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ICT and MDGs
A World Bank Group Perspective

December 2003

The World Bank Group

Definition of ICT

ICT, as defined in the Information & Communication Technology Sector Strategy Paper of the World Bank Group (April 2002, http://info.worldbank.org/ict/ICT_ssp.html), consists of hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of information (voice, data, text, images).

ICT sectors are defined by the OECD as a combination of manufacturing and services industries that capture, transmit and display data and information electronically.

Manufacturing includes office, accounting and computing machinery; insulated wire and cable; electronic valves and tubes and other electronic components; television and radio transmitters and apparatus for line telephony and line telegraphy; television and radio receivers, sound or video recording or reproducing apparatus and associated goods; instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process equipment; and industrial process equipment.

Services include wholesaling of computers, computer peripheral equipment and software; wholesale of electronic and telecommunication parts and equipment; renting of office machinery and equipment (including computers); telecommunications; computer and related activities.

Millennium Development Goals (MDGs)

GOALS	TARGETS
1. Eradicate extreme poverty and hunger	1. Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day
	2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger
2. Achieve universal primary education	3. Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
3. Promote gender equality and empower women	4. Eliminate gender disparity in primary and secondary education preferably by 2005 and to all levels of education no later than 2015
4. Reduce child mortality	5. Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate
5. Improve maternal health	6. Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio
6. Combat HIV/AIDS, malaria and other diseases	7. Have halted by 2015, and begun to reverse, the spread of HIV/AIDS
	8. Have halted by 2015, and begun to reverse, the incidence of malaria and other major diseases
7. Ensure environmental sustainability	9. Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources
	10. Halve, by 2015, the proportion of people without sustainable access to safe drinking water
	11. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers
8. Develop a Global Partnership for Development	12. Develop further an open, rule-based, predictable, non-discriminatory trading and financial system
	13. Address the Special Needs of the Least Developed Countries
	14. Address the Special Needs of landlocked countries and small island developing states
	15. Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term
	16. In co-operation with developing countries, develop and implement strategies for decent and productive work for youth
	17. In co-operation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries
	18. In co-operation with the private sector, make available the benefits of new technologies, especially information and communications

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Disclaimer

"The debate in the 1990s over choosing between ICT and other development imperatives has now shifted from one of tradeoffs to one of complementarity.[3]"

PREFACE

At the United Nations Millennium Summit in 2000, the global community adopted eight Millennium Development Goals (MDGs) to guide and measure our development efforts. The MDGs cover a broad range of concerns, namely: poverty and hunger; primary education; gender equality; child mortality; maternal health; HIV/AIDS, malaria and other diseases; environmental sustainability; and global partnerships. In adopting these goals, and ambitious targets for each, we have made a commitment to achieving more development progress in less time than ever before. This will demand marshalling our resources – human and financial – as effectively and efficiently as possible.

Our ability to establish such goals, and even conceive of achieving them, is driven by not only the urgency of the concerns, but also the realization that we have within our reach the know-how and the tools to make the goals reality. One such set of tools is Information and Communication Technologies (ICT). These technologies have transformed our world, and in the process, our belief in how we can address its challenges.

ICT crosses all sectors, bringing increased efficiency and new opportunities to areas from small enterprise development and international trade, to education and healthcare. It also allows us to share experiences across geographies and organizations, so that we learn collectively and build on each others' advances.

However, as is apparent in this report, how we are using ICT to achieve the MDGs is still in its early stages. The seeds of success are being sown across all sectors and across the globe. This report illustrates the opportunities ICT offers policy makers and practitioners in their efforts to achieve the MDGs and highlights selected World Bank Group funded projects utilizing ICT to accelerate development.

As the world meets in Geneva in 2003 and in Tunis in 2005 for the World Summit on the Information Society, we should keep foremost in our minds the scale of efforts that meeting the MDGs will require, and how ICT holds a key to unlocking such possibilities. We hope that our report provides useful insights for the development community.

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Introduction

ICT and
Poverty

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ICT and
Gender

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Conclusion
and
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Abbreviations

AiDA	Accessible Information on Development Activities
ANFAS	Data Fusion for Flood Analysis and Decision Support
DOT Force	Digital Opportunity Task Force
EIN	Environmental Information Network
ETNO	European Telecom Network Operators Association
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFW	Global Forest Watch
GICT	Global Information and Communications Technologies
GIS	Geographic Information Systems
GNP	Gross national product
GPOBA	Global Partnership on Output-Based Aid
GSM	Global System for Mobiles
HDI	Human development index
IAM	Itissalat-al-Maghrib
ICT	Information and communication technologies
IFC	International Finance Corporation
*info*Dev	Information for Development Program
IT	Information technology
ITU	International Telecommunications Union
LVEPM	Lake Victoria Environmental Management Project
MDGs	Millennium Development Goals
MIGA	Multilateral Investment Guarantee Agency
NDDB	National Dairy Development Board
NEI	Networked economy index
NIE	Newly Industrialized Economies
NGO	Non-government organization
OECD	Organization for Economic Cooperation and Development
PPIAF	Public-Private Infratsructure Advisory Facility
RESCUER	Rural Extended Services & Care for Ultimate Emergency Relief
SIDS	Small Island Developing States
SMS	Short Messaging Service
UNDP	United Nations Development Programme
VHF	very high frequency
WBG	World Bank Group

INTRODUCTION

During the past decade the international community has focused its efforts on strategies to help the people of the world's poorest countries share in the benefits of globalization and escape the traps of poverty. The decision at the United Nations Millennium Summit in September 2000 to adopt eight specific Millennium Development Goals (MDGs) provides an agreed political benchmark for measuring the progress of global development.

In the same year, the G-8 initiated the 'Digital Opportunity Task Force' (DOT Force) to harness the forces of new technologies in order to narrow social and economic inequalities by making the benefits from these technologies accessible and meaningful for all humanity. As world leaders gather at the World Summit on the Information Society in Geneva (December 2003) and in Tunis (November 2005), these two major international efforts have begun to converge.

Millennium Development Goals

The MDGs were adopted at the United Nations' Millennium Summit in 2000 as part of the Millennium Declaration, a document signed by 189 countries, including 147 Heads of State. The eight MDGs and associated targets represent an unprecedented agreement –among developed countries, developing countries, and international agencies– to work towards a world in which sustaining development and eliminating poverty would have the highest priority.[1]

The uniqueness of the MDGs lies in two dimensions. First, by defining the goals in terms of development targets –as distinct from inputs and outputs– the MDGs draw attention to the multisectoral determinants of development targets (World Bank 2003a). Second, the MDGs focus on the achievement of quantified and time-bound targets, providing both opportunities to make headway in the fight against poverty and risks of non-attainment. Given current trends of progress, many countries and regions will be unable to achieve the MDGs by 2015 (See Table 1 for a summary of progress in achieving selected MDG targets for developing countries).

The Role of ICT in Accelerating Development Progress

The debate in the 1990s over choosing between ICT and other development imperatives (e.g. by stating that, in poor countries, investment in ICT draws precious resources away from more urgent development needs) has now shifted from one of tradeoffs to one of complementarity.[3] These new technologies, it is now clear, are not an end in themselves. Nor has a one-size-fits-all approach proven effective –the challenges faced by developing countries vary too greatly by geography, culture and

Evidence is growing that ICT is a powerful tool when used appropriately as part of an overall development strategy.

Table 1: Progress in Achieving Selected MDGs[2], Percentage of Developing Countries

MDG	Likely	Possible	Unlikely	Very Unlikely	No data
Child malnutrition	16	7	4	14	60
Primary school completion	30	18	12	11	29
Gender equality in school	49	9	6	6	29
Child mortality	20	28	19	14	19
Maternal mortality	20	18	13	20	29
HIV/AIDS prevalence	25	7	8	14	45
Access to water	14	10	12	0	63

Source: World Bank (2003a).

[1] www.developmentgoals.org/

[2] The calculations for most indicators in this table are based on the differential in trends observed between two points, the first spanning 1990-94 and the second 1995 to the most recent year. It was then estimated how long it would take a country to achieve the MDG based on the percent change between the two points.
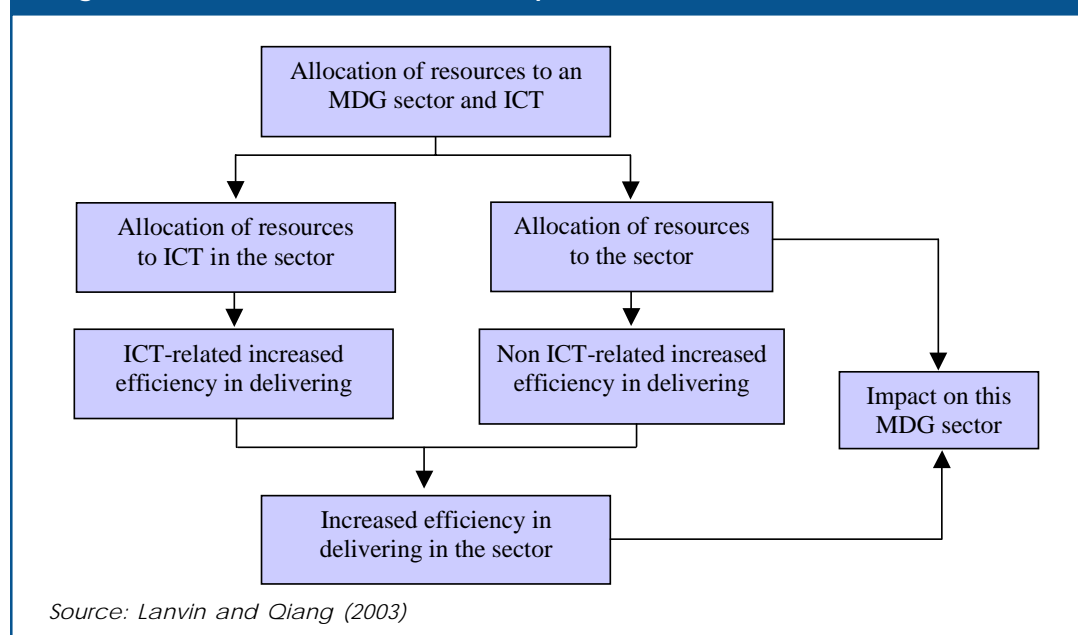
[3] Accenture, Markle Foundation and UNDP (2001)

Figure 1: Resource Allocation and Impact in MDG Sectors

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                    ┌─────────────────────────┐
                    │ Allocation of resources │
                    │  to an MDG sector and   │
                    │          ICT            │
                    └───────────┬─────────────┘
              ┌─────────────────┴─────────────────┐
              ▼                                   ▼
   ┌──────────────────────┐         ┌──────────────────────┐
   │ Allocation of        │         │ Allocation of        │────┐
   │ resources to ICT in  │         │ resources to the     │    │
   │ the sector           │         │ sector               │    │
   └──────────┬───────────┘         └──────────┬───────────┘    │
              ▼                                ▼                 ▼
   ┌──────────────────────┐         ┌──────────────────────┐  ┌────────────┐
   │ ICT-related          │         │ Non ICT-related      │  │ Impact on  │
   │ increased efficiency │         │ increased efficiency │  │ this MDG   │
   │ in delivering        │         │ in delivering        │  │ sector     │
   └──────────┬───────────┘         └──────────┬───────────┘  └────▲───────┘
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                 │ Increased efficiency in  │──────────────────────┘
                 │ delivering in the sector │
                 └──────────────────────────┘
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Source: Lanvin and Qiang (2003)

level of economic attainment. ICT cannot eliminate the need for political stability, physical infrastructure, human capacity and basic health care, or offer a panacea for all development problems. But evidence is growing that ICT is a powerful tool when used appropriately as part of an overall development strategy. Seizing the opportunities ICT offers will clearly require innovative and close partnerships between governments, business and civil society.

