# Accelerating Development Using the Web:

## Empowering Poor and Marginalized Populations

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WORLD WIDE WEB
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# Foreword from the Rockefeller Foundation

For almost 100 years, the Rockefeller Foundation has been at the forefront of new ideas and innovations related to emerging areas of technology. In its early years, the Foundation advanced new technologies to eradicate hookworm and develop a vaccine for yellow fever, creating a lasting legacy of strengthening the application of new technologies to improve the lives of the world's poor and vulnerable.

By the middle of the 20th century, this approach led the Foundation to the pre-cursor to the modern day computer. At the dawn of the digital era in 1956, the Foundation helped launch the field of artificial intelligence through its support for the work of John McCarthy, the computing visionary who coined the term. More recently, the Foundation has supported the use of mobile information and communication technologies in expanding access to healthcare services, in providing farmers with commodity prices and weather related information, and in providing web-based employment opportunities for individuals in low-income areas of cities and rural towns.

At the Rockefeller Foundation, we have a deep respect for the myriad innovators, entrepreneurs, and forward-looking thinkers who are using the web to expand economic opportunities for social development. As expressed so eloquently by the many contributors to this book, we share an abiding concern that the benefits of the web be marshaled to improve the well-being of all people. In so doing, we anticipate that by expanding access to and use of the web, we will ensure that a greater number of individuals and communities will become more resilient and better able to respond to unexpected man-made and natural shocks, and that societies will grow more equitably over time through improved access to new opportunities.

Our support of this compendium is just one part of a suite of thought-provoking efforts to rethink the ways in which new technologies could be better positioned for greater impact across the development landscape. However, technology is only one – albeit very important – driver of social change. At the Foundation, we take an integrated approach that considers the interactions among the various political, economic and environmental complexities of a system. This holistic perspective, we believe, allows for a more nuanced understanding of the different dimensions that need to come together to solve critical problems and implement novel solutions.

As the web continues to define the 21st century, we are grateful to the World Wide Web Foundation for bringing together such a diverse array of experts from different backgrounds and disciplines to share their points of view. We are excited to hear your thoughts and reactions to this publication, and we hope that this will be a useful resource to all of those in the public, private, and civil society sectors that are committed to working to make the web a tool for social innovation on a global scale.

*Zia Khan and Evan Michelson*

*The Rockefeller Foundation*

# Foreword from the World Wide Web Foundation

The World Wide Web is just over 20 years old. It has transformed how knowledge is created and shared. It has transformed how people and nations communicate. The Web is now an essential component of modern life, a significant driver of economic value and a powerful enabler of political and social change.

For all these reasons, most Web users will be surprised to learn that they are in the minority – only about 30% of the world's population are using and benefiting from the Web at this time in history. However, in terms of its potential contribution to economic, political and social development, the need for access to and effective use of the Web is greatest where such access is most rare. The poor, the underrepresented and the vulnerable can in theory gain immensely from what the Web has to offer, but for a variety of reasons — poverty, illiteracy, remoteness, language, restrictive regulation — they are unable to benefit from it.

There is an urgent opportunity to accelerate Web usage and impact for these billions who need it most, and the Web Foundation aims to close this gap. For example, we are working in Mali and India to explore ways to provide voice access to the Web on simple mobile phones, thus opening the Web to people without Internet connectivity and/or with low literacy. We are giving bright, young entrepreneurs in Senegal, Ghana and Kenya the technical and business skills and nurturing environment to create applications on the Web that could address commercial and social needs. We are testing and demonstrating the potential value of Web access to address real-world problems, by empowering rural community radio stations and journalists, and helping farmers share information needed to push back the Sahara desert to claim useful agricultural land. Our objective is that our interventions will, like the Web itself, be able to scale to reach all those around the world who could benefit from them.

This book explores the fundamental factors that are shaping the use of the Web for social and economic development. It describes the contributors that shape how the Internet grows, and how the Web can be made available to and effective for those billions in need. It addresses issues currently restricting access to the Web — political, technological, economic, cultural and linguistic — and suggests what mechanisms can be brought to bear to accelerate its utilization for poor and underserved populations.

The Web has brought many changes to our world. It is increasingly difficult to remember how we functioned in our pre-Web existence. The Web Foundation is working to accelerate the growth of the community of Web users, and to accelerate the value of the Web for that entire community. It is our hope that this volume and the insights within it will enable policy makers, practitioners, funders, and all others concerned with development and the realization of human potential everywhere to contribute more effectively toward that goal.

*Steven Bratt*

*The World Wide Web Foundation*

# Preface

This work is the result of the contributions, large and small, of a significant number of people. The evolution and application of ICT for Development has grown far beyond its initial stages, and ICTs are now thoroughly enmeshed in many substantive and policy aspects of social and economic development in its broadest sense. This publication therefore is necessarily the result of contributions by specialists in various dimensions of this field, and we are grateful to them for having shared their considerable knowledge and experience.

Any discussion of the role of ICTs in economic and social development is aiming at a moving target. While the problems that affect developing countries specifically, and all countries to some extent, are well identified, the technological environment changes rapidly and it takes some time to explore how such changes can be exploited to ameliorate the problems. Such a focus sometimes appears to be very "tool oriented," and may give a misleading impression that the focus has been directed away from the more fundamental social and economic goals. The focus is rather upon how the rapidly evolving tools of ICT can assist in achieving these goals and the nature of their strengths and limitations in doing so.

One might question the need for another exposition of the role of ICTs in development when much has already been written about it. One reason is that most writing in the field concerns itself with specific application areas or pilot applications, rather than surveying the field more generally. Furthermore, as the Internet spreads, the issue of accessibility by poor, vulnerable and underserved individuals and communities becomes more important to achieve true inclusiveness, regardless of whether they are in a developing or a developed country. If the use of ICTs and the Web have proven so beneficial for the developed world, surely their extension for use by others cannot be withheld. This monograph specifically addresses this issue and reports on current policy and technical initiatives in this area. In addition, technical progress in this area is rapid, and we believe that it is useful to present a current picture of tools, needs and possibilities.

This is a book about both ICTs and the World Wide Web. While the Web is one application of many existing on top of the Internet, it is the application that provides the principal window through which users increasingly access ICTs and which is evolving to permeate many aspects of daily life. The rapid evolution of the Web from its static beginning to the rich interactive interoperable media platform that it is today indicates that it is likely to be the principal platform for new development for the foreseeable future. It therefore deserves significant attention for its potential in making further significant contributions to assisting poor and underserved individuals and communities throughout the world.

This monograph is oriented toward several classes of audiences. We have used an advanced tutorial style, that exposes the reader to the main thrust of application of ICTs to development, including the history of ICTs applied to development, the technical infrastructure and interfaces used to deliver ICT-based services in developing environments, important areas of development and ICT-based activities taking place within them, and the cultural environment into which ICTs are being introduced and the effects of that introduction. The content should be of interest to those who are involved with policy formulation and implementation of ICT-related assistance, as well as funders who are involved with investment decisions in this area. In addition, the contents can provide a general education on the subject for interested readers.

The evolution of ICTs, as well as their application to development, is an increasingly broad and complex subject, and no one individual is capable of covering all of their aspects. The creation of this monograph is therefore a team effort; each section has been written by a specialist in the area being described. The major authors for each section are identified in each section, and an Appendix contains a short biography and a photograph for each of them. We are grateful to them for agreeing to contribute their knowledge and experience to this effort.

A number of reviewers were instrumental in contributing to and improving the contents of this volume. In particular we would like to thank Josema Alonso, Stéphane Boyera, Olivier Crépin–Leblond, William Drake, Max Froumentin, Richard Fuchs, Gary Garriott, Aman Grewal, Michael Gurstein, Johan Hellstrom, Franco Papeschi, Larry Press and the authors for their diligent reading of the manuscript and for their perceptive comments and constructive criticism that have helped to make this a better product.

Special thanks are due to Najeeb Al-Shorbaji, Torbjörn Fredriksson, and Raul Zambrano, senior staff members of WHO, UNCTAD, and UNDP respectively, and to Tim Unwin, now CEO of the Commonwealth Telecommunications Organization, who took significant time from their busy schedules to serve voluntarily as authors, based upon their significant experience in their fields. The United Nations family has been involved in multiple aspects of ICT for development now for over 50 years, and remains an important player in this space. The knowledge, skill, and dedication of these people attest to the significant capability of their organizations in these areas.

We wish to thank those many pioneers who, through foresight and hard work, created what we now know as the Internet. We wish to pay special tribute to Tim Berners-Lee, who took the idea of the World Wide Web to fruition and continues to guide its development in important ways. We truly stand on the shoulders of giants. Without the imagination and the dedicated efforts of these people, this book could not possibly have been written.

Very special thanks are due to the Rockefeller Foundation for quickly recognizing the importance of this subject and expressing a willingness to lead the funding responsible for the creation of this monograph.

*George Sadowsky*

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# Executive Summary

The overall purpose of the book *Accelerating Development Using the Web: Empowering Poor and Marginalized Populations* is to serve as a basis for discussion and contemporary outreach to broad range of communities involved in ICTs in the developing world. Structured to provide overviews of the major macro issues (access, capacity, standards), while also providing insights into specific business and public policy domains, the book unites themes of technological innovation, international development, economic growth, gender equality, linguistic and cultural diversity and community action, with special attention paid to the circumstances surrounding the poor and vulnerable members of the Global Information Society.

