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Boosting the Social Development of the Majority Through the Creation of a Wireless Knowledge Society

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INTRODUCTION

The rapid advances and pervasive diffusion of information and communication technology (ICT), combined with the growth of the wireless Internet, has led to deep transformations in economic, social and institutional structures. ICT applications affect the performance of businesses and the efficiency of markets, foster the empowerment of citizens and communities as well as their access to knowledge, and contribute to strengthening and redefining governance processes at all institutional levels. Nevertheless, as all major and wide-ranging technological advances, the deployment of ICT is at the same time creating enormous opportunities and posing daunting challenges to the Majority in the emerging economies (EE).

According to C.K. Prahalad (2005) in his book, *The Fortune at the Bottom the Pyramid*, “The distribution of wealth and the capacity to generate incomes in the world can be captured in the form of an economic pyramid. At the top of the pyramid are the wealthy, with numerous opportunities for generating high levels of income. More than 4 billion live at the Base of the Pyramid (BOP), on less than \$2 per day. Those are the Majority.”

This paper presents some of the successful sustainable ICT practices aiming at boosting the social development of the Majority contributing to the creation of a wireless and inclusive Knowledge Society. It also offers a road map for the international financial institutions, particularly the Multilateral Development Banks (MDBs), aiming at supporting ICT for development programs benefitting EE.

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BACKGROUND

The United Nations Millennium Declaration (United Nations, n.d.) noted that efforts to make internet access available to all and to harness the power of ICT could contribute toward the achievement of the Millennium Development Goals (MDGs), thereby creating “digital opportunities” in development. The ongoing debate on the new set of UN Sustainable Development Goals (SDGs) reignites the interest for the ICT in a contest of emerging knowledge economies and societies.

The ICT can facilitate the participation of lower income populations, the majority at the base of the pyramid, according to the definition given in (Pralhad, 2005) in the development process by directly tackling relevant aspects, which precisely hinder their integration into social and economic development. Such aspects concern:

- Limited knowledge and literacy which impairs access to skills and jobs (education);
- Poor health and sanitary conditions limiting employability and risk-taking attitudes (health);
- Scarcity of economic opportunities (economy);
- Limited involvement in civic life and in the democratic processes, as well as uneasy access to public services (government).

The following successful sustainable practices, show how ICT can help reducing the risks of exclusion related to the aspects cited above, thus contributing to the integration of lower income

populations into social and economic development. Based on the lesson learned from the practices, we draw some conclusions and offer some recommendations. These recommendations are the basis for forward-looking scenarios that can be realized through the deployment of ICT towards the attainment of an inclusive economic growth process for all, meeting social development and poverty reduction objectives, as expressed in the United Nations Millennium Declaration.

SUSTAINABLE PRACTICES IN ICT FOR SOCIAL DEVELOPMENT AND POVERTY REDUCTION

ICT in Human Capital Development

Inequalities in access to education—especially high-quality education that prepares young people for employment opportunities in an inclusive knowledge society and to become active citizens in complex, market-driven, democratic societies—are a critical barrier to reducing poverty and increasing economic growth. Near-universal access to the Internet via low-cost networks enables teacher training, enhances student access to traditional teaching materials via Internet distribution, and allows the introduction and use of new and advanced multi-media resources and learning tools. The young generation takes readily to computers and such resources, and there is

evidence that classroom access to ICT tools can improve learning and help motivate students to stay in school.

Best practices for ICT-enhanced classroom education have been slow to emerge, in part because of the high cost of providing computers, appropriate curricula and adequate teacher training. Nevertheless, there are a number of concrete examples that show the effectiveness of widespread, small-scale experimentation and pilot projects which, coupled with careful evaluation, provide best practice ICT applications for formal and informal education (see Table 1)

ICT in Health and Social Services

The improvement in the delivery of health care services in geographically remote and rural areas is one of the most promising and clearly demonstrated applications of ICT in social development. Evidence suggests that improved health outcomes have been achieved through various applications of ICT solutions. In particular, ICT is being used in many developing countries and communities to facilitate: (a) remote consultation, diagnosis and treatment through the use of digital cameras to download images onto a computer and transfer them to doctors in nearby towns; (b) collaboration and information exchange among physicians; (c) ICT-based medical research through the use a network of satellites and ground stations to submit data for clinical trials; (d) medical training through