In order to reach the targets set by the MDGs, countries can either increase the resources allocated to these objectives, or increase the efficiency with which available resources are used (Jayasuriya and Wodon 2003). At the core of the ICT and MDGs discussion is the question whether or not ICT can contribute to improving the efficiency in delivering the MDGs and hence accelerating the achievement of development targets (See Figure 1).

There is a growing acceptance that ICT can play an important role by providing new and more efficient methods of production, bringing previously unattainable markets within the reach of the poor, improving the delivery of government services, and facilitating management and transfer of knowledge, a key factor in reaching the MDGs.

At the same time, it is important to acknowledge that despite the vast potential of ICT to contribute to development strategies, it cannot do the job on its own. ICT will only be helpful to the extent that users are able to use the technology and take advantage of the opportunities it creates. This requires policies that create the right incentives and institutions, which are strong enough to implement those policies. In the end, the measure of success of ICT will not focus on the spread of technology, but rather on the overall progress towards reaching the MDGs.

The main objectives of this report are: (i) to illustrate the opportunities ICT offers policy makers and practitioners in their efforts to

achieve the MDGs, with the assumption that the appropriate policies and institutions exist or will be forthcoming; and (ii) to highlight *selected* World Bank Group funded projects with an ICT component which have contributed to the intended development outcomes.

The World Bank Group provides both financial and technical assistance through various instruments.

■ *World Bank Loans.* The World Bank has developed a range of lending instruments to support governments in activities in the telecommunications, Internet, information technology, postal and broadcasting sectors as well as ICT applications in other sectors.

■ *International Finance Corporation (IFC) Private Sector Investments.* IFC provides long-term financing for private providers of information and communications infrastructure and services in developing countries, and invests with a focus on building successful information technology businesses in emerging markets.

■ *Multilateral Investment Guarantee Agency (MIGA) Guarantees.* Guarantees promote private financing in borrowing member countries by covering risks the private sector is not normally in a position to absorb or manage.

■ *Grants Administered by the World Bank.* The World Bank administers several grant facilities that may provide financial support for projects in the ICT sector. These include the multi-donor Information for Development Grants (*info*Dev) and Public-Private Infrastructure Advisory Facility programs (PPIAF), the Global Partnership on Output-Based Aid (GPOBA), bilateral trust funds, as well as the Bank's own Institutional Development Fund.

■ *Knowledge Sharing and Capacity Building by the World Bank Institute.* The World Bank helps client countries enhance their capacity to generate, access and use knowledge from all sources. A series of knowledge programs have been initiated to help countries assess what they need to be effective players in the global knowledge economy, to share development issues, efforts, and opportunities, and to deliver distance learning activities.

This report does not aim to establish proven empirical links between ICT and the achievement of the MDGs, but to illustrate the positive impact ICT can make as an enabling tool for development. Each of the following sections describes respectively how ICT can play a role supporting development strategies and accelerating the progress towards the MDGs on Poverty (MDG #1), Education(MDG #2), Gender (MDG #3), Health (MDG #4, #5, and #6), Environment (MDG #7) and Partnership (MDG #8).
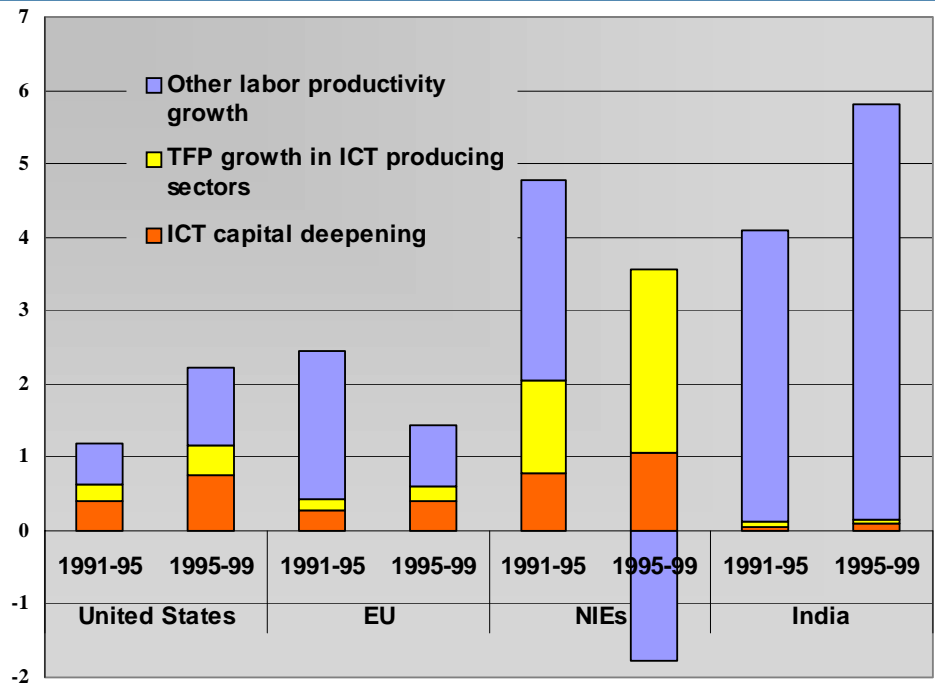
ICT and Poverty

If ICT is appropriately deployed to take into consideration people's differing needs, it can become a powerful economic, social and political tool for the poor, and for all those who work to eradicate poverty.

Figure 2: HDI and NEI, 2003
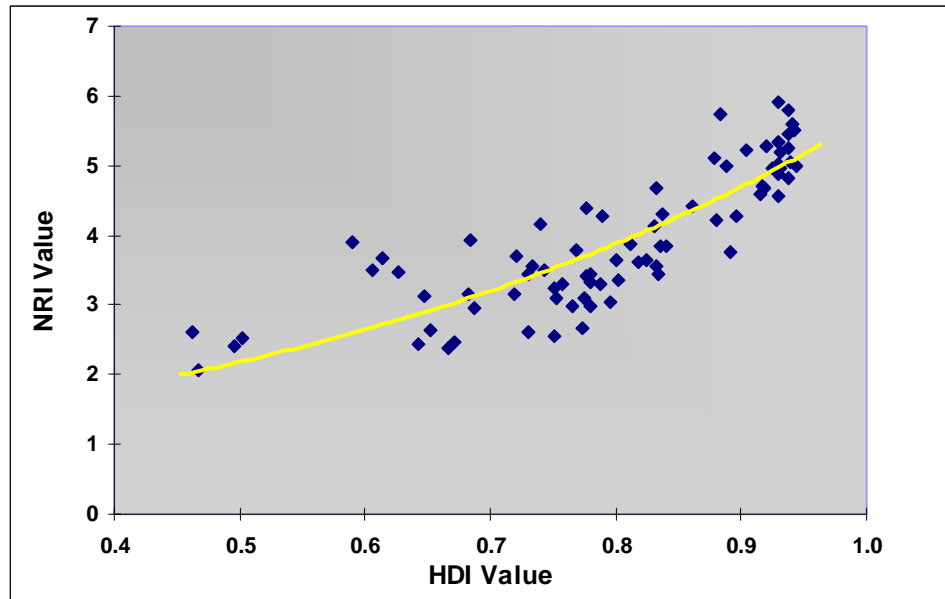
Source: Lanvin and Qiang (2003)

Figure 3: Contribution of ICT to Labor Productivity Growth (Percent of GDP)[6]

Source: Qiang and Pitt with Ayers (2003)

ICT AND POVERTY

Poverty is multidimensional and has complex causes. Not only do the poor have little money, few material possessions, they are often deprived of basic needs such as food, education and health services. Furthermore, they lack access to knowledge, a source of income earning opportunities, and to political visibility and influence, which reinforces their social and economic vulnerability. The deprivations from advantages and opportunities that the more affluent enjoy force the poor into social exclusion, powerlessness and poverty traps.

The role of ICT in combating poverty and fostering sustainable development has been the subject of much debate and experimentation during the last decade. The contrast between the complexity and expense of some of these technologies and the urgent, basic needs of the poor has led some to doubt whether ICT should be a priority for development agencies or for developing countries themselves (Marker, McNamara and Wallace 2002).

Lack of access to ICT is clearly not a primary problem of poverty as compared to insufficient nutrition or inadequate shelter (Kenny, Navas-Sabater and Qiang, 2002). Nevertheless, ICT can be seen as both a driving force and a result of human development, as shown in Figure 2, the correlation across countries of the human development index (HDI)[4] and the networked economy index (NEI)[5] is above 0.8, suggesting a link between welfare and the existence and use of ICT in developing countries.

Therefore, evidence seems to suggest that ICT can play an important role in eradicating poverty. If ICT is appropriately deployed to take into consideration people's differing needs, it can become a powerful economic, social and political tool for the poor, and for all those who work to eradicate poverty. Promoting opportunities for the poor is essential for reducing poverty. ICT can help reach this objective by: (i) stimulating macroeconomic growth; (ii) making markets more efficient; (iii) improving social inclusion; and (iv) facilitating political involvement.

Stimulating Macroeconomic Growth

The key to poverty reduction, in the end, is sustained economic growth. By using ICT, nations can make a significant contribution to economic growth by increasing labor productivity (See Figure 3) through high growth of total factor productivity in ICT producing industries, increase in the real ICT capital stock per worker, and through the overall productivity growth across the entire economy arising from the reorganization of production around ICT goods and services (Qiang and Pitt with Ayers 2003).

Increasing Market Access, Efficiency and Competitiveness of the Poor

At the microeconomic level, ICT provides farmers, workers and entrepreneurs opportunities to reduce transaction costs, increase market coverage and improve competitiveness even across borders. For example, Novica, a Web and catalog merchant of international artwork and crafts, connects more than 1,800 artisans and artisan groups through its offices in Peru, Indonesia, Thailand, Mexico, India, Brazil and Ghana with consumers and retailers globally. According to IFC, Novica provides income to approximately 50,000 people in the developing world, including artisans and the family members they support.

