health systems/sectors is changing the prospects for better service delivery, and where evidence based resource allocation appear to have a considerable role, and enough experience, to make a big difference. Transparency and accountability are also priorities that ICTs can support in the health sector. At a minimum, ICT support can serve:
   - an effective (regular, quick, wide coverage) health needs surveillance mechanism for all developing countries lacking this capability, and this could well be a global priority; and
   - better management of health systems and service delivery , including health/nutrition education, water and sanitation, preventive and curative services.

   Given the prevalence and consequences of governance failings, there is a very good case in many countries for a major ICT-supported campaign for ***public sector transparency and accountability, and better management***. Politically, this is almost never easy, but there are probably starting points on the e-government front, depending on country, but often including:
   - continuous efforts to maintain a decent central statistical system, good poverty monitoring capability, and sufficient economic management capability - this is not expensive, but requires persistent long-term commitment to developing and maintaining key skills and institutions;
   - automation and transparency in budget making and financial implementation at national, state/provincial and local levels, together with access to information, and other public accountability frameworks;
   - good mechanisms for monitoring and understanding poverty, and implementing poverty reduction strategies, policies and programs (PRSP), which are typically effective only with good ICT content and support;[223] , and usually include:

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[223] As above (IV 7.c), these typically include:
- participatory monitoring or survey activities of civil society organizations and means of networking and assembling information and its implications nationally;
- national small-sample consumption-expenditure and income-expenditure surveys, and periodic larger sample surveys to capture state/provincial and more local profiles of poverty;
- periodic multi-indicator surveys (adding health, education, security etc indicators) to capture the different faces and causes of poverty, and poverty dynamics;
- participatory or community-based monitoring systems which offer low cost and effective coverage, substantial empowerment and altered public budget allocations, and monitoring of the local results of principal poverty reduction policies and programs; and

- multi-stakeholder strategy and policy development processes.

In many countries, building e-government components, with special attention to poverty reduction, looks to involve quite low cost and quite high potential.

2. The economics of using ICTs in public services provision; for example

Experience indicates that there are large quality, coverage and efficiency benefits possible in **primary, secondary, technical and tertiary education systems** in most countries, and sufficient guidance to design and carry them out well. The education planning and providing sectors of many poorer countries are absorbing this information, but slowly, and national (and international) efforts to speed absorption will be productive.

From a socio-economic view, ICT centred and supported public services should be assessed on the basis of low connectivity/infrastructure costs, and low/zero expected rates of return on investment, for reasons elaborated at the end of IV above. ICT use would be considerably more attractive and higher if public goods elements of connectivity and infrastructure could be subsidized. Budget constraints make this unrealizable in most poor countries without donor grant funding. To the extent that countries or donors can do rough calculations of the ICT-related subsidy element of public services provision, mobilizing donor finance can be facilitated.

What could donors and international fora do?

Keep pushing for and supporting the development of *co-ordinated* country development, poverty reduction and knowledge economy strategies. It would be good if the WSIS and related fora made this point strongly - and backed it up by coordination within and among donor agencies. E-strategies, for example, will have little relevance until grounded within the other priorities and fiscal realities of each country.

Provide strong, additional and co-ordinated (sector wide) support for implementation of good strategies; ie make good on the rhetoric and growing practice of strategies being domestically developed and owned, and supported by donors over extended periods of time on this basis.

Push on some strategy areas where needed. Governments are often fairly capable, for example, of undertaking improvements in public sector management, but not so much in transparency, accountability, citizen engagement and empowerment. Particularly where governance problems of the transparency/accountability kind are binding constraints, donors have little option but to work with non government organizations to raise engagement and empowerment, and realize public accountability frameworks of all kinds. Most of these initiatives need good information and networking support.

Accept socio-economic rationales for subsidizing ICT connectivity and infrastructure elements of public services as (partly/mostly) public goods, and find simple administrative ways of doing this.

Support research programs which provide, in particular:
- more, more frequent and better synthesis of technical knowledge, and lessons and good practices, including country by country reviews across sector and issue areas;
- more synthesis of experience on the integration of ICT and knowledge-economy strategies with poverty reduction and overall development strategies;
- microeconomic analysis and evidence on the main ICT-centred and supported applications which are central to both the private and the public-services sectors important to poverty reduction.