Table 1. Committee to democratize information and communication technology in Brazil

<p>The <i>Comitê para Democratização da Informática</i> (CDI), a nongovernmental, nonprofit organization fosters the social inclusion of less-privileged social groups with ICT as a tool to encourage education and active citizenship. It works to create opportunities for young people to free themselves from poverty and social exclusion through the implementation of community Computer Science and Citizenship Schools (EICs). The CDI views computer literacy as a vehicle for creating employment opportunities and promoting civic participation, formal education, literacy, concern for the ecology, health, human rights, and nonviolence. The CDI also uses ICT to benefit low-income communities and institutions by assisting individuals with special needs (including the physically and mentally disabled, the visually impaired, homeless children, prisoners, and indigenous populations). CDI invests in the community's capacity to organize its own educational programs. Since its inception in Rio de Janeiro in 1995, CDI has provided support to 130 communities in the establishment of autonomous and financially self-sustaining EICs. In order to promote digital inclusion, CDI entered into partnerships with national and international philanthropic organizations, companies, government agencies and individual donors. There are currently 965 EICs using the methodology and model developed by CDI. In a recent evaluation, carried out by an external consulting group, 86 percent of the students stated that CDI schools had a positive impact on their lives (such as going back to regular schools, making new friends and staying away from drugs). The experience has been replicated throughout the world and, today, CDIs operate in Argentina, Chile, Colombia, Guatemala, Honduras, Mexico and Uruguay as well as in Angola, Japan and South Africa.</p>

ICT-enabled delivery mechanisms; and (e) access to centralized data repositories connected to ICT networks that enable remote healthcare professionals to keep abreast of medical knowledge.

Moreover, ICT provides considerable benefits and capabilities when applied to disease prevention and response efforts during epidemics (see Table 2).

As far as the social services are concerned, it is important to mention the CETID project, a successful good practice of the State of Sao Paulo, Brazil, for the social inclusion of people with disabilities through ICT. CETID stands for “Center of Excellence in Technology and Innovation for the social inclusion of people with Disabilities”. This successful practice is the result of the Knowledge economy approach to the activities of the “Sao Paulo State Secretariat for the rights of people with disabilities”. By the simultaneous and seamless investments in Innovation, Education, ICT, Habilitating policies and Institutional regimes, the Secretariat created a virtuous cycle that led to the creation of the Center that benefits people with disabilities.

ICT in Financial Services

ICT tools can drive down transactions costs for financial services such as microfinance and a widening range of banking, insurance, and other services for low-income groups, particularly as their delivery expands beyond nonprofit groups

and becomes more widespread (see Table 3). For example, the expanded use of ICT and the Internet can reduce the transaction costs of remittances in a way that brings higher social benefits for all parties involved in these transactions. Nonetheless, there is still much to do. Transaction systems adapted to serve low-income communities via text messaging over mobile phones have been successful in Asia and Africa, and may prove useful in Latin America and the Caribbean as well. ICT offers several approaches to expanding access to electronic transactions and banking services via remote transaction devices for microfinance that work over mobile phone networks; smart cards that can store account balances, transaction histories, and positive IDs such as a fingerprint. The next generation of mobile phones and bank services are capable of conducting transactions automatically via very short-range radio, potentially turning phones into electronic wallets.

Wireless Technologies and Community-Based Communications Services

Largely for reasons of cost, most rural communities and many low-income urban communities lack effective and affordable local phone systems. These communities usually rely on a few pay phones or shared mobile phones (which are used sparingly) and most calls are made to numbers outside the community. Yet historically, where affordable lo-

Table 2. Alerta DISAMAR: an innovative disease surveillance system in Peru

Real-time reporting of disease outbreaks as well as ordering medicines and supplies via software such as the VOXIVA toolset pioneered in Peru (which is now used worldwide) has dramatically increased the efficiency of health services delivery. Such solutions combined with handheld devices assist frontline health workers in efficiently collecting and reporting patient data, and contain digital diagnostic and treatment guides for a wide variety of conditions. Alerta DISAMAR is a pilot disease surveillance program implemented in 2002 by the Peruvian Navy, which relies on novel technology from VOXIVA Inc. Alerta DISAMAR allows users to collect, store, disseminate and analyze data on diseases under surveillance, reported through any type of telephone or the Internet. Designated users receive automatic notification of selected reports via e-mail, voice mail, or SMS message. Health officials can communicate with remote health professionals using voice mail as if they were e-mails to individuals or to predetermined groups of users. The system sends timely automatic reports on the number of cases of eight of the most reported diseases compared to the previous three weeks and a monitoring of cases that do not have yet a final diagnosis. Alerta DISAMAR shows a sustained improvement in coverage, data quality, baseline incidence rates, and outbreak detection capability. Alerta is a flexible and stable program with minimal recurring costs. It is a prime example of sustainable technology transfer for improving public health in a country with limited resources. More than 18,042 health events have been reported so far using this program. In addition, 18 outbreaks have been detected that have led to recommendations for improving vector control and food procurement processes.