Artisans working with Novica earn between 10 percent to 50 percent above their local, market prices and earn on average 70 percent of Novica's retail price. Isidoro Rojas, a woven tapestries artist in Peru, earned US$2,500 in one month alone (in 2000), far more than the average annual salary in Peru, which was US$2,200 in 2000 (World Bank 2001b). Prior to Novica, Mr. Rojas made a five-hour journey to Lima in order to sell his tapestries. But today, he uses a public computer kiosk two hours from his hometown to correspond with Novica via the Internet (Romney 2000).

[4] The human development index is a composite index measuring average achievement in three basic dimensions of human development – a long and healthy life (as measured by life expectancy at birth), knowledge (as measured by the adult literacy rate and the combined primary, secondary and tertiary gross enrollment ratio) and a decent standard of living (as measured by GDP per capita).

[5] The networked economy index is a composite of three components: the environment for enabling ICT; the readiness of a community's key stakeholders (individuals, businesses and governments) to use ICT; and finally, the usage of ICT among these stakeholders (WEF, INSEAD and *info*Dev 2003).

[6] The data is the average of some European Union (EU) countries (Austria, Denmark, Finland, France, Germany, Italy, The Netherlands, Portugal, Spain, Sweden and United Kingdom) and of the Asian Newly Industrialized Economies (NIEs: Hong Kong SAR, South Korea, Singapore and Taiwan, Province of China).

Box 1: Targeting the Poor

Although the poverty line in Brazil dropped sharply in the mid-1990s, a "hard core" of 40 million people –nearly a quarter of the population– still live on less than half the minimum wage of 240 reais (US$80) a month. The government-linked Institute of Applied Economic Research says 23 million live in extreme poverty (lacking the money to feed themselves properly). Brazil's government used information technology to identify the needy and make sure resources reach them –beneficiaries can collect their income transfer from the bank through electronic cards. This not only reduces the possibility for corruption or political favoritism, but the cards can hold a wealth of information for designing, targeting and monitoring programs. The government wants to boost spending on income support next year (2004) by up to 1.5 billion reais. The goal is to end hunger before 2007. (The Economist 2003)

Improving Social Inclusion of Isolated Populations

People living in rural and remote areas tend to be poor and socially isolated. They lack information relevant to their particular situation and thus have difficulty interacting with other community members or other communities. This isolation serves to reinforce their marginalization. ICT, such as radio, telephone, and email, can be of great value in bringing people together, bridging geographic distances and providing relevant information about and to the poor. People can be isolated not only by geography, but by cultural barriers such as gender, ethnicity, caste and race. The four characteristics of ICT, namely (i) interactivity, (ii) permanent availability, (iii) global reach, and (iv) reduced costs for many, as summarized in a recent report by the Swiss Agency for Development and Cooperation (Gerster and Zimmermann 2003), have made social inclusion of the poor more feasible.

Facilitating Political Empowerment

The poor also often lack means to effectively voice their needs, learn about available public services, and pressure policymakers to be responsive to their interests and demands. ICT can improve information flows and communication services to make government and organizations serving the poor more efficient, transparent and accountable (See Box 1).

ICT can help the disenfranchised voice their concerns, demand their rights and take control of their own lives. Increasing ICT use for developing pro-poor policies is a critical component to reduce poverty and sustain development. In India, for example, Sakshi, the women's rights non-governmental organization (NGO), had faced difficulties in lobbying for sexual harassment legislation. With help from international women's networks, Sakshi was able to receive advice and technical assistance on legal issues surrounding sexual harassment. As a result, the group succeeded in convincing the Supreme Court to establish sexual harassment guidelines in workplaces and brought the issue within the purview of human rights violations (APC 2000).

ICT and Poverty:
Selected World Bank Group Funded Projects

IFC
Sudanese Entrepreneur: Expanding Mobile Networks
Sub-Saharan Africa, 1999 – Present
US$67.5 million

Dr. Ibrahim, a Sudanese entrepreneur, is founder and Chairman of MSICIH, a holding company with mobile investments primarily in Africa. Dr. Ibrahim launched MSICIH in 1998 with a vision to create an indigenous African-owned mobile operator providing global quality telecommunication services at affordable prices to African consumers neglected by global telecom sponsors. Today, MSICIH has controlling stakes in the following 11 African mobile operations: Uganda, Zambia, Democratic Republic of Congo, Sierra Leone, Malawi, Niger, Republic of Congo, Gabon, Burkina Faso, Chad, Sudan; and a minority stake and management control in the wireline network of Tanzania.

IFC has been an investor in MSICIH since 1999, helping MSICIH develop a pan-African franchise of mobile networks. IFC has invested a total of US$67.5 million in MSICIH and in four of its op-

erating subsidiaries to finance license acquisitions, initial build-outs and expansions of its successful networks. In many of its countries of operation, IFC's investments support and complement the World Bank's ongoing efforts to liberalize the telecommunications sector and to establish an even playing field for competition to thrive.

Since its formation, MSICIH has grown at a very high rate, establishing itself as the most geographically diverse mobile operator in Africa and more than doubling its subscription base each year, to over 1.5 million subscribers today (See Figure 4).

IFC's role in MSICIH extends beyond providing financing. IFC has been instrumental in assisting MSICIH draft and implement a global environmental and social management program that has been implemented throughout its operations. IFC Against AIDS is also working with MSICIH to refine its HIV Policy and develop an AIDS Action Plan to address HIV/AIDS in the workplace and to potentially extend the action plan to surrounding communities.

ICT and Poverty (side tab).

Figure 4: MSICIH Subscriber Growth (1999–2003)

Bar chart: End Of Year Proportional Subscribers by year. 1999: ~75,000; 2000: ~270,000; 2001: ~480,000; 2002: ~1,100,000; 2003 (3Q): ~1,500,000.
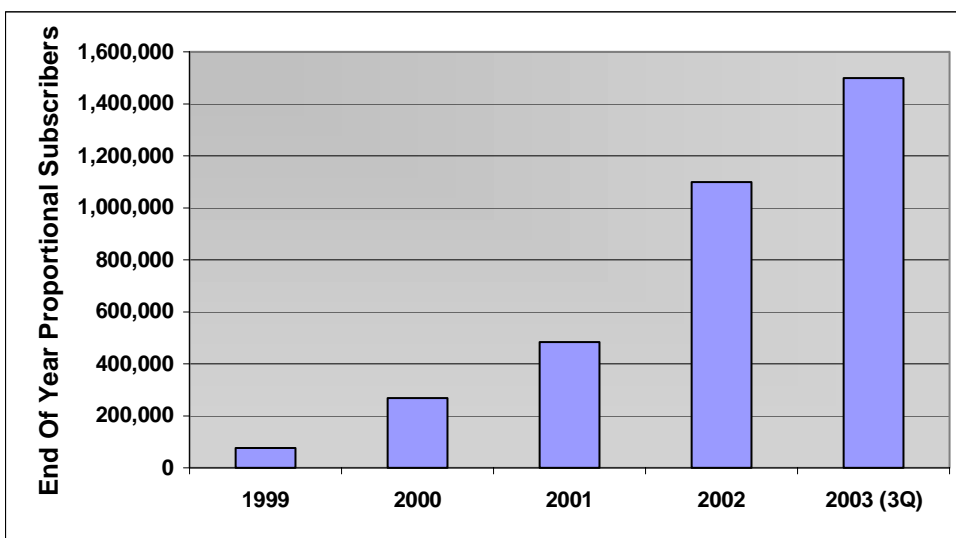
Source: MSICIH

*info*Dev
E-Commerce for Farmers Hands-On Training Program
Philippines, 2002 – 2003
US$850,000
*(info*Dev *contributed US$118,000)*

Farmers in the Philippines have long suffered from a lack of market price information, which has made it difficult to get the best return for their products. This *info*Dev project contained two components: (i) an electronic marketing site where farmers can post commodity prices, transact, and even pay online; and (ii) a training program to increase computer literacy in the countryside to aid in marketing agriculture produce.

Project leaders developed a website (B2Bpricenow.com), with an electronic bulletin board and a free marketplace. Farmers can access the bulletin board to get relevant market information directly. Knowing the prevailing prices allows farmers to increase their negotiating power and minimize the middleman costs, thereby enabling farmers to reap the gains from lower transaction costs and a broader market reach.

In addition, the project trained more than 620 small entrepreneurs, farmers and fishermen to use computers, email and the Internet to improve their businesses and personal lives. The hands-on training means farmers can reduce their poverty by becoming more efficient in agricultural markets. Figures from August 2003 show that the website has 1,967 businesses connected covering sectors including agriculture (1,344) and manufacturing (196).

World Bank
Operation Flood Program
India, 1978 – 1985, 1987 – 1996
US$510 million

In India, milk production was scattered. For the most part, the average illiterate and poor farmer had no access to organized markets and was often exploited by middlemen. This changed, however, with the inception of India's "Operation Flood" Program, initiated by the National Dairy Development Board (NDDB) in 1970. NDDB helped organize the dairy cooperative network by forming 170 milk unions that operate in 285 districts and cover nearly 96,000 villages.

ICT has been an essential component of NDDB's success. Across India, 3,500 milk collection centers use computers to accurately and efficiently measure production and to pay each farmer accordingly. As daily-computerized accounts are maintained, chances of fraud are reduced. The result is a reliable and regular source of income for more than 10.7 million landless laborers and marginal or small farmers, which has improved their quality of life and helped India emerge as the world's largest milk-producing nation.

ICT AND EDUCATION

Education is fundamental to the development of a dynamic labor force capable of accessing and integrating knowledge into social and economic activities and participating in today's global economy. Driven by new technologies and a growing service sector, demands for more highly-skilled labor have increased worldwide.

Today, disparities in educational access across countries are considerable. The average length of schooling in high-income countries is ten years, but in developing countries it is approximately less than half, 4.6 years. Of the 680 million children of primary school age in developing countries, 115 million do not attend school–60 percent of these children are girls and 74 percent live in South Asia and Sub-Saharan Africa (UNDP 2003).

Increasing Access through Distance Learning

ICT can provide various channels to bring educational options to those who have historically been excluded, including populations in rural areas without schools, women facing social barriers that limit their access to education, students with disabilities or with specific vocational training needs. Radio and TV, for instance, are popular educational media in many developing countries. In the 1980s, before the age of online learning, 44 percent of students registered in Chinese higher education were enrolled in radio or TV-based distance education courses (Willkox, Kline and Nagashima), supplemented by the postal system, which delivered textbooks. Today, more sophisticated technologies, such as video conferencing and the Internet, offer advanced two-way interactive delivery modes and can be combined with traditional technologies to meet the educational needs of various communities.[7]

Enabling a Knowledge Network for Students

With knowledge as the crucial input for productive processes within an economy, the efficiency by which knowledge is acquired and applied determines economic success. Timely transmission of information and knowledge by ICT, unhindered by its volume or the nature (voice, video, data), can help the education system meet this challenge.