- co-ordinated processes of drawing together the often several sources of good information annually, and facilitating discussion and debate within the country.

In brief summary… one person's view:

Accelerated pro-poor access and utilization/services

A next step for the ICT4D community, (operating responsively and largely outside developing country governments, supported by multilateral and bilateral donors outside bilateral government-to-government channels), would be to consolidate the successful experience and lessons of the past decade of 'research venture capital', and intensify efforts to bring ICT access and beneficial uses to poor communities. More specifically, with the focus of donor support on poverty reduction, it is suggested that global ICT4D fora, including the forthcoming World Summit on the Information Society (WSIS) develop an explicit ICT4P platform which includes concerted efforts on:

- support for low-cost technology development and application, aimed at poor-community access;
- support for improvement and scaling up of key applications and services for poor communities - within countries and internationally:
  - bringing together essential partners, eg organizations specialized in development and community organization, gender equality, education, economic development and poverty reduction..
  - funding well conceived initiatives at a scale much larger than current ICT4D pro-poor access initiatives;
- support for some leading-edge ICT-pro-poor initiatives in areas of global focus re poverty reduction, eg girl's primary education (aimed at girls but not excluding boys), where there are active global consortia.

Systemic poverty reduction improvements

At the same time, the effectiveness of governments and bilateral government-to-government cooperation in ICT4P investment could evidently be improved by co-ordinated country initiatives, for poorer/poorest developing countries, which included:

- elaboration of ICT and knowledge economy game plans, integrated with overall development and poverty reduction strategies, and the policy and regulatory regimes needed;
- elaboration of ICT application in government services strategies, notably education, health, macroeconomic and budget management, gender equality and poverty monitoring;
- support for the implementation of these strategies, once elaborated, including long-term support for the public goods component of ICT infrastructure development

ICT4P Research Support Program

Both of the initiatives above would need research support including:

- more, more frequent and better synthesis of technical knowledge, and lessons/good practices, including country by country ICT4D/ICT4P reviews across sector and issue areas;
- research support for connecting and building coalitions among ICT, community development, gender, livelihoods, education, health etc oriented organizations internationally and within countries;
- more synthesis of experience on the integration of ICT and knowledge-economy strategies with poverty reduction and overall development strategies;
- microeconomic analysis and evidence on the main ICT-centred and supported applications which are central to both the private and the public-services sectors important to poverty reduction.

This section ends with a quick look, with references, at the major global fora now constituted around 'ICT for development' (ICT4D) issues, as they are drawing together a lot of people and organizations, and represent one forefront of knowledge and commitment. Perhaps the main ones are:

G8 Digital Opportunity Task Force (Dot Force),[224] with the following teams:

National E-Strategies   Access And Connectivity   Human Capacity And Knowledge
Enterprise & Entrepreneurship   Global Policy Participation   ICT For Health
Local Content And Applications

UN ICT Task Force[225] has met four times, and supports widespread collaboration and networking.
"The Task Force is an innovative mechanism – it is the first body created by a intergovernmental decision of a United Nations in which members, representing governments, civil society (including the private sector, not-for-profit foundations, NGOs and academia) and organizations of the United Nations system have equal decision-making power."

World Summit on the Information Society (WSIS),[226] under the auspices of the International Telecommunications Union (ITU) and UN (General Assembly)
"…a Summit in two phases with the first phase to be held from 10 to 12 December 2003, in Geneva, Switzerland and the second in 2005 in Tunis, Tunisia… to develop and foster a clear statement of political will and a concrete plan of action for achieving the goals of the Information Society, while fully reflecting all the different interests at stake. The scope and nature of this ambitious project will require partnerships with public and private entities…"

Global Digital Divide Initiative (GDDI) of the World Economic Forum[227]
"The Initiative is made up of a Task Force and Steering Committees, focusing interests and competencies on efforts relating to *education, local content, entrepreneurship and regulation policies*. The Task Force is co-chaired by Microsoft EMEA, and the International Development Research Centre (IDRC)… to mobilize resources to build-out digital divide-related projects and to advance this issue on the global and regional public policy agendas. The Task Force works closely with six community development initiatives from around the world and works in collaboration with the UN ICT Task Force, the G-8 DOT Force…"

Global Knowledge Partnership (GNP)[228]
"The GKP is a "network of networks" with a diverse membership base comprising public, private and not-for profit organizations from both developed and developing countries. The Partnership was born as a result of the 1997 Global Knowledge Conference… the secretariat is hosted by the Government of Malaysia… The Global Knowledge Partnership is an evolving network of public, private and not for profit organizations…to promote broad access to – and effective use of – knowledge and information as tools of equitable sustainable development… share information, experiences and resources to realize the potential of information and communication technologies to improve lives, reduce poverty and empower people."