Table 3. PRODEM FFP's multilingual smart ATMs for microfinance in Bolivia

Bolivian PRODEM Private Financial Fund (PRODEM FFP) offers low-income communities and micro, small and medium enterprises a wide range of savings, credit and money transfer services. Its 65-branch network is the largest in the country and spans both urban and rural areas. To expand its market, improve its services in even the most remote areas and help overcome barriers such as illiteracy, the company has developed and deployed a new technology-based solution that employs smart cards, digital fingerprint recognition technology, and Smart ATMs, as well as stand-alone, voice-driven Smart ATMs in local languages with color-coded touch screens.

cal phone systems exist, typically 60 percent of all phone traffic is within the community. Thereby, a low-cost local phone system can make universal access a reality in many communities of EE (see Table 4).

The technological potential of the project has emerged, via local Wireless Fidelity Networks (WiFi) and Voice-Over-Internet (VOIP) telephony using peer-to-peer systems. For example, technologies such as Skype are having a global impact on long distance calling. In addition to making a wide range of voice-driven e-government and commercial services accessible and affordable, low-cost wireless networks, VOIP and high-capacity broadband networks, enable access to a great variety of Internet services and information via a computer or other converged device.

One of the benefits of voice-driven or voice-accessible services—especially if also made available in indigenous languages—is overcoming literacy and computer skill barriers. Other benefits also include ending rural isolation, enhanced family solidarity, increased access to information and services, improved ability to find employment and, at a community level, higher economic capacity and productivity and wider citizen participation in

democratic processes. The experience shows that this can be achieved with affordable computers and Internet access, especially if these services are delivered through local entrepreneurs or community access facilities that can assist in computer and Internet usage.

Nevertheless, not all the countries in Latin America and the Caribbean (LAC) have made VOIP legal or removed restrictions to its use. Likewise, few countries have made frequencies available for unrestricted WiFi use, permitted open competition for telecom and Internet services, or allowed community-based systems exemption from legal/natural monopolies. Beyond regulatory restrictions, the business environment in many countries still poses barriers to entrepreneurs and the creation of small businesses. There have been few pilot projects that promote best practices with rapidly emerging ICT technologies such as those cited. As a result, the LAC Region still lags behind many Asian, and even some African countries in realizing the potential development benefits from widespread ICT access and emerging wireless and no conventional communication technologies (see Table 5).

Table 4. Communications and social services in the Amazon

The Amazon Association, a Brazilian NGO, and the Solar Electric Light Fund, a nonprofit organization based in Washington, D.C., teamed up to provide basic services and economic opportunities to the Caboclo Indians by means of broadband wireless Internet. Many members of this indigenous community lack basic health care, education and economic opportunities. In the absence of phones, electricity or Internet infrastructure, solar panels are being used to power a permanent satellite uplink to a local telecenter, which was built in four days and is expected to be self-sustainable in four years. In addition, it is expected that connectivity will be extended to other communities along the Jauaperí River in a cost effective manner by using WiFi technologies and sharing costs. According to the Wireless Internet Institute, “communicating on a regular basis with the outside world has provided a tremendous psychological lift to the community.” The Amazon Association is able to stay in contact with community members via e-mail, reports on problems at the reserve, participates in decision-making, and requests supplies and medicines. Wireless technologies are an important means for outreach, empowering a community and promoting civic involvement. The project has become a source of income for local craftswomen, who can now sell their wares through the Amazon Association.