In 1990, the Chilean government embarked on a major educational reform program, which included an initiative to integrate ICT as a learning and knowledge resource for all students within the public school system, known as Enlaces. Enlaces began as a pilot project interconnecting 100 schools but quickly became a nation-wide initiative. By 2000, over 5,300 primary and secondary schools had received computers, local networks, educational and productivity software and free/unlimited Internet access. Enlaces had reached 90 percent of the student population attending state-subsidized institutions.

Training Teachers

Large numbers of elementary school teachers will be needed to meet the MDG educational targets. ICT is even more relevant for the training of these teachers than it is for the training of students in elementary school, as it transfers knowledge to the person most likely to achieve effective dissemination. Moreover, ICT provides opportunities to complement on-the-job training, and to provide continuing education for teachers. It also allows networking of elementary school teachers in ways never before possible.

ICT can provide various channels to bring educational options to those who have historically been excluded.

[7] Improved access to ICT can overcome the distance barrier to education, but it cannot solve the problem of social and cultural barriers, which can, for example, prevent girls from access to education.

Broadening the Availability of Quality Educational Materials

Teachers are both information consumers, using the Internet to access resources, as well as information providers, acting as information filters and dissemination channels for students, and as educational resources for colleagues and for the community. Network technologies have the potential to increase the availability of quality educational materials. Their interactivity and global reach allow for customized sharing of knowledge, materials and databases quickly and cheaply, independent of the physical movement and geographic distances of individuals.

Furthermore, online resources offer teachers access to a diverse collection of educational materials, which enables teachers and non-formal education facilitators to design curricula that best meet the needs of their students. Educational materials can be provided in electronic form, as with educational radio, educational cassettes, educational videos, and indeed computer courseware, simulations, and games. The content of a school library can be mounted on a CD-ROM and made available for only a few dollars per copy. Desktop publishing offers new alternatives to providing affordable tailored, paper-copy educational materials for students.

Enhancing the Efficiency and Effectiveness of Educational Administration and Policy

ICT provides support not only for classroom activities but for administrative activities as well. Through ICT training programs, school principals and administrators learn how ICT can help improve the process and quality of administrative activities through management software and computer networks, including human resource management, student registration, and monitoring of student enrollment and achievement.

ICT and Education:
Selected World Bank Group Funded Projects

World Bank
Turkey Basic Education Program
1998 – 2006
US$600 million

The policy objective of this project is to provide computer literacy to all teachers and students and to enhance the quality of the country's basic education system. To achieve this objective, some 6,000 eight-year basic education schools throughout the country have been equipped with ICT classrooms under this project. In addition, the project provides ICT in-service training to school-teachers on computer literacy and integrating the existing software and hardware into classroom teaching and learning activities. An e-learning portal, which contains both pedagogical content and e-learning training materials, is being developed to provide the trainers with an effective communication platform for sharing ideas and resources.

As of December 2002, 2,802 primary education schools had been equipped with ICT classrooms, and Internet access has been provided to those schools. IT hardware, software and peripheral equipment are being procured to equip a total of 22,854 rural schools with computer facilities. Since the implementation of the project in 1998, basic education enrollment in the country has been increased by 900,000.

IFC
Escol@24Horas.com
Brazil, 2000 – 2007
US$3.25 million, co-funded by Pitagoras School Group

This ongoing project aims to provide services that support student learning, and improve access and content of educational materials for students, parents, and schools in Brazil by pioneering the use of the Internet. Bringing Internet-based education solutions to Brazil is helping to ease some of the constraints facing the Brazilian education system.

With IFC investment and technical assistance, Escol@24Horas provides tutoring services to students from kindergarten through high school by assisting client schools across Brazil. It operates 24 hours a day, seven days a week via its website, www.escola24h.br.com, and through a Web-based program that facilitates email and online exchanges. Tutors respond to the needs of students by asking questions and guiding responses. Escol@24Horas also offers its client schools innovative tools to develop their own websites and extends its services and education materials to parents and to communities in which it operates.

The pilot program began by providing services at the basic education level to 70,000 students and has now expanded to over 200,000 students.

World Bank
World Bank Institute: The Global Development Learning Network (GDLN)
(www.gdln.org)
Launched in 2000

In June 2000, the World Bank and several partner institutions launched the Global Development Learning Network (GDLN). The objective of the network was to utilize opportunities offered by communication technologies to cost-effectively connect policymakers and development practitioners across the world with each other, enabling them to share ideas and to integrate global experiences into country-level initiatives.

The World Bank and its partners initially set up 11 GDLN Centers with two-way videoconferencing and e-learning capabilities, connecting them over a satellite network. Within a year, GDLN had grown to a network of 28 affiliated centers, beaming an average of five to ten learning programs across the globe each day.

Today, GDLN totals over 60 centers around the world, and more than 30,000 people participate in GDLN events every year. Dialogues and learning exchanges among developing countries have become a common feature, with countries in Africa, Asia, and Latin America sharing experiences about education reform, HIV/AIDS prevention, community-driven development, and other key development issues. For example, in October 2003, participants in Ethiopia, Tanzania and Uganda participated in a series of learning workshops entitled "Gender and the Legal Dimension of HIV/AIDS." The series focused on building a community of practice to discuss and strategize on key issues relating to gender and HIV/AIDS, and how to strengthen the role of laws and institutions in HIV/AIDS policy and operational interventions.

ICT AND GENDER

In many developing countries, gender inequality persists in education attainment, in access to and control of productive and financial resources, and in political participation, even though such inequality has decreased over time in low-and middle-income countries (See Figure 5). Lack of schooling coupled with gender biases that dictate domestic roles for women, perpetuate gender disparities. ICT can empower women and help them surmount gender inequality by raising awareness of their social and political status and creating new economic opportunities.

Influencing Public Opinion on Gender Equality

Gender prejudice exists in many developing countries. Through ICT enabled information distribution channels including radio, telephone, television and the Internet, awareness of gender inequality issues can be raised and enhanced. ICT can be an invaluable tool in positively changing people's attitude, including women themselves, towards women by disseminating educational programs on gender equity. Radio Rabia Balkhi in Mazar-E Sharif, a remote northern city in Afghanistan where more than 80 percent of women are illiterate, airs recorded essays and features on gender inequality issues and successful efforts to overcome these challenges. After listening to this program, some conservative family heads in the region, which had refused to let their daughters attend school, changed their minds (Constable 2003).

In addition, role models of women who actively participate in the socio-economic development can increase self-esteem and self-confidence of other women and therefore encourage them to push for changes in their own social status. Increased pressure from an informed constituency aware of gender inequality could also persuade local policymakers to include gender as an important component of their social and economic policies.

Increasing Economic Opportunities for Women

Women have been limited from participation in many forms of economic life. In some cultures, women are expected to stay at home and are not permitted to have face-to-face contact with men other than close family, or to travel. For such cultures, ICT may open economic opportunities for women since telephone and the Internet allow them to interact with men without face-to-face contact, and even without being in the same place (Daly 2003). ICT also helps female entrepreneurs, who often have limited resources and experiences, reduce transaction costs, increase market coverage, and even expand business across borders. For instance, Tortas Peru is a women-owned enterprise that uses the Internet to reach a wider market, selling cakes and desserts through their website, mainly targeting the two million Peruvians living outside the country, who send orders by email. With just three hours of instruction, the housewife-members of the network learn to use email, find the website, and interact with clients through public computer booths (World Bank 2003b).

ICT can empower women and help them surmount gender inequality by raising awareness of their social and political status and creating new economic opportunities.

Figure 5: Gender Ratio in Selected Indicators by Income Level

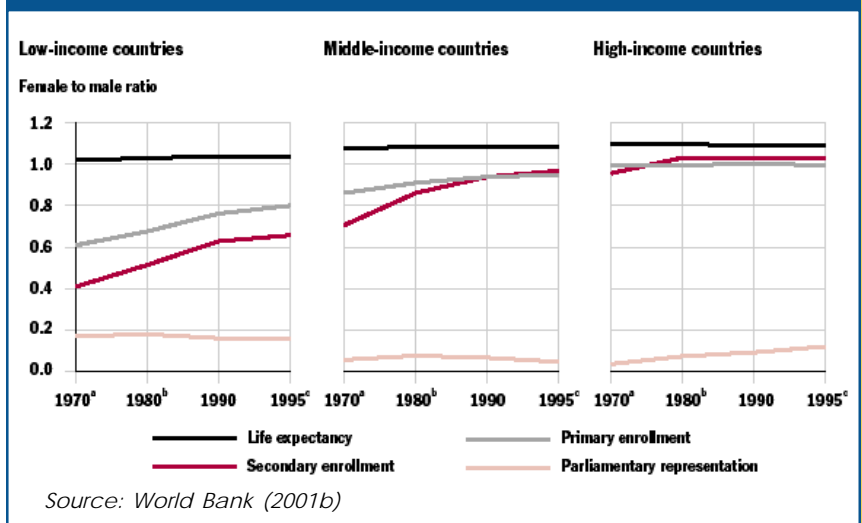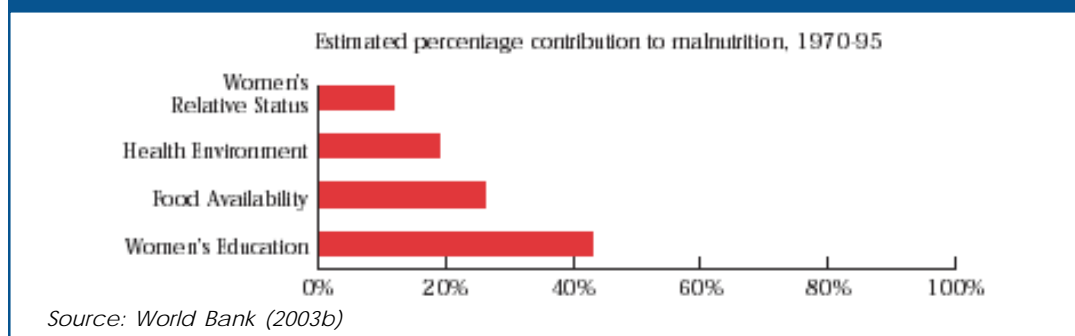*Source: World Bank (2001b)*

Figure 6: Women's Education Significantly Reduces Under-5 Malnutrition

Estimated percentage contribution to malnutrition, 1970-95

Source: World Bank (2003b)

in Non-Agriculture Jobs

Some women work in the expanding ICT industries, but data from developed countries suggests that men dominate these new opportunities, mainly because from the outset women lag men in access to ICT and skills to apply it. A study by Hafkin and Taggart (2001) indicates that women are 22 percent of all Internet users in Asia, 38 percent of those in Latin America and only six percent of Middle East users. Women need access to educational resources in order to lower overall illiteracy levels and acquire skills required for the ICT sector. Over time, the skill requirements are gradually diminishing–in the service sector, for instance, using computers often involves simple, repetitive tasks that are easy to learn. As more and more ICT applications become user-friendly, it is likely to increase the value of less-skilled workers. For instance, a significant proportion of employees in the expanding telecenter industry are women.