Taken as a whole, the work will be of value to policy makers, NGO staff members, foundations, private donors, and regional experts. It will also be of use to academics and members of civil society who are interested in progress in the least developed countries in the world. This book is naturally the sum of its parts, and as such, select chapters may also be of interest to doctors, nurses, and other health care workers in distant lands; agricultural professionals seeking to help farmers and small holders in the field; bankers, lenders, and micropayments specialists involved in finance and credit, gender, language and cultural researchers, technologists who may be taking an expansive survey of end user needs and practices; and even anthropologists and sociologists, who are working on the impact of ICTs on society.

Further, the book offers useful information to inventors, social entrepreneurs and thought leaders who are focused on global competiveness. As evidenced by the rapid rise of China and India in the high-tech industry, when we imagine a child accessing a web site for the first time in an LDC today, we know that he or she may be tomorrow's high tech leader in the next BRIC nation.

The subject of ICTs for development has many branches and complex connections between them. Though there are numerous books that tackle the main themes and address select problems individually, few books cover the material in an interdisciplinary manner. While a book of this length cannot delve into the topics in great depth, it offers a foundation in the following areas:

- The policy, legal, regulatory, and financial frameworks that guide the use of ICTs in an international context.
- The technical standards and design decisions that impact ease of use, availability, capacity, and applicability to consumer needs in both business and personal environments.
- And finally the local structures and individual practices that enhance and reflect the end result of technology deployment – human interaction with ICTs for economic and social development.

This book is focused on the use of these technological tools in achieving social and economic goals, and, as stated in the Preface, strives to highlight both their strengths and their limitations. Among several other observations to that end, we acknowledge that the Web is a rich interoperable multimedia platform, but given the vast quantity of information available, the greatest question becomes one of access.

Where in the industrial nations, we take connectivity and bandwidth more or less for granted, we must consider the numbers of poor and underserved individual and communities across the globe; for the long term, governments, policy makers, and corporations must work together to ensure that technological access is guided by principles of social equality and the equitable distribution of information resources.

*Accelerating Development Using the Web: Empowering Poor and Marginalized Populations* may serve to stimulate interactions within and across groups who are working on political, economic, health, education, agriculture, trade, and finance issues around the world and will add to the collection of work and actions that bridge the gaps between the public sector, private sector, and civil society.

This book fills a gap in the current store of knowledge by taking a broad view, offering detailed commentary from fourteen experts who are deeply engaged in the field of ICTs for development, many with extensive experience in LDCs, each able to emphasize the key questions, challenges, and successes unique to their field. While these authors speak of the fields with which they are most familiar, much of the commentary is structured in a way that enables the reader to draw parallels across the fields and see where there are similarities in the deployment of ICTs for development and where there are divergences. By taking holistic approach, the book provides a unique body of material for those studying the current state of play across various economic domains.

For the purpose of this Executive Summary, we will cover the material in brief, chapter by chapter, as it pertains to the interesting findings, open questions, and possible directions that would be most important for senior policy-makers, NGO representatives, private sector interests, or even philanthropies to consider in future initiatives and partnerships. Some of these observations are also noted in the Introduction and many are elaborated more fully in Chapter 14, Conclusions.

As the reader will find, the book addresses these subjects with both macro- and microscopic perspectives. There are vignettes, statistics, personal anecdotes, and an ample supply of references for those seeking to look deeper in one area, or all of them. Above all, the book seeks to be relevant in many of the main ICT contexts today, from rural to urban, poor and vulnerable groups to emerging entrepreneurial classes, and from local to global.

## Chapter Descriptions

***Chapter 1 – Introduction*** provides an abbreviated history of ICTs and their application to development issues. Within the past 20 years, the notion of evolving toward an information or knowledge society has gained credence, and has highlighted the inequities among population groups, regions and countries with respect to access to information resources, a situation often characterized as the digital divide. Such realizations culminated internationally in the United Nations' World Summit on the Information Society in 2003 and 2005.

The primary technologies making possible eventually the achievement of an information society and ubiquitous access to that information have been the Internet and the Web, so that the issue of Internet governance has become an important international political issue. It is therefore important to understand from structural, technical and administrative perspectives — as well as from a political perspective — how and where Internet governance policy can be made so that it addresses effectively the needs of all Internet users, including users who are poor, underserved and otherwise marginalized. National industrial and regulatory policies have a very large impact on the direction and effectiveness of Internet use. This chapter explores the space of Internet policy decision making and the organizations that inhabit that space, and makes suggestions regarding those policies and the loci of their creation and implementation that would permit the Internet to grow and flourish best.

***Chapter 2 – Fundamental Access Issues*** describes how Internet access is evolving, covering the major constraints affecting access levels today and the measures that can be taken to ameliorate them, using a 'broadband evolution conceptual framework to contextualize the factors and identify needs and roles. Without effective access, issues of interface and content are not meaningful. The bootstrapping process of connecting countries to the Internet has now been completed for all but some of the most remote island communities. However the situation within countries is quite different, as not all countries have yet extended Internet access to the majority of their inhabitants and broadband in many countries is only beginning to be deployed.

In addition, the notion of effective access is being redefined as new technologies are developed and introduced. In particular, the rapid and explosive rollout of mobile telephony in almost all parts of the world has provided SMS capability worldwide. The introduction of "smart phones," has offered an increasingly cost effective way of providing Internet access in wide swaths of rural areas where investment in fixed line capabilities is uneconomical. Internet and Web services can sometimes best be delivered through a combination of access methods. This chapter evaluates fundamental access across technological platforms and national contexts.

***Chapter 3 – Technical Access Issues*** focuses on the methods by which we interface with ICT-based services. Innovations, such as the use of pointing devices and finger and hand motions has eased the difficulty in learning how to exploit ICT devices by those previously disadvantaged and vulnerable, including the challenges faced by people with disabilities or who are illiterate. The more sophisticated assistive devices that previously relied heavily on increases in processing power, memory size and communications capabilities are becoming more common now, as technology has delivered those capabilities at lower cost. The rate of progress of the technologies underlying these components continues to be rapid, and will be the basis for further improvements in user interfaces.

However, usability is not an exact science. There are abundant guidelines and possible techniques for making things usable, but ultimately they must be validated by the experience of by real users. Users with minimal technology experience and those who have no desire to become technologically proficient are likely to be most affected by ease of use issues. Although this review includes a range of usability issues, a prime focus will be on those issues and technologies that can make Web access practical for those most challenged by usability.

***Chapter 4 - Internet Access: Policy Issues for Persons with Disabilities*** covers Internet access for persons with disabilities from policy, legal and practical perspectives. For the first time in history, the Web provides possibilities for users with disabilities to more fully participate in society and for society to be enriched by their diverse contributions. A Web strategy that accommodates the functionality needs of persons with disabilities, such as hearing, visual, cognitive and mobility disabilities means that many of the barriers that contribute to the disadvantages they experience can be avoided or reduced. Some of these disadvantages include: poor health outcomes; lower educational achievements; lower employment rates; higher rates of poverty; and not being able to live independently or participate fully in community activities. Unless ease of use and functionality is addressed for Web users with disabilities, they will most likely not benefit from Web initiatives supporting economic and social development.

The impetus for increasing the ease and usefulness of interfaces comes both from public policy and technological considerations. Many countries of the world have adopted legislation to promote or require that interfaces take people with disabilities of various kinds into account. Industry associations also understand the value of interfaces that are easily used by people with various disabilities, and the World Wide Web Consortium has developed and published guidelines for designing easily accessible Web sites within the limits of current technology. This chapter provides a thorough background on the methods and rationales for the various governmental activities in this direction.

***Chapters 5 through 10*** address the uses of ICTs to assist progress in substantive core areas. For each area, the current status is described, as well as the impediments to progress and any current work done to break through those impediments.

***Chapter 5 – Governance*** in this context is defined as the exercise of political, economic and administrative authority to manage the affairs of a nation-state. Governance encompasses all of the processes, relationships and institutions through which citizens and stakeholders articulate their interests, exercise their rights and obligations and mediate their differences. A key element of governance is thus the *distribution of power* among competing groups of actors and networks within a given national or international political environment.

From the human development perspective, 'good' governance is democratic governance. Democratic governance entails respect for human rights and fundamental freedoms where people also have a say in the decision and policy making processes that affect their lives. Principles such as transparency, accountability, responsiveness and inclusive participation are core trademarks of democratic governance.

There is substantial evidence that countries can have rapid economic growth without necessarily embracing good governance mechanisms and principles. In fact, it is quite feasible to have accelerated growth while both poverty and inequality increase, potentially leading to lower levels of human development overall. In recent decades, the concept of good governance has evolved to include a shift in system dynamics, where the process of globalization and the emergence of the Internet and new ICTs have played important roles. The spread of ICTs has helped to bring about good governance, and good governance has exploited ICTs to develop.

***Chapter 6 – Agriculture*** contends that the agricultural sector needs to be rejuvenated, especially for the vast majority of the rural poor dependent on it for their livelihoods. Improving information flow throughout the chain of production to market can bring in major gains. Today, the advancements in information and communication technologies, highlighted most by the spectacular penetration of mobile phones, present an enormous opportunity to harness ICTs to aid agriculture.

Bringing benefits of decentralization and widespread reach, these tools allow for customized solutions to specific and diverse problems, as well as enhancing the effectiveness of global programmes, connecting old and new players, and helping to improve knowledge flows. With a focus on highlighting the importance of small holders in revitalizing agriculture and having a positive impact on rural poverty, this piece explores the possible ways in which ICTs can support this process.