Table 5. Vodacom's community cell phones in South Africa

Vodacom Community Services started operating under a 1994 government mandate to provide telecommunications services in disadvantaged communities in South Africa. Vodacom developed an innovative way to meet this mandate, via entrepreneur-owned and operated phone shops. These have provided affordable communication services to millions of South Africans, and empowered thousands of previously disadvantaged individuals with income-generating opportunities and lasting business skills. The Community Services program now provides over 23,000 cellular lines at over 4,400 locations throughout South Africa. By investing so extensively in disadvantaged communities, Vodacom is also investing in its own future by creating a distribution channel for its services, in addition to a well-recognized brand name. Though full returns will materialize in the future, the company is confident that its investments will pay off directly through increased sales and indirectly through a stronger, better-connected South African economy.

A WIRELESS KNOWLEDGE SOCIETY¹

Table 5 illustrates what Professor C. K. Prahalad of the Michigan Business School poses in his book *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits*, which highlights the collective purchasing power potential of the world's 4 to 5 billion poorest people (the Majority). He urges efforts to promote an enabling business climate that goes beyond the promotion of social corporate responsibility as means to foster local well-being, while generating a strong revenue and profit potential base in the long term. Moreover, a recent study by the London Business School found that, in a typical developing country, an increase of ten mobile phones per 100 people boosts GDP growth by 0.6 percentage points. The study concludes that wireless solutions are concrete examples of "technologies that help people help themselves" (Avgerou, Ciborra, Cordella, Kallinikos, & Smith, 2005) by: promoting a multi-stakeholder partnership framework delineating the effective participation of the public sector and civil society, while creating the incentives for socially responsible private investment; strengthening the provision of ICT-based public social services and promoting social inclusion, while maintaining the role of the private sector as the main source of innovation; stimulating macroeconomic growth by facilitating access to knowledge and information through increased connectivity and appropriate ICT solutions for marginalized and lower-income populations, thereby tapping a strong market potential; designing and adopting long-term ICT investment frameworks in human development.

By removing barriers to the entry of new and lower-cost technologies (such as fixed wireless) and of new communication and ICT-based services (such as Voice-Over-Internet phone service), and ensuring open competition, it will be possible to increase entrepreneurial activity and expand private sector investment. Nevertheless, the direct involvement of the public sector continues to be fundamental in sharing and expanding service into remote areas and to serve as a catalyst for the effective delivery of social services. This also reduces risk for private enterprises and helps comply with commitments to serve certain regions, communities and marginalized or disadvantaged groups, while also allowing market forces to trigger actions and operate effectively.

The World Summit on the Information Society (WSIS) asserted the importance of the use of information and communication technologies (ICTs) for the achievement of the Millennium Development Goals (MDGs).²

In particular, wireless Internet technologies deserve particular attention not only because of their importance to the development process, but also because of their ability to reduce the costs of providing ICT access and ICT-enabled services to underserved areas.

The cost of providing access to voice and data networks using wireless technologies, even in rural areas, approached in 2005 US\$300 per subscriber, compared to US\$1,000 for fiber optic or copper networks in urban areas. In addition, wireless technology does not imply significant sacrifices in quality or throughput. Furthermore, while copper or fiber optics usually cost between US\$20,000 and US\$40,000 per kilometer of

connectivity, hundreds of kilometers of wireless connectivity can be provided for US\$50,000 (Best, 2003). This cost advantage (which is widening with increasing global use of wireless technologies and resulting economies of scale) can be used to connect rural areas in a cost-effective and even self-sustainable fashion.

Given its unprecedented cost advantages wireless technologies promise more than a cost-effective way of providing access to underserved populations. For governments, wireless technologies offer a way to deliver valuable services (such as health and education), as well as government services, to citizens living in remote areas.³ In some cases, rural populations can pay for the capital costs of any necessary equipment as well as the recurring costs of Internet connection. For example, poor rural residents of Tamil Nadu, India, have funded telecenters for as little as US\$3 in revenue per day by using a wireless technology similar to WiMax called corDECT. An analysis of Latin America and the Caribbean shows that the same could be accomplished in the region for approximately US\$3 to US\$14, covering between 100 and 500 households. Recurring monthly costs for wireless Internet connectivity for education purposes in Sucre, Colombia, amount to US\$5 per student per year. The latent demand for communication services from poor rural populations could bring financing and sustainability even without government aid. The following examples from selected EE countries provide a broad picture of possible successful wireless applications:

Providing Education in Sucre, Colombia

The state of Sucre is marked by high poverty and illiteracy rates and, until some years ago, uncontrolled violence. After security was re-established, population increased by 30 percent without a commensurate increase in the state budget. The *Corporación Politécnica Nacional de Colombia*, a partnership between the government

and the private sector, was created in an attempt to control high school dropout rates and improve the cost-effectiveness of education.⁴

Through a grant (that is considered a social investment) from the Ministry of Education for approximately US\$220,000, the *Politécnica* connected 11 schools across the state using wireless technologies, provided new computers, and trained local staff at each school in hardware and LAN maintenance. Recurring costs of the Internet connection, software upgrades, ISP uplink costs, and network infrastructure amount to US\$5 per student per year, which, so far, has been funded by the state government.