ICT for Women's Education and for Women as Educators

In most societies, women are predominantly responsible for child-care, food preparation, and other household tasks. Therefore, providing women with useful information may have multiple benefits –in addition to the benefits to the woman herself– the technical and substantive knowledge gained by women is often shared with their families. Educated women do a better job caring for their children, increasing their

children's chances of surviving to become healthier and better educated adults (World Bank 2002a, See Figure 6). In Brazil, a domestic-based NGO, Cemina, is promoting communication and information on gender issues through radio broadcasting. Cemina aims to improve education on gender through strengthening the use of community radio by low-income women. In addition to providing content on gender issues, Cemina has also trained 1,500 women from across the country in radio production. With funding assistance from *info*Dev, today Cemina broadcasts to a network of 350 Women's Radio Programs throughout Brazil and is nationally and regionally (Latin America) recognized as a focal point for informative media for women.[8]

Enhancing Women's Ability to Know their Rights and Participate in Decision Making

Women remain vastly under-represented in national and local assembles accounting for less than ten percent of the seats in national parliaments, on average worldwide (World Bank 2003b). Some women do not even know their rights and lack knowledge on the political and development processes that shape their lives. ICT has a lot of potential for empowering women by enabling them to participate in public discussions and democratic processes with the use of multi-way communications, through electronic and non-electronic ICT networks. In Kenya, for instance, a group of women used videos to inform the decisionmakers about their needs and concerns.[9]

ICT and Gender:
Selected World Bank Group Funded Projects

IFC
Expanding Mobile Services and Empowering Women in Bangladesh
1999
US$18.3 million

In 1999, IFC extended a loan of US$16.7 million and invested US$1.57 million in GrameenPhone Limited, currently the largest mobile operator in Bangladesh. The financing was IFC's first investment in the telecommunications sector in Bangladesh, and funded the initial installation and operation of a Global System for Mobiles (GSM) network.

GrameenPhone launched operations in March 1997, under a 15-year license issued by the Government of Bangladesh. At the time there were three other mobile operators in the market but mobile penetration stood at only 0.3%. The fixed line incumbent had just 350,000 lines in service and the waiting list for these lines stood at over 200,000 subscribers with a waiting time of over ten years for residential customers.

GrameenPhone's arrival into the market in 1997 helped spur competition among the existing operators and led to a rapid increase in mobile penetration, as illustrated in the Figure 7. GrameenPhone's adoption of a low tariff strategy benefited consumers as other operators competed to provide a similar price, as well as increased the range of services offered within the market. Since IFC's investment, the company has outperformed its original estimates and reached over one million subscribers representing 67% of the market.

One of the company's main shareholders is Grameen Telecom, a non-profit organization and a subsidiary of Grameen Bank, an internationally recognized microfinance bank. GrameenPhone is assisting in the expansion of rural connectivity as the sole provider of telecommunications services to the Village Phone operators, a program run by Grameen Telecom. The program currently provides access to mobile phone services for approximately 30 million people living in rural areas of the country and plays a vital role in empowering local women (See Box 2).

*info*Dev
Abantu: Strengthening Electronic Communications Capacities of Women's Organizations in Africa
1999 – 2002
US$500,000
(infoDev contributed US$250,000)

Abantu for Development, www.abantu.org, is an international NGO established in 1991. The focus of Abantu's work is on training and providing information and advice on mobilizing resources for sustainable development in Africa. The East African office is based in Kenya and currently has four ongoing projects: (i) Gender and Poverty; (ii) Gender and Governance; (iii) Gender and Conflict; and (iv) Gender and ICTs. The Gender and ICT project began in 1999 in collaboration with a number of other African organizations and is mainly

Figure 7: Evolution of Mobile Penetration in Bangladesh and Subscriber Base of GrameenPhone
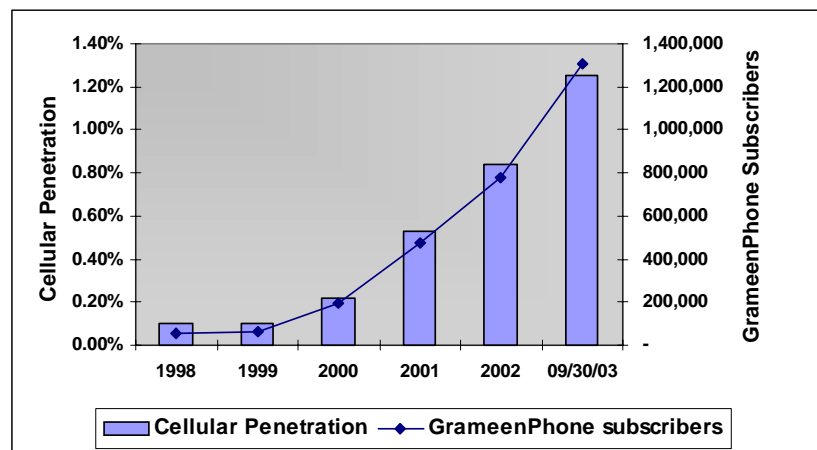
Source: GrameenPhone

Box 2: Village Phone – Empowering Women

Villagers, mostly women, who are eligible for micro-credit through Village Phone, are given loans to purchase mobile phones. These "operators" then provide telephone service (making and receiving phone calls) for the villagers in their community and are able to earn enough money to repay the Grameen Bank loan. This program has several benefits. First, prior to the program, remote rural communities would make costly trips to nearby cities, which could cost two to eight times more than a phone call. Second, owning mobile phones, empowers rural women. An "operator" expects to earn more than US$1,000/year in comparison to the country's average of US$380 (BBC News 2002). In addition, villagers depend on "operators" to obtain a valuable service. These benefits give women a new-found economic independence and a more prominent role in their communities. As of October 2003, more than 39,000 Village Phones are in operation and in nearly 28,000 villages. (www.grameenphone.com).

funded by *info*Dev. This project aims to improve African women's access to, and use of the Internet.

As part of this project, Abantu has been working closely with policymakers to try to ensure that gender perspectives are part of all new policies on ICT. To accomplish this, Abantu has developed a strong and focused core group of women across Africa and information is regularly exchanged electronically between Abantu's regional offices and their core group. Abantu is also proposing a small telecenter project and has recently produced gender-sensitive ICT guides for use by women's organizations throughout Africa. These guides cover such issues as "Making the most of the World Wide Web" and "Advocacy and the Internet".

World Bank
Mexico: Gender Equity Project
2000 – 2004
US$3.07 million

The Gender Equity Project aims to facilitate the mutual learning and piloting of community-based initiatives to promote gender equity and to provide capacity-building assistance to the Mexican Institute for Women. The project consists of three components:

1. *The Institutional Strengthening component* provides financing for training the Institute's staff, studies on gender issues and the establishment of a monitoring and evaluation system to assess progress in promoting gender equity.

2. *The Community-based Gender Development component* is aimed at improving equity in opportunities for men and women, peaceful sociability, and respect for all social groups, regardless of sex and ethnicity through a program called Convive. Convive, a small demand-driven grant program, has distributed grants supporting community-based initiatives to promote gender equity in 53 small cities throughout the country (average population per city is about 50,000). The total amount of grants to be distributed is US$600,000. The Convive program also provides technical assistance to women organizations in eight cities by helping to increase their opportunities to receive credit.

3. *The Gender Awareness component* is intended to raise awareness of the value of equitable relations between men and women by transmitting new ideas and successful experiences that can be replicated throughout urban and rural Mexico. This component will utilize low-cost media distribution technologies including radio and television to transmit its nation-wide gender equity campaign. In order to increase the participation of rural women, the campaign's announcements are translated into indigenous languages. The first phase of the campaign will begin in December 2003 including regional campaigns delivered to the 53 Convive cities. This component also contains a Gender Equity Certification Program designed to encourage the development and implementation of gender equity programs by the business community. In December 2003, a first-round of 20 medium-size firms will receive "certification" for promoting gender equity in their operations.

ICT AND HEALTH

ICT utilization has had a profound impact on health care within developing countries. It enables health care workers perform remote consultation and diagnosis, access medical information and coordinate research activities more effectively than ever before. ICT also provides an effective and cost-efficient channel for the distribution of health and disease prevention information to the general public.

Providing Remote Health Care Services

Today, health care workers can provide remote consultation, diagnosis and treatment, and collaborate with colleagues without traveling long, costly distances. In Gambia, for instance, health care workers use digital cameras and computers to send images of a patient's symptoms to physicians in nearby towns or overseas for diagnosis. ICT has played a pivotal role in controlling Onchocerciasis (river blindness) in West Africa. Local inhabitants use computers and satellite radio to transmit data collected by sensors along 50,000 km of rivers to entomologists who then calculate the optimum time to spray against the disease-carrying blackfly. Today, river blindness has been eradicated in seven countries, enabling 30 million rural inhabitants to live free of the disease (Kenny, Navas-Sabater and Qiang 2002).

Storing and Disseminating Health Care Information

Greater access to medical information not only helps the public understand general health issues, but ICT can also be used for disease prevention. By transmitting health messages via radio and television, the public can be educated on how to take preemptive actions to prevent or curb the spread of disease. Health care facilities utilize computers to lower costs and improve service by expediting administrative processes such as storing patient records and procuring medical supplies.

Research and Training for Health Care Workers

ICT allows health care workers in developing countries to access the latest medical research. It also provides a way to further their training through online educational programs. A significant percentage of health care workers in Uganda (54 percent) and Kenya (20 percent/ year) have participated in radio training courses that lead to improved health care services (Kenny 2003). Physicians in Bangladesh use the Internet to access online medical journals for a mere US$1.50 per month, while physicians in Africa use the Internet to track meningitis outbreaks to curb its spread (The Economist 2001).

ICT's Role in Achieving Health-related MDGs

ICT is an invaluable tool for health care workers and for the international development community in their combined effort to address three of the MDGs directly related to the health sector: (#4) reducing child mortality; (#5) improving maternal health; and (#6) combating HIV/AIDs, malaria and other diseases.

MDG#4. Reducing Child Mortality

Prior to the 1990s, child mortality rates had been steadily declining but during the last decade, progress has slowed considerably. In fact, in some parts of Africa, child mortality rates increased. As of 2000, nine percent of children born worldwide would not live to see their fifth birthday according to the United Nations Development Program (UNDP 2001). The World Health Organization estimates that disease or a combination of disease and malnutrition is responsible for 70 percent of these deaths (World Bank 2002a). These deaths are avoidable and ICT can help. Measles and other "diseases of childhood" are readily preventable through vaccination. The mortality due to diarrhea can be reduced with oral rehydration

ICT enables health care workers to perform remote consultation and diagnosis, access medical information and coordinate research activities more effectively than ever before.

therapy, and vaccines exist to prevent some diarrheal diseases. Some acute respiratory infections can be cured with antibiotics, others can be prevented using vaccines, and the mortality from viral respiratory infections can be reduced with appropriate medical care. Health care workers can use ICT to establish databases to track vaccination programs, to coordinate antibiotic shipments and to inform communities of medical services, which can help to reduce child mortality.