***Chapter 7 – Health*** addresses the use of information and communication technology in health or eHealth. eHealth has been defined by WHO as "the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".[1] This chapter will focus mainly on the use of Internet to support access to health information and health services. One central goal in this effort lies in enabling and empowering individuals and organizations in the health care field from the most remote to the most urban locations through better access to and utilization of the vast store of health knowledge that is available through electronic means.

***Chapter 8 – Education*** focuses on the ways in which the Web can enhance access to educational information and facilitate communication in the context of lifelong learning, paying particular attention to the role of the Internet in distance education. For the Web to be used effectively in support of learning, five critical things need to be in place:

[1] World Health Organization. WHA58.28 eHealth. http://apps.who.int/gb/ebwha/pdf_files/WHA58/WHA58_28-en.pdf

First, governments need to have integrated national ICT strategies that incorporate explicit attention to the use ICT in education and learning. Second, these strategies must place teacher training at their heart. Third, attention should be paid to the inclusivity of learning, across gender, language groups, age groups and cultural divides. Fourth, despite the shift to the privatization of education in many global systems, the enormous potential of Open Educational Resources needs to be realized through policies and practices that specifically advocate its utilization. Finally, much more attention needs to be paid to the effective use of mobile devices in learning. It will not be long before most people primarily access the Web through a small tablet or mobile hand-held device. This will transform learning, and educators must be prepared for the transformation that is likely to occur as a result.

This section evaluates some of the issues and applications that are relevant for education, and concludes with comments on the development of both local and international content.

***Chapter 9 – Commerce and Trade*** describes how the advance of new ICTs has had a transformational impact on the ways in which enterprises organize and conduct their commercial activities, both within and across national boundaries. While this has been the case for a long time in developed countries and for large enterprises throughout the world, it is only in recent years that the power of ICTs has also been felt among micro- and small enterprises in developing countries. Thanks to the rapid spread of mobile telephony and related applications, there are now greater possibilities than ever before for enterprises that matter to the poor to exploit ICT opportunities in their commercial activities. This chapter provides a brief overview of some recent developments and draws out key policy implications. It argues that, in order for policy interventions to harness the emerging opportunities, they need to become more demand-driven, better understand the needs of different enterprises, exploit the diversity of ICTs and leverage the capabilities and expertise of various stakeholders.

***Chapter 10 – Finance*** provides an overview of current understanding of the application of mobile phones for the delivery of financial services in developing economies. Internet banking has grown rapidly in the industrialized countries, but less so in the developing world due to constraints of infrastructure, access, affordability and user acceptance. Mobile phone networks, on the other hand, are close to providing a universal access infrastructure for data as well as voice transmission, offering a platform for a wide range of new mobile financial (m-finance) services that have the potential to reach the mass of populations located in both urban and rural areas of low income countries. M-payments and m-banking are subsets of the broader domains of e-payments and e-banking which incorporate other ICTs including web-based applications that integrate user interfaces and networks with back office systems and data centres which can be located anywhere around the globe.

Evidence from studies of mobile-money, mobile-payments and emerging account-based service deployments is considered in relation to a range of differing country experiences. Key impediments to the successful application of mobile technologies for the delivery of financial services are highlighted, as well as current initiatives that are being undertaken to overcome them. Finally, some recommendations are made with regard to promising future areas of work.

***Chapter 11 - Gender*** focuses on a key development issue, the role of gender in leveraging human resources in developing economies. While the initial discourse on inequalities in access and usage of the Internet was confined to internal divides within developed countries, it spread rapidly to an analysis of inequalities between countries that showed a wide gap between developed and developing countries — often called the global digital divide.

By the first part of the first decade of the twenty-first century, the idea of the Internet as a major tool for women's empowerment and promoting gender equality became axiomatic with the imprimatur of the United Nations, the World Summit on the Information Society and the World Bank, among others. The two issues — ICTs and women's empowerment — in turn, have come to be regarded as essential components of sustainable economic and social development.

Virtually all analysts now identify gender as one of the major components of internal developing country divides in a list that includes education, skills, income, language, ethnicity, age and geographical location. The majority of women in developing countries cross several of the other divides, leaving many women on the negative side of multiple barriers to advancement and making the gender digital divide that much harder to circumvent. This chapter illustrates these issues and provides prescriptions for change.

***Chapter 12 - Language*** surveys the critical issues of linguistic capability and content on the Web and on the Internet generally. Initially, users of the Web who did not understand English were explicitly vulnerable to exclusion from participation and content generation. Since then, a great deal of content in other languages has come into existence on the Web. Recently, the ability to navigate the Web through identifiers in non-Latin scripts is helping to fulfill the promise of creating Web environments that are completely localized with respect to language and script.

How important was, is and will be the *language factor* in the evolution of the Internet? What repercussions could the Internet have in the real life of languages? How are Internet contents and languages interrelated? These are difficult questions to answer, partly because of the scarcity of current and reliable data. This chapter addresses these and other issues related to language and the Internet.

***Chapter 13 – Culture*** deals with the social and cultural aspects of ICTs as an invasive force in the culture of communities and developing societies. In the past, some cultures have expressed a concern regarding the introduction of technology for a variety of reasons, and there are still significant concerns in some places regarding the substitution of ICT "capital" for labor because of the negative effects on human employment.

These economic effects are increasingly counterbalanced by the enthusiastic adoption of social networking tools, such as Facebook by younger people. Adoption of new communications channels has led to a media revolution, which has led to rapid coalescing of new citizen-driven political forces in some countries, some of which have been a significant element in toppling national governments. This chapter stresses this and other new capabilities that may be supported and delivered through new and emerging communications technologies. The field in dynamic and complex, with short term victories and losses as well; while the chapter takes a positive stance on the ICT revolution, there is room for future work to be done on what may be lost in traditional cultural forms and functions.

***Chapter 14 – Conclusions*** contains a summary of the main points and recommendations from each chapter and an analysis of the current state of ICTs used in international development. It focuses on the principal actors in this drama and assesses opportunities to augment the role of the Internet in general and the Web in particular for interdisciplinary, multilateral efforts in global economic and social development. A high level view of development theory and current megatrends sets a context for these summaries.

# CHAPTER 1

## Introduction

*George Sadowsky*[1]

### Prologue

Two major but very different currents of change have swept over the world in the last half of the 20th century. The first has been the liberation and independence of most of the colonies that existed prior to World War II, a major tectonic shift in governance for much of the world. Concurrently, the world's developed economies assumed the responsibility of making significant efforts towards assisting them in developing economically and socially. While such development existed during most countries' colonial period, the development efforts mostly reflected the values of the occupying colonial power, and the direction, rate, and level of developmental assistance were seen to be a responsibility of the colonial power and not that of a global society.

The other major tide of change has been the evolution of information processing to the point where, in its various manifestations, it materially affects the lives of billions of people today. In fact, many aspects of modern life in developed countries would not be possible if it were not for the rapid technological progress exhibited by the information processing industry since its effective birth shortly after World War II. While the information processing industry started well before the war with the exploration of Charles Babbage in the 19th century,[2] the card punch machinery of Herman Hollerith,[3] and the development of initial card processing equipment by firms such as IBM and NCR,[4] such developments served only as mechanical adjuncts to well understood processes that already existed. The current state of the information processing industry surpasses that state of affairs by many orders of magnitude, both conceptually and quantitatively.

This volume concerns itself with the interaction between these two major waves of change.[5] It focuses upon the interaction between the evolution and application of the information processing industry, now more appropriately designated by Information and Communication Technologies (ICTs), and their potential for accelerating their contribution to meaningful economic and social development. In particular, it focuses on a group that we shall call "the poor and vulnerable" who for one or more reasons have either not had access to ICTs, or have not been able to make use of ICTs that are available to others near them. The relationship between the two develop-

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[1] Raul Zambrano contributed to the content of this chapter.

[2] For a description of the life of Charles Babbage and some of his writings, see Charles Babbage and his Calculating Engines, (ed. Philip and Emily Morrison) Dover Publications, New York, 1961.

[3] Herman Hollerith's life and contributions to the beginnings of computation are described in many places. Two interesting references are http://www.columbia.edu/cu/computinghistory/hollerith.html and http://www.census.gov/history/www/census_then_now/notable_alumni/herman_hollerith.html

[4] The early history of the computing-tabulating industry is well covered in Building IBM: Shaping an Industry and its Technology, by Emerson W. Pugh (MIT Press, 1995) and in International Business Machines: A Business History, by Saul Engelbourg (Ph.D. dissertation, Columbia University, 1954).

[5] These are clearly not the only major waves of change that the world has experienced during this period. For example, the "green revolution" was absolutely essential for sustaining the lives of a population that has doubled during this period, a formidable social and technical accomplishment.

ments has had a long history, starting in the 1960s and continuing and generally strengthening over time until the present. It is the object of our attention later in this chapter.

It is a relatively common consensus that the evolution of ICTs is, at best, in its adolescent phase of growth, with major advances to come, both in the underlying physical technology used to build hardware and in the set of feasible applications that can be implemented by creating software to run on the hardware. If this is the case, then the use of ICTs for development has a long way to go, and it is vitally important to understand how ICTs can best serve the cause of development both now and in the future. As usual, the historical record contains important clues regarding previous conceptions of this understanding. These can aid us in developing an effective understanding of what is possible in the future, as well as in helping us to work efficiently toward goals that are both technically feasible and socially appropriate.