The initial response was not as good as expected. The availability of Internet did not by itself promote its use, and neither did the services offered when the project was launched. However, after adding customized services, including course management software as well as human and capital resources, software usage increased. Students and professors have reacted very positively to the Internet connection and the software, and they now routinely create websites and participate in classes via videoconferences from state universities. This experience shows that simply providing Internet connections is not enough to promote its usage or address development problems. In addition to providing connectivity, investments should be made to develop customized services.

Voice and Services in the Dominican Republic

A village-area network (VAN) was installed in Bohechio, Dominican Republic, in March 2001 as part of the LINCOS project headed by the Costa Rican Foundation for Sustainable Development. The rural community of Bohechio, one of the least developed communities in the country, is situated in a mountain range and has a population of approximately 7,000 people (Best, 2003).

The VAN covers an area of approximately one square kilometer and took three days to install.

The cost was less than US\$20,000 (prices fell significantly in recent years) for six computers, two telephones, a multifunction fax/scanner/ printer, a cash machine, an environmental testing lab, FM radio station broadcasting ability, a big-screen TV, and a telemedicine unit. A VSAT provides uplink connectivity via satellite link and, using an 802.11b network, gives access to wireless devices, including PDAs and voice-over-IP telephones at a radius of up to 1 kilometer and at speeds of up to 11 Mbit/second (Best, 2003).

Applications currently provide assistance to schools, a medical clinic and farmers. The VoIP solution and associated IP-based telephones installed around the town compete with the telecom provider, offering rates of US\$0.18 per minute on calls to the city, compared to US\$0.30 on fixed lines. INDOTEL, the national telecommunications regulatory authority, has relaxed its regulations so that spectrum used in the project is valid and has offered significant support and partnership (Best, 2003).

E-Commerce in Ecuador

The “world’s first Wi-Fi linked e-payments network” was created in the Mall of San Marino in Guayaquil, Ecuador, through a partnership between the US e-payments equipment and services provider, Verifone, and the wireless equipment provider MediaNet, a subsidiary of D-Link. The wireless network eliminated multiple dial-up phone lines and Internet access points, using instead a central uplink and IP-based Wi-Fi to connect Verifone’s “multimodal network access point-of-sale terminals” in the stores. This resulted in lower charges for long-distance calls for merchants and 24-hour/7-day availability. The speed at which payments were processed and data transferred improved by 350 percent, with an average of four seconds per transaction. Verifone’s marketing director for Latin America and the Caribbean stated that the company expects “wireless-enabled POS terminals to become more mainstream over the next several years, particu-

larly when the solution is delivered with the right partners” (Burger, 2004).

PDAs and E-Health in Uganda

Malaria, tuberculosis and AIDS have ravaged many African countries and have been largely responsible for the current health crisis in the continent. SATELLIFE, a Boston non-profit organization, has been using WideRay servers, rugged plastic boxes equipped with a GSM cell phone and Strong ARM processor in an effort to help ameliorate the critical situation.

Equipped with wireless-capable PDAs in rural areas in Uganda, health workers, many of whom had never used a computer before, are able to relay information to the Ugandan Ministry of Health on drugs needed by the population and local epidemics. The International Development Research Centre (2003) notes that, prior to this innovation, reports were hand written and requests for medicines took months to reach those able to fulfill them. The introduction of the PDAs has significantly reduced the time lag to receive needed medicines in rural areas, and has also made it possible to relay information back to healthcare workers in the field regarding the most cost-effective approaches or latest treatments for endemic diseases. In addition, reporting errors have been drastically reduced, improving the quality of the information available to policymakers. As a result of improved information on the health status and burden of disease of the population, important improvements can be expected in the management of national health budgets.