The Tygerberg Children's Hospital of Cape Town, South Africa implemented a tele-medicine system in 1999 with funding from the local Rotary Club. The system uses affordable, off-the-shelf computer equipment and software –a hard drive, scanner, and digital camera– to enable rural hospitals scan and send x-rays and blood-test results to Tygerberg. A Tygerberg health care worker reviews the data, forwards it to the appropriate diagnostic specialist and the specialist then emails treatment recommendations to the rural hospital. This system not only provides rural children with life-saving medical care but saves families costly transportation fees. Sending a child to Tygerberg would cost a farm worker the equivalent of one-week's salary (bridges.org 2003a).

MDG #5. Improve Maternal Health

In 1995, more than 500,000 woman died from complications during pregnancy and childbirth, which in most cases are preventable or at least, treatable. Developing countries are particularly susceptible to these complications, as maternal death is the leading cause of death for women of reproductive age (World Bank 2002a). The World Bank Group's World Development Report 2002 noted that empirical studies found a woman's access to the media is associated with better health and fertility outcomes.[10] ICT can also help providers in their efforts to make maternal health care services more efficient and effective. Therefore, ICT can play a critical role in reducing the incidence of maternal death numbers by facilitating access to information and to health care services.

In 1996, the Ugandan Ministry of Health, UNFPA and the Uganda Population Secretariat initiated the Rural Extended Services and Care for Ultimate Emergency Relief (RESCUER) project to reduce a mortality rate estimated at 506 per 100,000. The project was designed to improve maternal health by connecting traditional rural community health providers with a cost-effective formal health delivery system. Due to the scarcity of electric power in most rural areas and the lack of fixed telephone lines, Ugandan officials decided to employ very high frequency (VHF) radio technology that operated on fixed base stations, mobile walkie-talkies and vehicle radios. In 1999, three years after the project was implemented, a study sample of the Iganga district concluded that the maternal mortality rate had decreased by nearly 50 percent (World Bank 2002b).

MDG #6. Combat HIV/AIDS, Malaria and Other Diseases

Infectious diseases cause tremendous suffering, leave children orphans, stifle economic productivity and burden health care systems around the world. ICT offers new opportunities to effectively combat these diseases.

For instance, Cape Town, South Africa, has one of the highest rates of tuberculosis (TB) worldwide. In order to treat and contain TB, patients must adhere to a strict treatment of four tablets, five times a week, for six months. The treatment too often fails because patients forget to take their medication. In 2002, South Africans tried a different approach that led to tremendous success. They used mobile phones, Short Messaging Service (SMS) technology and a pilot computer database. Every half-hour, the database scans a list of patients and sends a SMS text message to those patients needing to take their medication. Of the 138 patients participating in the pilot, only one treatment failure occurred (bridges.org 2003b).

[10] Differences in income and education levels were taken into consideration and the association held true.

*info*Dev
Voxiva: A Voice Portal for Health
Peru, 2001 – Present
US$700,000
*(info*Dev *contributed US$250,000)*

Voxiva is an international organization established in 2001 to provide voice and data solutions for the public health sector. Through the creation of a shared application platform, ALERTA, Voxiva enables both the collection of data from health care workers on the ground and the interaction between health care workers across countries. This project targets 76 health care facilities and 204 users among doctors, nurses, technicians and other health care personnel in two geographic zones south of Lima. These zones comprise over 200,000 habitants and 49 districts. Peru was chosen to pilot this system due to the recent expansion of its telecommunications infrastructure.

6,000 health centers across Peru are currently required to report on outbreaks of certain types of diseases (e.g. cholera, dengue, malaria, polio) to enable the Ministry of Health to take remedial action. However, prior to Voxiva, the reporting system was entirely paper-based and it could take up to three weeks before the information was received at the Ministry of Health, by which point the disease would have increased and maybe spread to many other parts of the country. Beyond the challenge of reporting disease, the health care system faced the problem of providing feedback to remote health care workers. More than 90% of users reported receiving health alerts "never", "rarely" or "less than once a month".

To help tackle these problems, Voxiva started work in Peru in March 2002 with the objective to improve the speed and reach of communications between health care professionals and organizations. Currently 76 health care facilities have been connected to the network and have been able to submit 4,269 reports and 28,296 cases electronically. Designated health care authorities now receive immediate notifications of suspected cholera, Bartonellosis (a vector borne disease of the Andean region), other diseases, and local disasters. Thus, health care officials have been able to learn about new cases and to respond in a matter of hours and days instead of weeks.

IFC
Salutia, Argentina and Brazil Health Care Sector
2001 – 2004
US$12.5 million
(IFC contributed US$2.5 million)

Established in 1999, Salutia is a privately held health care connectivity company focused primarily on payer/provider transactions in Brazil and more recently, in Argentina. The company is starting a proprietary, multichannel, Internet-centric transaction platform –Health24TM– to efficiently and securely process transactions and exchange information among health care payers and providers and eventually among patients and suppliers. Salutia's core clients are health care payers who determine initial care eligibility and authorization.

E-health connectivity companies offer tremendous promise in Latin America and worldwide. Through connectivity, administrative inefficiencies are reduced and the distribution of clinical information is improved. Salutia has the potential to not only reduce health care administrative waste, but also improve the quality of care by giving health care professionals more complete, accurate data at the point of care. This project demonstrates that health care connectivity, enabled by ICT, can play a significant role in improving health care services.

ICT and Health

ICT and Health

*info*Dev
The Child Health Care Telemedicine Network, Russia
1999 – 2002
US$3.75 million
*(*info*Dev contributed US$250,000)*

In St. Petersburg, the oncology unit of First Municipal Children's Hospital is the center for the treatment of leukemia for the northwest region of the Russian Federation. Prior to installing computers and Internet access, hospital physicians were isolated from the medical community outside St. Petersburg. By using ICT, a network was formed that links the St. Petersburg hospital to the Georgetown University Children's Medical Center and the Lombardi Cancer Center in Washington, DC, providing access to educational and consultative resources.

The network consists of desktop computers, a server, Internet access, an electronic microscope with monitor and digital imagining equipment enabling physicians to conduct medical consultations via email by transmitting digitized images. The success of this low-tech, user-friendly and cost-efficient network quickly led to an expansion of its geographic reach to include additional medical facilities in the Russia Federation and new connections in Europe.

Today, physicians in St. Petersburg consult with their counterparts in Moscow and in the West on a daily basis. Examples of international medical consultations between Russian physicians and United States, United Kingdom and German cancer specialists have opened new lines of communication across great distances and cultural barriers. The result is improved care for pediatric patients. In the case of a 16-year-old boy with Acute Lymphocytic Leukemia, a consultation with a specialist in the UK spared the boy painful and dangerous blood transfusions (Amoss 2002).

ICT AND ENVIRONMENTAL SUSTAINABILITY

The environment is a large complex system. Managing and protecting it contributes to improving human health conditions, sustaining agricultural and other primary production, and reducing risks of disastrous floods as well as wildfires, mudslides and other natural disasters. The effects of ICT on sustaining the environment are multidimensional. The most fundamental effects involve the following areas.

Raising Awareness and Sharing Knowledge

ICT can improve people's understanding of environmental issues and their policy implications. It can ensure that environmental knowledge is communicated to a broader audience, especially by using electronic media to educate a new generation that does not believe that declining environmental quality has to be sacrificed for economic growth. This generation is more sensitive and willing to be involved in formulating policies that affect their communities, countries and the world in the medium and long term.

Environmental Monitoring and Associated Resource Management and Risk Mitigation

ICT improves the ability to obtain, store and integrate large volumes of environmental data and to conduct simulation and analysis in real time. It permits monitoring (See Table 2) of environmental quality, accuracy in detecting sources of pollution and projecting environmental problems. Geographic Information Systems (GIS), linking satellite imaging with computer analysis, are increasingly powerful tools in designing management plans and forecasting environmental threats.

Environmental Progress in the ICT Sector

The ICT sector has made substantial advances in improving the internal environmental performance.

By developing more efficient systems and equipment, the ICT sector uses fewer materials and has eliminated ozone-depleting chemicals. For example, between 1997 and 1999, signatories to the Environment Charter of the European Telecommunications Network Operators Association (ETNO) improved energy use by 21 percent and fuel consumption by 26 percent (UNEP 2002).

Enabling Greater Environmental Sustainability in Other Sectors

By intelligently using ICT products and services, other industrial, commercial and agricultural sectors can reduce resource use and save energy. For instance, microchips can create more efficient car engines. Electronic controls can improve energy efficiency and reduce pollution in many industrial processes. Email and online applications can reduce paper consumption. Amazon.com, the online bookstore, is an example of a new business model that sprung from the ICT revolution. The potential for its positive environmental impacts is demonstrated in Table 3. Substituting a service for a product is an example of dematerialization. A virtual network answering service requires about four percent of the energy for production and operation and generates approximately 1.5 percent of the waste, compared with a physical answering machine (Tuppen 2002). In 2000, it is estimated that tele- and video-conferences enabled by telecommunications services prevented 540,000 tons of carbon dioxide emissions from being released in North America (UNEP 2002)

Communication in Developing and Enforcing Policies Affecting the Environment

Communication among governments, business, scientific experts and concerned citizens is vital if environmental remediation programs intend to meet their objectives efficiently and equitably. ICT can promote the public's participation and incorporate its ideas. This leads to more inclusive and accountable policies and more environmentally sustainable outcomes. In Indonesia, for ex-

ICT improves the ability to obtain, store and integrate large volumes of environmental data and to conduct simulation and analysis in real time.

ample, government officials tackled weak enforcement of water pollution standards by developing a public-access information database. It rated how well firms complied with pollution-discharge requirements. Even before the information became public, firms rushed to improve their ratings. Regulators, meanwhile, could focus limited enforcement resources on the worst offenders. In the program's first 15 months, roughly one-third of the poorly performing firms came into compliance with regulations (World Bank 1998).