## Some History

The use of information and communications technologies to support economic and social development has a long history. Perhaps the first major contributions came from communications technology, enabling the dissemination of knowledge over distance without having to deliver it physically. Inventions such as the telegraph[6] permitted near-instant delivery of information. Telex, introduced in the 1930s as a low speed switched digital network, became *de facto* the first global electronic mail system, connecting many thousands of sending and receiving stations located in almost all countries.[7]

By contrast, electronic computing technology evolved more slowly, but the nature of its early applications foreshadowed its introduction into developing countries. The first successful mechanization of information processing was implemented by a young engineer in the 1880s, Herman Hollerith, who developed basic equipment for recording data by punching holes in card stock and for performing basic arithmetic and classification operations automatically on those data. Hollerith's inventions and techniques were used first to process the 1890 decennial census of population in the United States, and their successful use led to the elaboration of such machinery for both statistical and accounting functions in government and in industry.

The evolution of ICTs can be broadly seen as consisting of different eras, starting with large computers referred to as mainframes and proceeding through stages of ascension and dominance of minicomputers, microcomputers, and most recently computers connected via the Internet, both by wire and wirelessly. In the era of large computers or mainframes, early applications of computers to development were limited by high hardware costs, extensive site preparation, a reliable supply of electricity, the necessity of frequent maintenance engineering interventions, and primitive software environments for development of applications. Over time, advances in technology and lower costs helped to make the introduction of computers more feasible and useful in development contexts. Minicomputers were more rugged and required neither specialized sites, nor a frequent engineering presence.

Starting in the late 1970s, the emergence of the microcomputer changed the ICT landscape deeply and fundamentally, and effectively democratized the ownership and use of computing technology. The advent of low cost and increasingly powerful microcomputers popularized computing and led to their mass ownership. This was essential in laying the groundwork for the Internet, which would later provide connectivity among them. Microcomputers, or PCs (for Personal Computers) as we generally refer to them these days, are now more powerful than the most powerful mainframes of 20 years ago, and serve as stand-alone automation devices as well as hosts and clients on networks. The evolution of these devices will surely not stop here.

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[6] One interpretation of the early history of the telegraph is that it bears a striking similarity to the growth of the modern internet. See The Victorian Internet, by Tom Standage (Berkley Books, New York) 1998.

[7] For a history of the Telex network, see http://en.wikipedia.org/wiki/Telex

Developments in computer networking commenced early in the history of computers. A model of computer access known as time-sharing, connecting individual unintelligent terminals to a shared mainframe environment, was introduced in the 1960s, and such interaction still exists today.[8] In the 1970s, various vendor-based local area network protocol sets such as AppleTalk, ARCNet, Netware, and StarLan[9] were introduced for local area communication (LANs), while networks such as DECNet and IBM's Systems Network Architecture[10] were introduced for wide area use (WANs).

In 1969 the Defense Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense funded an experimental networking project among universities and research laboratories in the United States. Called ARPANET and starting with nodes in four research universities, this network evolved through multiple stages to become the Internet, a network of interconnected networks using the TCP/IP protocol suite that now connects an estimated two billion users.[11] The World Wide Web, invented by Tim Berners-Lee at CERN in 1990, is a distributed application that uses the Internet to make available both communication and content, and is currently one of the most dominant and useful applications on the Internet.[12] Both the Internet and the Web continue to gain in functionality under the direction of their respective standards bodies, the Internet Engineering Task Force and the World Wide Web Consortium, and have evolved far beyond their initial forms.

The computing industry has enjoyed a virtuous cycle of technological progress. With respect to hardware, a rule of thumb known as Moore's law[13] states that the performance/price ratio for computer hardware doubles approximately every 18 months to two years. A rigorous analysis of the rate of progress during the first 30 years of computing yields a somewhat smaller, but nevertheless impressive growth rate of 28% per year.[14] As communications facilities have evolved from analog circuitry and copper lines to digital circuitry and optical fiber lines, they have also enjoyed the benefits of the rapid rate of technological progress.

Such exponential improvements in the performance/price ratio have two distinct effects. The obvious effect is that costs are rapidly decreasing for the same level of capability, which in turn satisfies an increased demand for such goods. More people and more organizations can extract benefits from ICT-based services. The not-so-obvious implication is that tasks which were infeasible at lower levels of performance and at any price can now enter the feasible set of tasks. This is a qualitative difference that has been very powerful in the history of ICTs.

A good example is provided by speech recognition and automatic language translation. Although both issues have been studied since the beginning of modern computing, it is only in the last five years that real progress has been made and that systems for recognizing and translating speech with adequate accuracy are now becoming

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[8] http://www-formal.stanford.edu/jmc/history/timesharing/timesharing.htmlcontains a good and easily readable explanation and history of time sharing by one of its founders, John McCarthy.

[9] Local area networks flourished in the 1980s and into the 1990s. There were a number of standards, none of which really came to dominate the market. In general, the growth of the Internet, with its global reach in addition to providing effective local networking, diminished substantially the importance of such independent local implementations.

[10] DECNet from Digital Equipment Corporation and SNA (Systems Network Architecture) from IBM were two well used wide area network architectures developed and evolved in the 1980s and 1990s. DECNet was a layered architecture having some similarity to the TCP/IP protocol suite, while SNA was essentially a centrally controlled architecture corresponding to the structure of a business enterprise. DECNet has essentially vanished while SNA is still used in some organizations as a basis for their corporate network architectures.

[11] The Internet Society has made available a large collection of articles on the history of the Internet. See http://www.isoc.org/internet/history/

[12] For a definitive history of the World Wide Web written by its principle creator, see Weaving the Web, by Tim Berners-Lee (HarperBusiness, 1999).

[13] Wikipedia has a definition and comprehensive discussion of Moore's Law. See http://en.wikipedia.org/wiki/Moore's_law

[14] See [Triplett 1986] and [Cole 1986] for background material explaining how a hedonic price index is constructed and for discussions on the application and interpretation of hedonic methods with respect to computing systems.

commonplace. While this is due in part to breakthroughs in research, the methods employed could not have been implemented on computers as little as ten years ago.[15] The potential for exploiting such technology for assisting poor and vulnerable users should be obvious.

With respect to the use of ICTs in support of development, some use was made of mainframes to achieve development objectives, but only in those countries having sufficient infrastructure to provide adequate support.

More formal recognition of the potential of ICTs for development was provided by the United Nations, which in the early 1970s established a formal study group on the subject. The reports published as a result of the study group's work[16] provided visibility for the field and were used as input to guide the United Nation's own nascent development activities. In particular, a major UN statistical initiative, the African Census Programme, initiated in 1974 and lasting for a period of almost ten years, resulted in the introduction of initial computers in almost all African countries, replicating Hollerith's path breaking entry of first information processing equipment into the processing of the U.S. population census of 1880.

With respect to applications, this virtuous cycle has been strengthened by rapidly growing markets, increased competition and, as one consequence, declining prices.[17] On the application side, each improvement in the size, reliability, portability, flexibility and performance/price of information technology makes a wider set of applications feasible, broadening the market for products. In addition, advances in software technology have made it easier for people to develop software, both general and special purpose. The result is that an industry which, just 60 years ago, had produced only a few computers and could claim only a handful of people who knew how to use them has now produced well over a billion computers and there are literally millions of people who know how to create software for them.

Recent product developments offer new ways in which ICT can be helpful. In particular, the emergence of the "smart" mobile phone, with substantial computing capability and including a web browser, has introduced new ways to access the Internet. With the development of high speed digital telephony protocols, the range of Internet access had been significantly extended, and at costs not exceeding those of fixed access facilities in the worst cases; in many instances the costs are much lower. Both mobile phone computing capabilities and those of its tablet relatives are now empowering the creative use of ICTs where geographic mobility is essential.

By any quantitative measure, the result of this virtuous cycle for the application of these technologies to economic and social development has been spectacular, with ICTs now mainstreamed to a fair extent in development assistance. However, as we shall see, ICTs have not lived up to their full potential in assisting development, and there are significant problems with them that have not yet been resolved.

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[15] Automatic language translation has been a goal since the 1950s, when Howard Aiken pioneered research in the field on the Mark IV computer at Harvard.

[16] Two studies published, both titled The Application of Computer Technology for Development, by the Department of Economic and Social Affairs, The United Nations, 1971 and 1973.

[17] This has not been evident in operating systems that have evolved more slowly, as the oligopolistic nature of that industry segment has historically resulted in high barriers to entry. However the persistence of major operating systems has provided a stable base for the development of applications, and has even given so-called legacy applications a very long life.

## The Current State of ICTs

The present state of information technology is characterized by a complex multi-dimensional development and use of various forms of participating technologies. Technological progress is rapid and entrepreneurial activity is rampant.

Four trends stand out as being among the most important, especially for their potential contribution to development.

First, advances in the underlying hardware technology have led to devices that show an extraordinary combination of processing capability, memory, mobility, battery longevity, portability, communications capability and location awareness, all in parallel and at increasingly affordable price points.

Second, the creation of the Internet has provided a distribution method *sine qua non* for knowledge that exists in any part of the world to be accessed rapidly by anyone with access to the Internet and the Web, as well as being able to communicate directly potentially with billions of people. In the future, in developing regions, much of this communication will be realized through mobile telephone networks, which themselves have experienced their own revolution in the distribution of voice communications.