The application of these new low-cost technologies in Africa shows the type of improvements in social well-being that can be brought about by the use of wireless technologies. Like the example from the project in the Dominican Republic, this project demonstrates the success of using simpler technologies (i.e., PDAs with wireless) in cases where those involved may not know how to use computers.

E-Government in India⁵

Through e-government services a government can stay connected to remote populations and, with fee-based servicing, can ensure a steady stream of revenue so that local communities are able to run self-sustainable access points.

The Gyandoot project in the Dhar district of Madhya Pradesh established a set of telekiosks (small, self-service telecenters) that bring e-government services to the local population. The government has promised a one-week response time on local grievances for a fee of approximately US\$0.20. This has become the third most popular service, behind market prices and job availability (Best & Maclay, 2002). Additional services provided include assistance in obtaining legal certificates for land deeds, e-mail, village auctions, on-line matrimonial listings, and educational guides. Although most of the current network is based on wired infrastructure, wireless technology is being used to reach isolated and remote areas.

LESSONS LEARNED AND RECOMMENDATIONS

Based on the learning derived from the preceding examples and others, the following actions are suggested for the promotion and use of ICT for development:

- The creation or strengthening of the institutional capacity with the participation of the public, private and civil society sectors, in order to promote and foster the dissemination and use of ICT through programs and initiatives that build a participatory information and knowledge society.
- Raising awareness and creating the conditions for the design and implementation of pilot initiatives and the replication of best practices in priority areas including ICT for social development and poverty reduc-

tion, ICT for governance, and ICT for economic growth, among others.

- Undertaking the actions necessary to promote a digital inclusion for all.
- Creating the organizational conditions for the identification of concrete and comprehensive national ICT investment plans which effectively delineate the participation of the various sectors and stakeholders.
- Implementing and/or strengthening national and regional regulatory frameworks to, among others, promote competition and loosen restrictions on the telecommunications market, allow for the expansion of media convergence, and promote and facilitate research and technological innovation.

The Multi-Lateral Development Banks (MDBs) can play a relevant role in supporting ICT for development programs. Indeed, the MDBs are aware that they must continuously update their financial and technical assistance instruments to effectively adapt to the demand of their borrowing member countries; they have to support activities to provide and facilitate access to efficient ICT tools for the exchange of information, ideas and knowledge; and they have to support the deployment of ICT to promote a more inclusive socioeconomic development that extends benefits to the poor.

In particular, the MDBs could establish collaboration agreements with the technology-based private sector by taking into consideration:

- The extensive need for new and modern technologies in pilot and demonstrative projects, and whose results and applications can be replicated in operations of a wider scale.
- The goal to make the private sector from both, donor and borrowing member countries of the Banks, as active stakeholders in the development process through ICT.

- The aim to provide opportunities for the private sector to participate in the efforts of the countries towards social development and poverty reduction, while creating value added opportunities and the expansion of ICT-based services.
- The example of the Inter-American Development Bank (IADB) that created the “Facility in Information and Communication Technology for Development”, which set the institutional, financial and legal means for the Bank to effectively partner with leading private sector firms and civil society institutions with the goal of contributing to the attainment of the MDGs by the countries of the Region and, specifically, through the value added ICT solutions described above.

The MDBs have the opportunity to take a leadership role in shaping the enormous potential of wireless ICT in the EE. One overarching principle is that the MDBs should not in any way replace or hinder the significant efforts of the private sector. There are, therefore, four primary initiatives related to wireless technologies that the MDBs can lead: convening policy discussions across sectors, streamlining existing country operations through pilot projects, generating and sharing best practices, and fostering a regional policy consensus.

FUTURE RESEARCH DIRECTIONS

The hypothesis that ICT can have significant positive impact upon socio-economic development indicators is based generally on three propositions: (1) speed, because ICT are based on increasingly sophisticated digital instruments, and because rapidity of processing is one of their principal attributes, the use of ICT to deliver development services increases the speed at which those services become available to development beneficiaries; (2) reach, because ICT can make use of massive communication means, the number of potential

beneficiaries is greatly augmented; and (3) cost, as a function of a larger customer base and faster deployment rate, lower costs in the delivery of development services can be expected of the use of ICT as compared to other (traditional) instruments.