Table 2: Selected Initiatives Using ICT in Environmental Monitoring

Initiative and Application Model	Impact
Environmental Information Network (EIN) Project of Ghana. Launched in 1999, **EIN** uses ICT to link the databases of two national environmental agencies – the Environmental Protection Agency and the Forestry Research Institute of Ghana. By sharing databases, local and international researchers, government agencies and other environmental groups can use the information to support decision-making, intervention strategies, and awareness campaigns about environmental protection. The database is publicly available for free use. http://www.bridges.org/iicd_casestudies/ein/index.html	• EIN is now pivotal in preventing the destruction of Ghana's natural resources and developing them in a sustainable way. • By sharing project details with other African countries with a similar historical and developmental background, EIN helps them avoid reinventing the wheel of pest management practices. • EIN provides access to international sources and facilitates collaboration between researchers and agencies.
SIDSNet, the Small Island Developing States Network, is a communication medium to discuss and share information on biodiversity, climate change, coastal and marine management, energy sources and trade. It promotes sharing experiences and developing a global SIDS agenda. http://www.sidsnet.org/	• The web site receives an average of 300,000 hits per month from over 100 countries including donors and SIDS. • The site heightens awareness among SIDS decision-makers about the link between the environment and human development
Global Forest Watch (GFW) is an international data and mapping network. It combines on-the-ground knowledge with digital technology to provide accurate information about the world's forests. Since 1997, GFW has worked with Cameroon, Canada, Gabon, Indonesia, Chile, Russia, Venezuela, the Democratic Republic of Congo and the US. By the end of 2005, GFW is expected to have its forest-monitoring network operational in 21 countries, covering three-fourths of the world's remaining frontier forests. www.globalforestwatch.org	• Scrutinizing the practices of forest product companies and ensuring they honor pledges to harvest only from sustainably-managed forests. • Providing information on what is happening to the forests, helping promote and establish successful forest management practices.
Weather/Pest Information Network provides weather data to forecast pest problems. This reduces pesticide use and its subsequent impact on environmental quality and farming sustainability. The network benefits farmers in developing countries such as Zimbabwe, Armenia, Israel and Jordan by helping them improve their pest management. http://ppathw3.cals.cornell.edu/iipmweb/veg_fruit_IPM.htm	• Seven existing pest models have saved the fruit and vegetable industry an estimated US$7.1 million by using improved forecast data to guide pest management practices.

ICT and
Environmental Sustainability:
Selected World Bank Group Funded Projects

World Bank
Lake Victoria Environmental Management Project (LVEMP)
Kenya, Tanzania, and Uganda, 1997-2002
US$70 million, co-funded with Global Environment Facility (GEF)

LVEMP is a comprehensive program aimed at maximizing the benefits to riparian[11] communities by:

■ using resources within the basin to supply safe water and ensure a disease-free environment;
■ conserving biodiversity and genetic resources; and
■ integrating national and regional management programs to reverse –to the maximum extent possible– environmental degradation of Lake Victoria.

To reach these goals, LVEMP uses ICT extensively in managing its environmental resources. The project has used ICT to create and update scientific and socio-economic baseline data on the current status of Lake Victoria's forest growth, land-use practices, wetlands, industrial and municipal waste management, fishing factors, satellite lakes, water quality and quantity, sedimentation, limnology and hydraulic conditions. GIS is the main tool used to investigate changes in the wetland habitats around Lake Victoria. The satellite imaging helps to quickly assess Lake Victoria's wetlands, identify and quantify threats, propose solutions and formulate guidelines for its wetland management.

LVEMP made it easier for riparian governments to embark on a long-term resource management and environmental improvement program. For instance, surface coverage of the water hyacinth[12] in Lake Victoria, which in the late 1990's spread across 12,000 hectares, has been reduced by 80 percent and fish exports to the European Union have resumed. The project's training programs have enhanced the awareness and capacities of local people and government institutions.

*info*Dev
Data Fusion for Flood Analysis and Decision Support (ANFAS)
China, Slovakia and France
2000 – 2003
*US$4.2 million, co-funded with the European Commission (*info*Dev contributed US$250,000)*

The ANFAS project's objective is to create an information system that will provide solutions for flood prevention and protection. The new simulation system will help make decisions that could reduce flood damage. The final product will be a Decision Support System –as opposed to an early warning system– with near real-time prediction capabilities.

During the pilot flood data analysis period (2000 – 2002), applications were tried on the Vah river in Slovakia, the Loire river in France and the Jing Jiang Reach in China. Partners from Europe and China shared expertise –in remote sensing, scien-

Table 3: Energy Saving – Traditional Bookshop vs. Amazon.com (US$)

	Traditional Bookshop	Amazon.com
Sales per square foot	250	2000
Energy cost per square foot	1.1	0.56
Energy cost per 100 sales	0.44	0.03

Source: Sawhney and Contreras

[11] Communities that are located on the bank of a river, lake or tidewater.

[12] A pervasive floating aquatic plant notorious for clogging waterways.

ICT and Environmental Sustainability

ICT and Environmental Sustainability

tific computing, computer vision, Internet technology, GIS, knowledge-based systems and soil sciences– to make the most appropriate decisions when there is a flood risk.

The ANFAS system performs flood simulation of water flow based on likely scenarios and can assess flood damage by using either simulated results or remote-sensed images of a real flood event. At a prospective level, the system can analyze flood-plain morphology including changes in the riverbed and subsurface properties that follow repeated flooding.

IFC
Natural Disaster Risk Management Project
Honduras, 2004 – 2014
US$50 million, to be co-funded with Inter-American Development Bank and major international re-insurers

This project involves designing a private sector-driven, comprehensive natural disaster risk-management scheme. The project combines financial, technical (early warning systems, watershed management and emergency planning), regulatory and educational infrastructures into a mutually supportive system that creates a secure and sound foundation for development.

In order to effectively implement this scheme, the project utilizes a GIS, which is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information (data identified according to location). Sources of data for GIS include aerial photographs, satellite data, and digital maps. GIS technology can be used for scientific investigations and environmental management. For example, GIS can enable emergency planners to easily calculate emergency response times in the event of a natural disaster or scientists to find wetlands that are threatened by pollution.

In 1998, Honduras was devastated by Hurricane Mitch. As a result, Honduras has been selected as the first country to implement this natural disaster risk-management scheme. Both the public and private sectors are very receptive to the project. After Honduras, project developers are interested in extending the natural disaster risk-management scheme to all of Central America and South America, beginning with Nicaragua, the Dominican Republic and Colombia.

ICT AND PARTNERSHIPS

Globalization has intertwined the world's economies and societies creating a global marketplace with new opportunities and challenges –particularly for developing countries striving to participate in the global economy and improve their competitiveness. Without a robust international framework supported by good economic policies and governance at both the national and international level, trade and investment could deter economic and social development. By leveraging ICT, countries can foster global participation and partnerships that promote job creation, knowledge transfer and greater efficiency and transparency in politics and business.

Good Governance

ICT is an invaluable resource to national and international efforts to institute good governance and economic policies. Through greater access to information via traditional technologies such as radio and emerging technologies like the Internet, governments can use ICT to improve public services and promote accountability and transparency. For instance, Vijaywada, India, a city with a population of one million, has lowered corruption, expedited services and improved government responsiveness by providing municipal services through five kiosks located throughout the city and linked to the municipal office via the Internet (World Bank 2001a).

Using ICT to provide public services not only improves transparency but can yield high economic returns. Singapore estimates that ICT use by government services has yielded a US$2.70 return for each dollar invested (Kenny 2003). For instance, ICT utilization can improve the administration of taxation. Tax revenues provide resources for public services, infrastructure investment and debt services. Many developing countries suffer from opaque tax systems that spur corruption and discourage foreign investment. To remedy this problem, some countries have utilized ICT in parallel to instituting tax reforms to improve their tax systems through greater transparency.

Prior to reform, Cameroon's tax system was plagued by long processing delays, ambiguous regulations and outdated information. These hampered proper tax collection and discouraged foreign investors. In 2001, the situation improved when the government of Cameroon published the latest tax information online, which allowed individuals, corporate taxpayers and foreign investors quick and easy access to tax information. In less than a year, the tax department's website became the third most-visited site in Cameroon (World Bank 2002c).

Leveraging ICT to Promote Trade

Increased international trade can have profound implications for the economic prosperity of developing countries. The World Bank estimates that if trade protection were cut in half, developing countries would gain about US$200 billion by 2015 (World Bank 2002a). ICT can help developing countries overcome inefficiencies in trade promotion, logistics and customs services to become more competitive and integrated in the international trading system. Malaysia's ICT infrastructure investment policies have increased the telephone penetration rate from 16.6 percent in 1995 to 23.2 percent in 1999 and fueled the development of a vibrant ICT manufacturing export sector. In 1999, the ICT sector contributed roughly 36.5 percent of GNP (Accenture, Markle Foundation and UNDP 2001).

Access to ICT through Public-Private Partnership

Making available the benefits of ICT is itself an MDG target. In this context, access to basic telecommunication services is essential. Telecommunication sector reforms creating an enabling pro-competitive environment and public-subsidies that support rural expansion have improved access and lowered costs. Cross-country evidence strongly suggests that economies with well-regu-

By leveraging ICT, countries can foster global participation and partnerships that promote job creation, knowledge transfer and greater efficiency and transparency in politics and business.

Figure 8: Cumulative Annual Growth Rate of Mainline Penetration in Developing Countries, 1996-2001
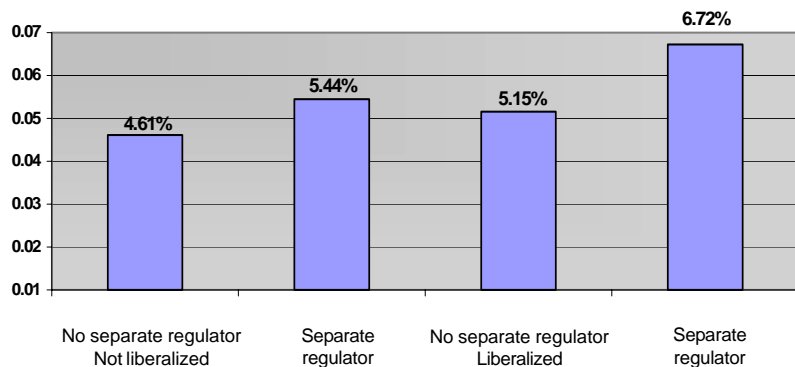
Source: *Qiang and Guislain (2003)*

lated, competitive information and communication infrastructure experience lower costs, better service, wider access (See Figure 8) and greater dissemination of telecommunications and Internet services (Qiang and Pitt with Ayers 2003).

In the mid-1990s, the Chilean government financed a fund to support the expansion of telecommunication services to rural communities. Five-years after initiating the fund, pay phone service was extended to more than 6,000 rural localities. The percentage of Chile's population without access to basic voice communication dropped from 15 percent in 1994 to one percent in 2002 (Wellenius 2002).

Effective Data Management for International Development

In order for the international development community to foster partnerships and leverage their collective development experience, access to timely and reliable information on who is doing what and with what results is critical. The Internet enables the international development community to exchange vital project information and best practices at an unprecedented rate. However, the proliferation of information available online can

make searching for specific information cumbersome, time consuming and costly. To remedy this situation, the Accessible Information on Development Activities (AiDA) site was launched to facilitate the consolidation of information for analysis and interpretation around issues and topics of common interest to the international development community.