Third, the proprietary lock on software and software costs has been eroded significantly by two phenomena. The first, the free software movement, has contributed an enormous variety and amount of software that can be obtained at no cost and used with minimal legal restrictions. Although much of it may be difficult to use and some may be of dubious quality, over time the general levels of quality and reliability have increased substantially. Two outstanding examples of programs in this class are the Ubuntu operating system and Mozilla's Firefox browser. The overall result has been to provide major pieces of operating software at very low cost, thereby expanding the market for consumers. More recently, the rise of social entrepreneurs has extended the free software phenomenon into a phase one might characterize as a "free development" movement, with investments being made in both intermediate and final tools for socially oriented projects.

The second phenomenon illustrates a reverse effect. As a result of the rapid proliferation of inexpensive computers and other low cost devices, and the consequent enlargement of the market for software, the software industry now includes a major component consisting of many thousands of individuals and small firms that produce low cost software and are increasingly using automated web services to distribute their product. Such an environment encourages the emergence of individual creativity and a wealth of new concepts, products and services. It is estimated that there are thousands of developers now working on applications for advanced mobile phones and tablets, and that they have created well over 500,000 applications for these environments. While many of these are not relevant for development, many are useful, and their growth in numbers continues at a rapid rate.

In addition, a fundamental base for the Internet, free and open standards, remains strong. At the technological level, the Internet Engineering Task Force (IETF) continues to be active in standards development. Its governance model is a meritocracy, the organization is open to anyone, and approved standards are based on rough consensus and running code. At the level of content, the Word Wide Web Consortium (W3C) has pioneered free and open standards for the Web, and development of the latest markup language for Web content, HTML5, is in the process of being implemented.

Fourth, the character set used for computing and communications, originally composed of the Latin alphabet augmented by some punctuation symbols and referred to as ASCII[18], has evolved into a relatively comprehen-

[18] The original ASCII (American Standard Code for Information Interchange) standard was published in the mid-1960s

sive standard consisting of the union of almost all of the world's known scripts, called UNICODE.[19] Furthermore, recently ICANN,[20] the Internet Corporation for Assigned Names and Numbers, has just made available the ability to use any UNICODE code table in the top level of an Internet Domain name. Such internationalized top-level domain names are now being adopted and implemented in many scripts.[21] For most alphabets, this removes a major barrier to being able to use the Internet in any local languages that can be expressed in written form.

## Software for Support of Development

Software is the critical component that allows us to make creative use of information technology hardware. It is worth looking at the current state of software as it impacts activities that support development.

First, it is clear that general purpose software has had a major impact upon developing regions as well as upon developed regions. Although general purpose software such as word processing, spreadsheets, presentation tools, e-mail, web browsers and search tools were not created specifically to assist in development, many of the needs of developing regions are similar to those in developed regions, so that such software has provided a significant productivity assist to all.

In addition, the growth of the World Wide Web and the availability of Web browsers have led to what might be considered as the democratization of data resources. Large databases and collections of information such as Wikipedia,[22] Medline,[23] the CIA Fact Book,[24] and more recently the World Bank data archives[25] have become available to anyone, anywhere, at no charge. As information continues to migrate to the Web, both developed and developing regions are benefitting significantly from the evolution of such free worldwide resources. Ac-

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and consisted of a 7-bit code based on the then current teletype paper tape character encoding standard. It has since been augmented to an 8-bit standard, allowing a maximum of 255 characters, 32 of which are typically reserved control codes. The limitation of 255 characters was not an obstacle for even the extended Latin character set, but was totally inadequate to include the multiple alphabetic and ideographic characters in multiple scripts.

[19] The UNICODE Consortium, a group of organizations and individuals, was formed in 1988. Its goal is to establish a multi-byte standard for character representation of characters in all of the world's scripts, much as the ASCII standard provides such a standard in one byte for the basic Latin character set. Since its beginning, the standard has undergone extensive evolution, and is currently at version 6.

[20] ICANN's IDN (Internationalized Domain Name ) program is described in http://www.icann.org/en/topics/idn/

[21] At the time of this writing (October 2011), 42 internationalized country-code top-level domains have been created in, among others, Cyrillic, Arabic, Hindi and other Indian language scripts, traditional and modern Chinese, Korean, Sinhalese and Tamil.

[22] Wikipedia (http://www.wikipedia.org/) represents a new paradigm in information generation. It is an on-line encyclopedia created and managed by a wide variety of volunteer contributors, with distributed peer management to obtain accuracy of content. Initially an experiment, the content has grown enormously to over 10 million articles in more than 200 languages. Informal analysis indicates that the quality of the content is comparable to or better than that of the Encyclopedia Britannica.

[23] MEDLINE (MEDical Literature Analysis and Retrieval System Online), a product of the U.S. National Institutes of Health, was one of the first comprehensive medical data bases that could be accessed by developing countries through a dialup telephone line and a simple user interface.

[24] https://www.cia.gov/library/publications/the-world-factbook/

[25] The archives are located at http://data.worldbank.org/. The phrase "open data" used by the bank, is related to the OGD or Open Government Data movement, which works with governments to make an increasing amount of public data available in a usable form on-line for general use. A good example of such projects is contained in http://www.webfoundation.org/projects/ogd/. The power of the OGD movement is explained by the availability of tools to combine data to create new information sources and services, as opposed to only official government use of the data, and the emergence of tools and individuals who can implement such combinations with relative ease.

cess to this vast amount of information is all the more important for many developing countries because their public and university library resources range from poor to essentially non-existent.

The history of the development of specific software to assist in development has been less productive. The field is littered with anecdotal evidence claiming various levels of success produced by pilot projects, executed in a specific location having a specific set of circumstances. Yet these pilot projects rarely progress beyond the pilot stage, for two reasons. First, they are generally neither scalable at marginal cost nor replicable in other locations; their success is due to specific local circumstances that are not likely to exist in the same combination elsewhere.

Second, the organization of the ICT4D (ICT for Development) "industry" is fragmented. With notable exceptions, individual development projects involving ICTs are generally isolated from other work in a country, and are possibly even isolated within the development portfolio of the executing organization. Funding cycles are relatively short, and funding agencies expect results in a timely manner. This environment biases results toward claims of success without having sufficient degrees of freedom to test for sustainability, scalability or replicability. This is aggravated by the propensity of development funding agencies to fund new projects rather than to evolve, extend and support projects that have already been funded. Further, the use of ICTs is not yet a common ingredient in country poverty reduction strategy programs, even when the payoff to using them is moderately clear. Overlooking them weakens the possibility of coordinated planning between local groups, regions and countries as a whole.

*"What do they think we are, a dumping ground for hardware?!"*

The year was 1984, and the speaker was Dr.V.K. Samaranayake (known as "Dr. Sam"), a pioneer in the use of ICTs in Sri Lanka. In his office in downtown Colombo there was a table with four or five different makes of microcomputers, cords and related equipment. He was indignant, and complained on and on about the naïve do-gooders who believed that development issues could be solved just by supplying computers and who therefore brought one to him to solve Sri Lanka's development problems. "There aren't any decent manuals, and there are no applications," he said, "and when it breaks, how do I get it repaired?"

Dr. Sam may or may not have realized the longer run potential of the technology that was being "dumped" in his office, but he understood well that while ICTs may be part of a solution, the goal of development is to solve a problem that has its origin in social and economic issues, not technological ones.

There are exceptions to this somewhat unsatisfactory state of affairs. The trio of population census data processing programs, CENTS, COCENTS, and CONCOR[26], developed by the U.S. International Statistical Programs Center was initially implemented on mainframes and ported to microcomputers, has been used successfully to process population census data in over 90 countries. Similarly, the ASYCUDA program,[27] developed by UNCTAD, is used by many national customs agencies to process manifests of imported goods. However, such examples are the exceptions rather than the rules, and owe their success in large part to the fact that they implement administrative processes that are more or less commonly defined across countries.

Balancing this concern regarding an inadequate supply of specific development software, there has been an explosion in the number of people who have the ability to generate modest software modules for specific purposes

[26] See Census Catalog and Guide 1985, U.S. Department of Commerce, Bureau of the Census, p. 340 (available through Google Books at http://goo.gl/Ugdgf)

[27] ASYCUDA, an automated system for customs data, was developed and distributed in the early 1980s by UNCTAD. It is one of a few examples of software that has been successfully used in multiple countries, succeeding because it addressed a common problem and was based upon international trade standards.

fairly easily. Given simple development tools and robust middleware, there are now hundreds of thousands of people who can generate simple programs for computers, tablets and mobile phones. Some of these programs are very useful for the purpose for which they were created, and others can even be repurposed. Examples are Frontline SMS,[28] which can be used to provide some flexible interactions using only SMS, and Ushahidi,[29] which combines incident data with a geographic data base and was originally created to aggregate information about the location of riots in Nairobi during the 2007 elections in Kenya.

Both approaches, developing general purpose solutions that are widely applicable and building simpler solutions to one or a limited set of problems, have merit and can be appropriate. At this time, it is unclear where the balance point is between such general purpose approaches and specifically tailored tools. While it is possible that most solutions are indeed local and can best be dealt with using local solutions, it frustrates many development professionals that common solutions cannot be found which could provide substantial economies of scale.

The situation is much better with respect to content. Plentiful tools exist for people to publish content in its most general form including images and videos, typically on the Web, without having to be software developers. The markup language itself, Hypertext Markup Language (HTML) is itself relatively easy to learn and requires no programming expertise, and graphical interface programs exist to convert page layouts into the underlying markup language.