In addition, many of the ICT4D portals on the Internet have been referenced above, and it is worth highlighting the **Development Gateway**[229] of the World Bank, which posts materials daily under the headings: Key Issues, Editor's Choice, Most Popular, About ICT for Development, Access & Connectivity, Capacity Building & Training, Community Telecenters & Cybercafes, Digital Divide, e-Commerce for Development, e-Readiness & Needs Assessments, e-Strategies & Action Plans, ICT & Disability, ICT & Gender, ICT & Youth, ICT Country

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[224] See: http://www.dotforce.org/teams/
[225] See: http://www.unicttaskforce.org/
[226] See: http://www.itu.int/wsis/index.html
[227] See: http://www.weforum.org/site/homepublic.nsf/Content/Global+Digital+Divide+Initiative
[228] See: http://www.globalknowledge.org/
[229] The Development Gateway (http://www.developmentgateway.org/node/133831/?)

Profiles, ICT for Agriculture & Rural Development, ICT for Education & Science, ICT for Environment, ICT for Health, ICT for Poverty Reduction & Growth, ICT for Older Persons, ICT for Private Sector, ICT for Public Sector, ICT Policy, Laws & Regulations, Open Source Software, Radio & Development, Wireless for Development, World Summit on the Information Society, Awareness Raising & Networking, Broadband for Development, Broadcast Streaming & Digital Media, Building Online Communities, Computers & Hardware, Digital & Virtual Libraries, e-Discussions & Mailing Lists, Emerging Technologies, Geographic Information Systems, Grants, Awards and RFPs, Financing ICT4D, Free Computers, Software and Services, ICT & Aid Effectiveness, ICT & NGOs, ICT & Democracy, ICT, Governance & Transparency, ICT, Leadership & Innovation, ICT & Millennium Development Goals, ICT & Knowledge Sharing, ICT & Law, ICT & Solar Power, ICT & Volunteers, ICT for Community Development, ICT for Culture & Arts, ICT for Employment & Labor, ICT for Financial Sector, ICT for Indigenous Development, ICT for Investment & Export Promotion, ICT for Peace & Security, ICT for Post-Conflict Reconstruction, ICT for Regional Integration, ICT for SMEs, ICT for Tourism, ICT for Transport, ICT for Urban Development, ICT Governance & Institutions, ICT Industry Development, ICT Infrastructure, ICT News Sources, ICT Projects Coordination, ICT Trends & Statistics, Impact Evaluation, Information Society & Digital Economy, Intellectual Property & Copyrights, International Cooperation, Internet, Technology & Information Revolution, Internet2, Jobs & Other Opportunities, Key Articles.

Annex A: A Further Recent Literature Review

Please see http://network.idrc.ca/ev.php?URL_ID=24718&URL_DO=DO_TOPIC&URL_SECTION
(The file is relatively large, to include in this paper)

ICTs and Poverty: A Literature Review, By C. Nyaki Adeya, PhD (For IDRC)

1.   Introduction
2.   The Concepts of ICTs and Poverty
        2.1   ICTs and Some Related Issues
                2.1.1   ICTs and Collective Access Points
                2.1.2   ICTs and Development
        2.2   Poverty and Some Related Issues
3.   The Relationship between ICTs and Poverty
        3.1   Old ICTs
        3.2   New ICTs
4.   Case Studies on ICTs and Poverty
5.   ICTs and Poverty Reduction Issues
6.   ICTs and Selected Thematic Areas
        6.1   ICTs and Agriculture
        6.2   ICTs, Culture and Governance
        6.3   ICTs and Education
        6.4   ICTs and Health
        6.5   ICTs and Gender
7.   Concluding Remarks
8.   Recommendations for Further Research
        Bibliography