AiDA is a multilingual platform offering information on development activities from more than 100 multilateral, bilateral and smaller organizations, on 33 sectors in more than 200 locations, including countries and regions. AiDA currently contains more than 450,000 records, and the number of projects is growing. Participating organizations share information on planned, current and completed projects and programs that they fund, execute or implement. Today, AiDA is the largest single source of integrated information on development activities. (aida.developmentgateway.org)
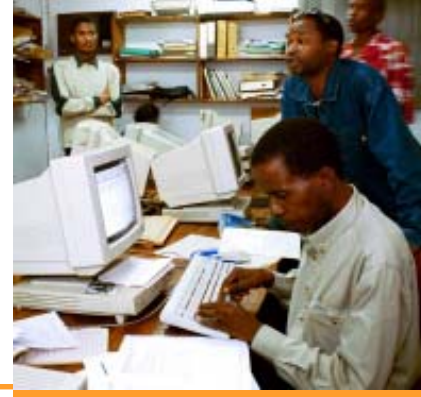
ICT and Partnerships
Selected World Bank Group Funded Projects

The World Bank Group's Global ICT Department (Policy and Investment Divisions)
Introducing Telecommunications Competition in Morocco
1996 – 2000
US$100 million, co-funded with the African Development Bank

The Global ICT Department (GICT) was instrumental in liberalizing Morocco's telecommunications sector and in successfully issuing a second Global System for Mobiles (GSM) license. This has led to improved access and lower costs. The GICT Policy Division provided advice on drafting Telecommunications Law 24/96, which enabled competition, established an independent regulatory body and allowed for the privatization of Itissalat-al-Maghrib (IAM), the state-owned telecommunications monopoly.

The GICT Policy Division also assisted in the issuance of a second GSM license to Meditel in August 1999 for US$1.1 billion, which increased Morocco's fiscal revenue for 1999 by about 13 percent. World Bank estimates suggest that the total fiscal impact of the second GSM license (including future taxes and research and development) could range from US$2.0 to US$3.5 billion by 2008.

In the fall of 2000, the GICT Investment Division disbursed a US$400 million equivalent multi-currency debt package to Meditel, owned 61 percent jointly by Telefonica International of Spain and Portugal Telecom and 39 percent by local financial investors. This disbursement was catalytic in raising additional funds both locally and internationally, which brought Meditel's total debt financing to US$912 million equivalent. The new capital enabled Meditel to expand its operations to nearly two million subscribers today. Furthermore, since the start of its operations in 2000, Meditel has helped create several thousand new jobs in Morocco.[13]

Introducing competition into the Moroccan telecommunications market has energized the performance of incumbent, IAM. Competition has reduced IAM's prices for mobile communication by roughly 44 percent and increased its customer base by 57 percent in 1998 and by another 30 percent in the first half of 1999. Between 1998 and 2000, the total number of mobile subscribers in Morocco increased from 116,000 to 2.3 million. In 2000, the number of Moroccan mobile subscribers surpassed that of fixed-lines. Two years later, there were 6.2 million mobile subscribers representing 85 percent of total subscribers and a penetration rate of 21 percent (ITU 2003).

The World Bank Group's Global ICT Policy Division
Telecommunications Reform in Mauritania
1998 – Present
US$10.8 million

Mauritania embarked on an ambitious reform of its telecommunications sector in 1998. By providing comprehensive support to the reform process, the GICT Policy Division helped the Government in the design and implementation of a project, which contributed to an overall sector reform strategy. More specifically, the project has supported the set-up of a sound legal and regulatory framework, the establishment of a fully operational and effective regulatory agency, the successful opening of the market to competition as well as the privatization of the incumbent operator, which was supported by IFC advisory services.

The outcomes of the reform, partly illustrated by a jump in the overall teledensity from 0.6 percent in 1998 to 12.4 percent in June 2003 (mobile lines increased from zero to over 300,000 in the same period – See Figure 9), are remarkable and can be attributed to the strong political will and commitment to reform of the government as well as to the World Bank Group's support.

[13] Meditel has spurred job creation in several sectors of the Moroccan workforce including: resellers and distributors of telecommunications equipment and services; construction related to Meditel's facilities; network installation and network management; public relations and marketing; and telecenters.

The setting up of a credible and transparent sectoral framework has also attracted record levels of private investment. Proceeds from the two mobile licenses (Mattel in June 2000 and Mauritel Mobiles in July 2000) totaled US$56 million, while the two operators launched services in just six months. Privatization proceeds of Mauritel amounted to US$48 million (equivalent to US$4065 per line) in April 2001 of which over two-thirds were injected into the company through a capital increase. The macro-economic impact of the reform goes well beyond these one-off revenues – the continuous development of the sector has led to higher fiscal revenues for the state and the creation of a large number of new jobs as well as the improvement of the competitiveness of the economy.

MIGA
Mali: Senegalese Investor to Provide Much-Needed Telephone Service
2003 – 2018
US$44 million

Mali is one of the world's poorest countries, ranked 153 out of 162 countries in the 2001 Human Development Index. The country's low rate of teledensity has adversely affected economic growth.

In 2003, MIGA issued guarantee coverage to Société Nationale de Télécommunications du Sénégal (Sonatel), a Senegalese company, for its US$18 million equity investment in Ikatel SA of Mali. The 15-year coverage provides protection against the risks of expropriation, war and civil disturbance, and breach of contract. MIGA is also providing coverage for an eight-month bridge loan of US$26 million.

The project will help provide various telecommunications services, including fixed lines, wireless, Internet, and satellite communication services, as well as public pay phones. It will also establish the

Figure 9: Teledensity Growth in Mauritania, 1998-2003
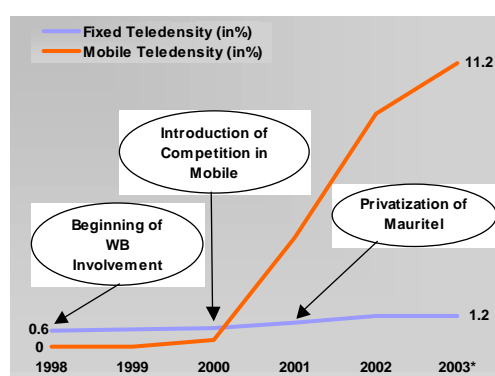
Sources: ITU World Telecommunications Indicators database, World Bank World Development Indicators, and Autorite de Regulation de Mautitanie

country's first fully digital GSM mobile network, which is expected to improve the quality and efficiency of mobile phones. Ikatel aims to reach 250,000 subscribers through the project over the next nine years.

The project represents one of the largest foreign investments in Mali and is expected to offer many development benefits. It will spur the growth of several industries, including small businesses and microenterprises, many of which will provide phone services to those who cannot afford a phone. Consumers will benefit from the diversity of service offerings and lower costs. The project will also generate government revenues in the form of taxes and fees, including a US$44 million license fee, which has already been paid. Ikatel plans to directly employ some 200 local staff and should indirectly generate thousands of additional jobs. Other benefits include staff training and a program that involves building affordable housing for employees. The project will also provide new technology to schools, in addition to contributing to local charities and sponsoring regional cultural and sports events.

ICT and Partnerships

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The Development Gateway
Foundation
Development Gateway
(www.developmentgateway.org)
Launched in 1999

Recognizing the importance of partnerships for the effective use of ICT for development, the World Bank incubated the Development Gateway initiative. This initiative attracted a number of partners, which helped form an independent Development Gateway Foundation. The World Bank became one of the founding members of the Foundation, a public-private partnership based organization supporting practical and action-based programs that harness and promote the use of ICT for poverty reduction and sustainable development.

The Development Gateway aims at improving people's lives by building partnerships and information systems that provide access to knowledge for development. It has created the Development Gateway portal, which has attracted more than 75,000 registered users. The portal builds interactive communities around key development topics to help improve collaboration among development practitioners and facilitate the exchange of information. Country Gateways, a network of 58 locally-owned partnership-based startups, builds country portals, provides local content and knowledge, and fosters innovation for local economic and social development.

To improve public sector transparency, the Development Gateway has developed dgMarket. Global online dgMarket provides turnkey state-of-the-art e-tendering solutions to partners and governments in developing countries with more than 30,000 current tender notices accessible daily. dgMarket fosters government transparency and efficiency, and contributes to local economic development by enabling small and medium enterprises to participate in procurement opportunities worldwide.
Also, the Development Gateway's Training Center in South Korea offers courses on applying public policies for ICT and on disseminating these new technologies. After a successful start in November 2002, the training center has carried out eight courses on ICT policy and technology and trained 127 ICT professionals from 51 countries. In addition, the Development Gateway's Research Center in India conducts applied research to develop tools and solutions that make ICT more accessible to local communities.

CONCLUSION AND THE WAY FORWARD

Communication is a basic requirement of social, economic and political interaction. When the crucial information and communication needs of the poor go unmet, quality of life may significantly degrade, resulting in social exclusion, marginalization, isolation, alienation and humiliation. Other dangers may include vulnerability (to external shocks and internal conflicts) and insecurity (the risk of being subjected to physical violence because of low social status, gender or ethnic identity).

As we strive to attain the MDGs, we must learn from the past and remind ourselves that achieving these goals requires a multi-faced approach because the goals are mutually reinforcing. Access to ICT is not only an MDG target in its own right, but an integral part of achieving all eight MDGs. Attempting to meet the MDGs without promoting ICT development will both increase the costs and reduce the likelihood of attaining the goals.

This report, as the first step of a research program on ICT and MDGs, illustrates the opportunities ICT offers for each of the MDG sectors. It also showcases selected World Bank Group funded projects where ICT have been effectively used in these sectors. However, it does not provide a rigorous analytical underpinning for assessing the contribution of ICT to the MDGs. This will require additional research and analysis, including the following areas.

■   *Analytical framework for establishing and measuring linkages.* Given the emphasis of the MDGs on measuring and monitoring outcomes, an analytical model needs to be developed and applied to quantify the relationship between ICT and MDG sectors, from the point of view of the 'efficiency' of resource allocation in relevant sectors and the cost-effectiveness of the ICT inputs. Such an indicator-based approach can help understand and monitor how investments in ICT will accelerate progress towards achieving the MDGs.

■   *World Bank Group project impact evaluation.* Issues to systematically analyze would include results achieved and contribution of the World Bank Group's ICT support (including World Bank loans, IFC private sector investments, and grants from *info*Dev and other facilities) based on impact data, implementation challenges faced and how they were overcome, pre-conditions for success, lessons learned, common themes emerging across the various projects, and guidance for clients and other stakeholders based on the World Bank Group's experiences.

■   *Replicability and scaling-up analysis.* Good practices need to be identified based on measured outcomes. Replicable approaches would be useful to be shared among policymakers and practitioners to promote wider impacts of ICT interventions.

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