## Who Are the Poor and Vulnerable?

An important goal of this publication is to focus upon the needs of "poor and vulnerable populations," so it is important to understand who would be included in such a target group; however, poverty levels are not always completely correlated with degrees of development. In addition, within almost all countries there are internal divides that reflect disadvantaged strata and disadvantaged communities. It is necessary to look beyond aggregate national statistics, since they often mask such inequalities.

Furthermore, if the focus is upon individuals, then different categories and a different pattern and distribution of "poor and vulnerable" emerge. Functionally, vulnerabilities to be considered include physical disabilities such as blindness, deafness or lack of mobility. There are also vulnerabilities based on gender, age and culture that today play a key role, particularly in situations of conflict. Illiteracy is also renders one vulnerable. Qualitatively it is a very different sort of vulnerability, and while it can generally be remediated through comprehensive educational programs, illiteracy exists in very large numbers today, mainly but certainly not totally in developing countries. Making literacy a condition of effective ICT use is not a good option when there are technical interface and policy contributions that can readily help to ameliorate the problem.

In addition, functional literacy, i.e. the capacity to understand the meaning of information and furthermore to transform that information into knowledge, remains a key factor in being able to use information technology effectively. This issue is sometimes referred to as "digital literacy" and is seen by some observers[30] as the most

[28] Frontline SMS (http://www.frontlinesms.com/) is a system using SMS text messaging in a creative manner to allow two way communications between mobile phone users (or between mobile phone users and a server offering a specific service). Developed by Ken Banks in East Africa, it has enjoyed widespread use for basic communications operations.

[29] Ushahidi (http://www.ushahidi.com/) is an open source software program that uses crowd-sourcing to develop mapping of critical information made available on the Internet. First developed and used during the violence surrounding the Kenyan elections of 2007, it has found widespread use in other community situations.

[30] See for example OECD's concern regarding digital literacy as the second digital divide, at http://oecdinsights.org/2011/06/28/reading-the-second-digital-divide/

underestimated barrier to digital inclusion through ICTs applied to disadvantaged groups. While a thorough examination of the scope of this issue goes beyond this work, it is an important facet in both the creation of ICT-based tools and in their introduction into poor and vulnerable communities.

For the purposes of this study, the phrase "poor and vulnerable" applies to countries, to communities, to social, cultural and gender strata, and to individuals, including subsets of individuals, communities and strata in developed countries. Our goal is to explore how access to and use of ICTs can empower them wherever they are and in spite of whatever vulnerabilities that characterize them.

## The Digital Divide and Development

Since 2000, the phrase *digital divide* has come to symbolize the gap in ICT capabilities between the developed and the developing countries. References to the "digital divide" occur in the Geneva action plan,[31] the Tunis Agenda,[32] the Report of the WGIG[33] and many other documents that address the issue of using ICTs to assist development.

Although it is a catchy phrase and has been responsible for galvanizing a certain amount of support for ICT-based assistance, it is based on a flawed understanding regarding the role of ICTs in development.

First, the digital divide is as much a symptom of more fundamental problems than it is a cause of a lesser rate of development. The more fundamental divides that consign countries to a less developed status are divides such as the education divide, the health divide, and the governance divide, among others. In this context, narrowing the digital divide, including the digital literacy divide, is regarded as a way to affect those more fundamental divides between advantaged and disadvantaged populations. One problem with such a framework for progress is that the more fundamental divides may not depend critically upon the state of ICTs, and that the model of addressing the larger divides through use of ICTs may be incorrect, causing its implementation to be inefficient and possibly even ineffective.

Second, the notion of divide implies a sharp division between haves and have-nots. In fact, it is more appropriate to think of digital inequality as a distribution, or set of distributions, of access to and use of various aspects of ICTs. Based upon such a concept, the shape of the distribution becomes meaningful in assessing how that distribution might be move toward a range indicating a richer and more useful ICT environment.

Third, there will always be a digital divide between rich and poor countries, at least as far we can see into the future. Technological progress has thrived in developed countries, and based upon what we now observe, such progress will continue for a long time. Our moral notion of what is an acceptable lag for developing countries has some effect of what actions we believe should be taken. For example, the developed world has had the capability of broadband connectivity for some time now, but it is only recently that broadband has been elevated to a level considered essential for developing countries to deploy.

From a development point of view, the truly important divides are in critical areas such as education, health, governance and employment. In this context, how should the amount of effort and resources to narrow the digital divide be allocated? This more general question depends upon the circumstances surrounding activities

[31] The Geneva Action plan is at http://www.itu.int/wsis/docs/geneva/official/poa.html
[32] The Tunis Agenda is at http://www.itu.int/wsis/docs2/tunis/off/6rev1.html
[33] The Working Group on Internet Governance produced two reports, a short official report and a longer background report. The short official report can be found at http://www.wgig.org/docs/WGIGREPORT.pdf

in the substantive areas and upon the opportunity costs associated with ICT-based investments in each instance. The question cannot be answered in a general way. One possible strategy would be to try to narrow the digital divide to the extent that it is no longer a significant contributor to another divide for each specific situation, i.e. when narrowing of the divide has achieved all that it can achieve.

This is an ambitious and very expensive goal. Another possible strategy would be to equate the marginal benefit from ICT-based interventions with the marginal benefit from alternative investment strategies. This is an economically efficient strategy, but it ignores the fact that generally speaking, such an equalization is only very approximately predictable, and that the marginal benefits are not only difficult to ascertain, but they may only become apparent after a significant period of time has elapsed.

A common perception that has intensified the prominence given to the digital divide over the other divides mentioned above is that ICTs have always appeared to possess some sort of magic when it comes to development. One component of development theory stresses the lack of access to current knowledge as a contributor to the slow pace of development. If only it were easier to have instant access to relevant knowledge, the theory notes, then developing countries could avail themselves of it and increase their rate of development substantially. There is clearly a germ of truth to this. Access to information is a necessary, but it is far from a sufficient condition for success.

The cycles of technological progress appear to have generated recurring cycles of hope and disappointment for advocates of the importance of ICTs for development. In the 1980s, microcomputers were properly regarded as low-cost and low-maintenance alternatives to their predecessors, but often improperly regarded as an overall solution to how ICTs can solve development problems. The spread of the Internet, starting in the early 1990s, offered even more hope for access to knowledge, both in the form of information and communication with remote expertise. This enthusiasm reached a peak of unrealistic proportions in 2000, coinciding with the attention given to the subject by the G-8 during its Okinawa meeting and the resulting DOT-FORCE initiative, which appears to have slowly expired over the following years.

In a parallel but unrelated example, the United Nations obtained support from all of its member countries and agreed in 2000 on a Millennium Declaration. The Declaration established the Millennium Development Goals[34] (MDGs) that, for the first time in history, established a series of concrete development targets to be achieved by developing countries in 2015. One of the MDG targets explicitly refers to ICTs, focusing on universal access to the new technologies, thus prioritizing emphasis on closing the digital divide, an emphasis that was very fashionable at the time. Given the explosion of mobile telephony, this is probably the only MD that has been met, and well before 2015.

Curiously, the progressive disenchantment with ICT as a panacea for the world's development problems followed closely behind the bursting of the bubble in the equity markets and the failure of many of the new entrants in the ICT market. This cycle of hope and hype on the upside and disillusionment on the downside regarding the contribution of ICT to development continues to this day, influenced in part by real innovations in the ICT marketplace and by psychological factors often attuned to equity market conditions.

Nevertheless, many developing countries have taken the issue into their own hands and tried to establish links between human development and the strategic use of ICTs. Not only did the "Four Asian Tigers" (Hong Kong, Japan, South Korea and China) make extensive use of ICTs to get where they are today, but also countries such as India, Brazil and China use the new technologies in two ways. First, they are seen as a strategic economic sector for those countries on the path to becoming global players in technology, while also generating employment and fostering new enterprise development. Second, the countries may choose to promote ICTs to directly

[34] The UN Millennium Development Goals are listed in http://www.undp.org/mdg/basics.shtml

tackle critical socio-economic divides by establishing national policies and programmes that use ICTs as a catalyst for development, and not as an end in themselves. The results of this advance beyond the first set of digital divide initiatives remain to be seen.

## Governance and Empowerment

The rapid economic growth of several developing countries, including those mentioned above, brought back to the development arena the notion of good, or democratic, governance. This concept of governance evolved to cover not only public sector management of efficient services and an enabling environment for development, but also the promotion of human rights and fundamental freedoms. In this light, the interactions between the state and civil society became a cornerstone of the development paradigm where transparency, accountability and participation are key ingredients if human development is to take place and benefit all.

The rapid development of inexpensive personal computers and computer networks in the late 1980s has played a key role here. The Internet, unlike any previous ICT, allows for network interactivity where any user can reach or be reached by one or one billion other users, at a relatively low cost and on a global scale. The evolution of the Internet in general and of the Web in particular were accompanied by manifestos, declarations and much research linking it to article 19 of the Universal Declaration of Human Rights (freedom of expression), and the potential for stakeholders and citizens to have a louder voice in political and policy issues at both the international and national levels.

In regards to the former, the best example is without doubt the Internet Governance process which emerged circa 1997 and that is still vibrant today through entities such as ICANN and the Internet Governance Forum (IGF). At the national level, the potential for direct and deliberate democracy started to be considered, especially in industrialized countries. Developing countries, in contrast, still faced many obstacles related to access to the new ICTs and thus did not immediately see the benefits of what has been referred to as the "democratization" of the means of communication.