However, there is a significant gap between current and available knowledge regarding optimal conditions to make the most of the introduction of ICT to the development tool-box. In particular, the following research priorities have been identified:

- Impact and end-result (increase in income; number of direct and indirect beneficiaries; reduction in costs of service to the service provider, etc.) that depict more accurately the differential impact of the inclusion of ICT in a development context, capable of being adapted to different cultural and socio-economic settings;
- Development of cooperative arrangements to achieve critical mass in infrastructure (communications, R&D) investment available to the poorest countries, where conditions are not present to maximize the usefulness of ICT investment;
- Reliable, low cost, patent systems, particularly for communal, historic, or otherwise not individual innovation products;
- Effective communication mechanisms between supply and demand of ICT to cover the needs and acquisition ability of special interest groups and different income levels;
- ICT public policy needed to compensate market failures, and differential needs for low and medium income developing economies.

CONCLUSION

Examples of past programs, projects and activities where ICT has been instrumental to improve the conditions of beneficiary populations allow the following conclusions regarding the impact of ICT in a development context:

- ICT substantially lowers transaction costs in most economic activities;
- ICT increases the organizational capacity of private firms and their ability to manage data and information to base their decisions;
- ICT improves market effectiveness by broadening buyers and sellers' access to information –for example information on market price; volume, location and characteristics of demand; supply options;
- Investment in R&D explains up to 75% of the differences in total factor productivity growth rates, once externalities have been factored-in (Griliches, 1979, as cited in IADB, 2014), with productivity growth identified as a result, not a cause, of R&D investment (Rouvinen, 2001, as cited in IADB, 2014).
- In poorer countries, investment in R&D can have negative results due to the absence of trained human capital, apt scientific infrastructure, capable private sector, and effective public sector incentives.

In fact, in recent years, the EE have experienced a significant progress in the penetration of ICT, exceeding the growth achieved in the sector by other regions in the world. Nevertheless, the current levels continue to fall short of those in industrialized nations with respect to overall connectivity and widespread access, in addition to the adoption of ICT products and services by the private sector (especially by SMEs), as a means to improve their productivity, market access and overall competitiveness.

Priority actions have been identified in several fields: public policy; private sector investment; external financing; research; dissemination; among others. Success stories and case studies must attain wider audiences in order to make potential benefits of ICT for development a reality for lower income communities and countries. There is ample room for collaboration between higher and lower income economies in today's globalized world,

where innovation and opportunity are not limited to one side of the economic spectrum, but are available to all as long as adequate instruments and farsighted leadership are at hand.

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KEY TERMS AND DEFINITIONS

Information and Communication Technology for Development (ICT4DEV): The universe of internet-related applications that in the different sectors of a Knowledge Society (KS), support boosting the living conditions of people, particularly in EE.

Knowledge Economy (KE): An economy based on knowledge as its principal asset. In a KE, knowledge is the new currency and ICT is a tool to enabling its attainment. Particularly important for emerging economies (EE).

Knowledge Society (KS): A society where tacit and explicit knowledge represent its main backbone. In a KS, local and indigenous knowledge are valued; imported knowledge is adopted whenever it could be adapted to local conditions; and new knowledge can be created to serve societal purposes.

Sustainable Development (SD): The set of economic, social, environmental, and institutional conditions that guarantee a constant or increased flux of benefits for the members of a given society. For societal development to be sustainable, such conditions would have to tend towards equity, fair distribution of benefits, and durability in the use of natural and financial resources.

Sustainable Development Goals (SDG): The new set of SD United Nations goals to be attained by 2030 in order to improve the living conditions worldwide. In the SDG, ICT4DEV is an enabling common denominator supporting tool.

ENDNOTES

¹ This chapter largely draws from the work of Mr. Adithya Raghunathan: *The Economic Advantage of Wireless Infrastructure for Development*. Mr. Adithya Raghunathan was a consultant with the Information and Communication Technologies for Develop-

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² A declaration was issued during the first phase of meetings, which were held in Geneva, Switzerland on December 10 to 12, 2003.

³ This includes such remote areas as the Andes or the Amazon. See case study on the Amazon Association Project.

⁴ Sixty-three percent of eligible students enrolled in primary school and only 8 percent did so in secondary school. Approximately 1 percent of students finished secondary school and went on to post-secondary education.

⁵ Based on information from the article "Gyandoot: A Community-Owned, Self-Sustainable and Low-Cost Rural Intranet Project" at <http://gyandoot.nic.in/gyandoot/intranet.html>.