The new millennium contributed to change this situation thanks to two distinct, but related developments. First, the emergence of what has been called Web 2.0, characterized by the emergence of new applications that put user-generated content at the center of networks. As a primary example of the power of such applications, social networks have been credited with contributing significantly to recent changes in government in the Middle East.

Second, and perhaps more important, is the rapid diffusion of mobile communications technologies throughout the globe. It is the first time in history that an ICT can reach so many people in so many countries in such a short period of time. At present, the majority of cell devices in use are basic devices with variations of voice services and SMS capabilities. However, Web browsers such as Opera Mini[35] can work on some limited feature phones. Ultimately, the growth of the market in Internet-enabled smart phones has the potential to give voice to billions of people who never before have had a chance to be heard in the local or global arenas.

Today's users of the latest ICTs are empowered to be real participants in governance processes that can end up directly affecting their own lives. Governments should be aware of this and see it as an opportunity to better engage with people and build more inclusive and democratic societies together.

Nevertheless, it is essential to avoid technological determinism. ICTs will not always have positive effects. Local conditions and existing institutions and governance mechanisms will determine the final outcomes. These are the products of human history and human activities, and good outcomes are not automatically guaranteed.

[35] For a thorough and impartial description of Opera Mini's capabilities, see http://en.wikipedia.org/wiki/Opera_Mini

## An Information Society?

The idea of an information society goes back to the beginning of the computer age. In a seminal article published in the Atlantic Monthly in 1945, Vannevar Bush, then Director of the United States Office of Scientific Research and Development, proposed the idea of the Memex, a machine that would store vast amounts of information that would be linked together, and that could be read and used as many times as needed.[36] In essence, Bush foresaw in the context of the science of his day both the Internet and the World Wide Web.

In the 1960s UNESCO established a branch in Rome, the IBI (Intergovernmental Bureau for Informatics), and hosted major conferences on the use of informatics by developing countries.[37] During its lifetime, IBI's major focus was on the development of national government-formulated informatics plans. This focus and the top down approach were more appropriate at that time because of the nature of computers; they were large and expensive, and coordinated planning was believed to allow considerably more efficient use of scarce and expensive resources.

In 1999, a proposal was made by the ITU (International Telecommunications Union) for the United Nations System to hold a summit meeting on what they conceptualized as the Information Society. The Government of Tunisia offered to host such a summit meeting.

The suggestion in 1999 must have been prompted in part not only by the rapid rise of the Internet as a medium *par excellence* in distributing knowledge and information, but also by the immense increase in value of public companies which were racing to enter industries related to the Internet.

As a result of political negotiations, the summit, named the World Summit on the Information Society (WSIS) was split into two parts, the first in Geneva in 2003 and the second in Tunis in 2005.

The first summit produced two major documents, a Declaration of Principles and a Plan of Action.[38] These are normative documents, describing the characteristics that the desired information society should have. The summit also resulted in the creation of two Task Forces, one on Financial Mechanisms and the other on Internet Governance, both of which issued reports on the current state of each area.[39] The Working Group on Internet Governance took on the issue of the meaning of the term "Internet governance"; since there were a number of incompatible definitions ranging from very broad to very narrow.[40] The final definition that the Task Force arrived at was moderately good, but subject to broad interpretation:[41]

"Internet governance is the development and application by Governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet."

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[36] Vannevar Bush, "As We May Think," is located at http://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/3881/, retrieved September 11, 2011.

[37] http://en.wikipedia.org/wiki/Intergovernmental_Bureau_for_Informatics, retrieved September 11, 2011.

[38] The documents, in all official UN languages, can be found at: http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=1161%7C1160

[39] In December 2004 the Task Force on Financial Mechanisms issued a rather comprehensive report of the pace of investment in ICTs in developing countries, with submissions from various donors integrated into the report. It serves as a useful historical document, but with hardly any prescriptions for the future: http://www.itu.int/wsis/tffm/final-report.pdf

[40] The Task Force on Internet Governance was considerably more contentions. It consisted of 40 members, 20 of whom represented governments and the other 20 representing other sectors, and was led by Markus Kummer, an accomplished Swiss diplomat who was pressed into this service by the Secretary-General soon after the conclusion of WSIS-1.

[41] The Task Force produced both a summary report and an associated longer report. The proceedings of the WGIG, including links to the complete report in all official UN languages, can be found at: http://www.wgig.org/

The second summit in Tunisia focused mainly upon the creation of an action plan that would move the world closer to an information society. The Tunis Action Plan assigned specific recommendations by sector for implementation to several of the UN specialized agencies, and called for enhanced cooperation to move toward the defined goal.[42] It also provided increasing recognition to the roles played by the technical community, the private sector, and civil society.[43]

Tension over the issue of Internet governance, and hence potential control over certain of the Internet functions, was a major point of contention in Tunis. The ultimate political solution was to accept the *status quo*, but to continue the conversation about Internet governance in a forum, the Internet Governance Forum (IGF), that would serve as a vehicle for the exchange of ideas, but would have no decision making powers.

One of the remarkable characteristics of the summits, as well as the processes leading up to them, was the significantly increased involvement of multiple stakeholders in the information society. The notion of a multi-stakeholder process is a new notion in intergovernmental activities; it implies that all stakeholders in the future of the Internet should be involved in the planning and discussion of the issues. While there are issues regarding the real number, composition and distribution of stakeholders, and perhaps more important, determining who should speak for those stakeholder groups, this transition has been by and large successful and has changed processes that were previously governmental and intergovernmental into processes that have broad involvement from multiple sectors of society.

## Emergence of Internet Governance as an Issue

Internet governance is an important factor in the ability to use the Internet and the Web for development. The policy choices that are made by international organizations, by governments, and by the private sector all influence the effectiveness of the Internet for all users at a macroscopic level. The future of Internet governance is crucial for the effectiveness and degree of innovation of the future Internet.

Six years into the IGF process, the issues of the level of activity, accomplishment, recommendations and general output that should ultimately be provided by the IGF are still being debated. National issues are being separated from international issues, and the number of national and regional IGF meetings is increasing. Based upon the level of activity, Internet governance is now regarded as a major issue.

Finding a successful model of Internet governance is crucial, because the Internet currently enjoys a degree of freedom to explore and innovate that many feel would not be possible under traditional governance mechanisms. There is no other global infrastructure or service that shares its development, its reach, its decentralized roots and growth, and its lack of central organization. The challenge assumed by the WSIS, as well as the subject of discussions in the IGF, is to discover a set of principles for its governance that provide for international acceptance and yet provide sufficient degrees of freedom and autonomy to continue its evolution as an innovative and creative culture. Much of what the Internet is about crosses national boundaries invisibly, bringing into play highly probable collisions between laws and cultures of different nations.

Internet governance is a collection of many different issues, and there already exist organizations that concern themselves with most of these issue areas. One interesting way to display these issues is shown on the chart

[42] See http://www.itu.int/wsis/index.html for the documents resulting from the Tunis WSIS meeting.

[43] WSIS-2 in Tunisia displayed a number of tensions between the developed and the developing world, much of which centered upon the so-called control of the Internet by the U.S. government through, as some countries claimed, "its agent, ICANN". Internet governance was the most hotly debated topic in the political sessions.

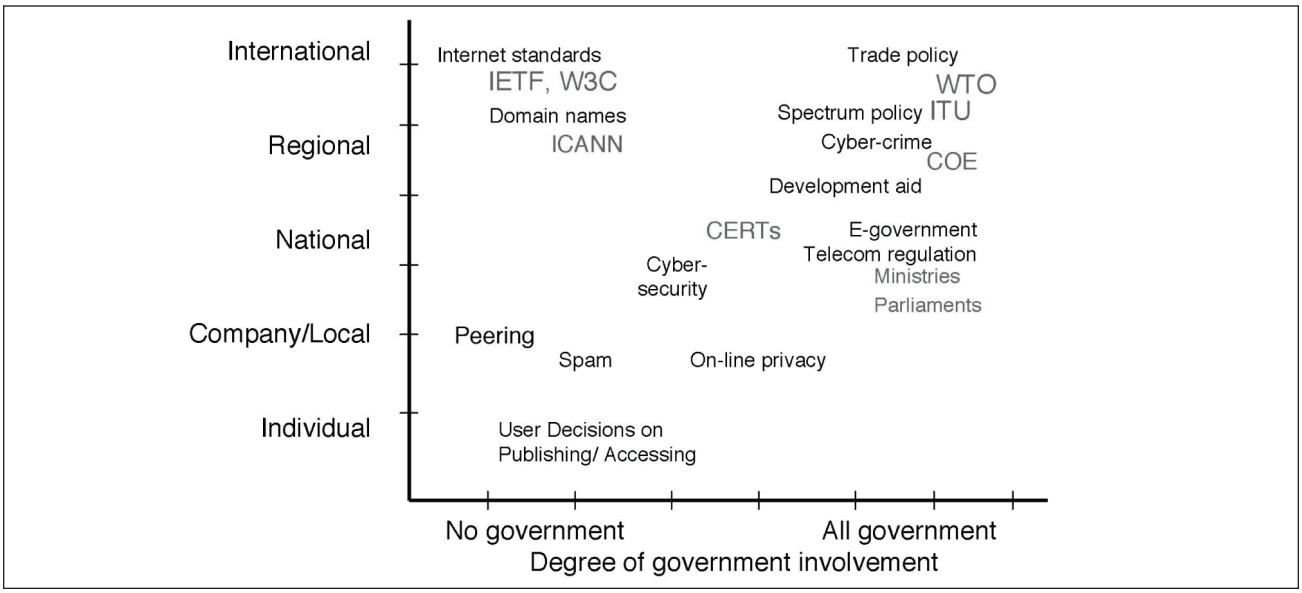
below.[44] Each issue is characterized according to the extent of government involvement that appears to be appropriate (the horizontal axis) and according to the extent to which the issue is local or international (the vertical axis).

Likewise, there is a significant number of organizations, international and national, some governmental and some private, that provide some aspect of governance of this space. The names of some of the major players are also contained in the chart, placed according to their governmental or non-governmental status and the jurisdictional scope of their interest.

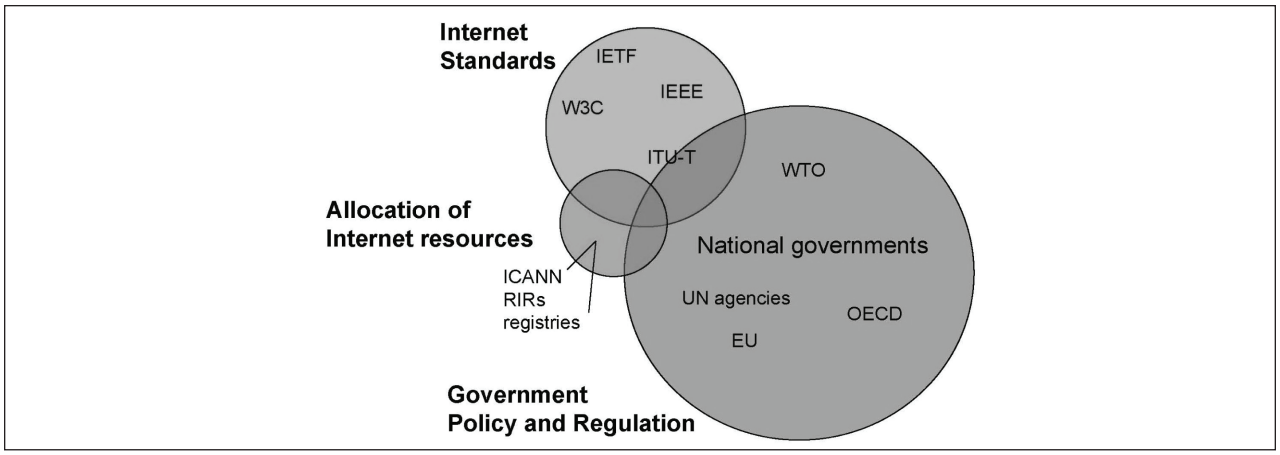
The area in which international initiatives in Internet governance, such as the WSIS and the IGF, could be of assistance is the upper right hand corner of the chart, i.e. those issues that are super-national and that require a significant involvement by governments. Issues appearing in the other quadrants of the chart appear to be best addressed either by individuals, by national and sub-national governmental bodies, and by private and professional organizations.

Another way to look at the space of government organizations that are involved in some aspects of Internet governance is to look at the scope of their responsibilities. A pictorial representation of such a view is provided below. A grouping of organizations by their general orientation suggests three groups:

- Organizations that concern themselves with establishing standards. The group includes intergovernmental organizations such as the ITU and the IOS, national standards offices, and professional organizations, both formal such as the IEEE and informal such as IETF.
- Organizations that concern themselves with the management of the core Internet resources required for the Internet to function. This includes ICANN, the regional Internet registries, and the global and national domain registries. Domain registries can be private businesses, not-for-profit organizations, or offices within national governments.
- Organizations that concern themselves with policy and regulation. This group includes agencies of the United Nations, national governments and regional governments such as the EU, and non-UN international organizations such as the OECD.




[44] The two charts below are provided courtesy of Dr. Michael R. Nelson of Georgetown University.




Each of these groups has specific responsibilities and obligations. In addition, there are issues that fall into the overlap of two or more of these areas.

Discussions of Internet governance address a complex space. Discussions at the international level, such as those that have taken place at WSIS and the IGF, have tended to assume that many if not most of the issues can be mitigated or solved at the international level. This is not the case. Any meaningful approach to Internet governance issues must first take into account the nature of the various components of the issue and come to an appropriate understanding of the level and the jurisdiction in which it is capable of being solved. Many if not most of the problems occur at the national and sub-national level, and can only be meaningfully addressed in a decentralized way at those levels. International discussions can identify these issues, and they can prescribe best practices and solutions, but they are not able to implement those practices or solutions.

## Policy and Governance Issues with Regard to Effective Use of the Internet

Policies that enhance the growth of the Internet and empower individuals to exploit it are important. They include training of technical professionals, technical and policy workshops designed to increase human capacity in Internet and related technologies, ease of Internet Service Provider (ISP) formation, growth, and related entrepreneurial activity. Foreign investment in the science, technology and Internet sectors in a country provide a link to capital and knowledge. NGO activities in the country often enhance access to the Internet and information resources. Appropriately targeted bilateral and multilateral assistance programs can speed development.

Some policies at the national level disadvantage users with regard to exploiting the resources available on the Internet. They include high prices for Internet connectivity and use, a lack of competition in the telecom market, high barriers to entry for ISPs such as strict licensing or high fees, a monopoly on the national Internet gateway, discouragement or prohibition of national or sub-national IXPs (Internet Exchange Points), high prices for computers and networking equipment relative to neighboring countries in similar circumstances, prohibitive import duties, slow, inefficient or corrupt customs clearance procedures, high local taxes, and restrictions on competition with existing networks.

Policies can also result in impediments unrelated to price. They include mandating ISP liability solely for transport of illegal content, non-transparent or arbitrary e-commerce legislation, unpredictable licensing requirements, lack of protection for information confidentiality or privacy, insecure e-business transactions, information services that are subject to content restrictions or censorship, prohibition of security tools such as encryption, unpublished laws or regulations, lack of respect for intellectual property, and lack of formalization of digital contracts and transactions in law.

Each of the above situations suggests a possible impediment that retards or blocks users from accessing affordable Internet and Web services. Experience indicates that each of the above impediments exists to some degree in some countries, and that there are at present a significant number of countries in which groups of these impediments combine to significantly block access to the Internet. Every one of these impediments occurs at the national level, and can also be removed at the national level.

Just as the Internet can promote good democratic governance, good governance of the Internet can assist growth and development. Internet technology has the capacity to contribute to economic and social development around the world like no other recent technology. The structure of the Internet, with innovation occurring all over its edges, has generated an enormous variety of information and services potentially accessible to almost everyone in the world — to the extent that they can access and afford it. In general, the private sector is the driving factor to make this happen, and national governments can amplify their efforts by adopting progressive and enabling national policies.

## Chapter Descriptions

The remaining chapters of this book treat the subjects discussed in this chapter and others in more detail, and are written by experts in each of the subject areas. The goal is to help the reader understand each subject, including the current situation and its problems, to understand the actors in that space and what they are doing, and to provide an assessment of how current and future resources could be used to maximize the return on those resources in the context of assisting social and economic development.

*Chapter 2* focuses upon access to the Internet. Without effective access, issues of interface and content are not meaningful. While almost all countries are connected to the Internet, the situation within countries is quite different, as not all countries have yet extended Internet access to the majority of their inhabitants.

*Chapters 3 and 4* focus on interfaces, i.e. the methods by which we interface with ICT-based services. ICTs have progressed substantially from their historic dependence of punch cards and command line interfaces. The use of pointing devices and finger and hand motions has eased the difficulty in learning how to exploit ICT devices by those previously disadvantaged and vulnerable, in addition to ameliorating difficulties faced by people with disabilities or illiteracy. Increasing attention is being given to legal and policy initiatives to assist individuals with disabilities to use ICTs effectively.

*Chapters 5 through 10* address specific uses of ICTs to assist progress in specific substantive core areas. For each area, the current status is described, as well as the impediments to progress and any current work done to break through those impediments. Gaps in knowledge are identified, and future prospects and promising areas of future work are noted. The areas chosen for examination, agriculture and rural development, banking and finance, education, commerce and trade, health, and governance, are core areas in which we believe that appropriate ICT-based assistance has a significant effect. We have reluctantly omitted consideration of some other areas, since being really inclusive with regard to the use of ICTs for assisting poor and marginalized populations would require detailed coverage and analysis well beyond the scope of this work...

While our overall focus is on the Web, the discussions of the impact of ICTs upon these areas of activity are based upon concrete needs rather than upon the application of specific technologies. The emergence of ICTs offers a range of tools for addressing problems, but the choice of tools is largely governed by the specific knowledge of individuals and organizations grappling with actual problems. Their observations in these chapters serve to provide a set of challenges for ICT practitioners who are versed in a variety of technologies.

*Chapter 11* focuses on the role of gender in leveraging human resources in developing economies. Women have often been discriminated against historically in terms of investment in human capital and of leveraging their skills to make contributions to development. *Chapter 12* surveys the critical issues of linguistic capability and content on the Web and on the Internet generally. Initially, users of the Web who did not understand English were explicitly vulnerable. Since then, a great deal of content in other languages has come into existence on the Web, with the promise of creating Web environments that are completely localized with respect to language and script.

*Chapter 13* deals with the social and cultural effects of ICTs as an invasive force in the culture of communities and developing countries. Adoption of new forms of communication enabled by ICTs has been a revolutionary development, and has led in some countries to rapid coalescing of political forces that have recently been a significant element in toppling a number of governments. These are powerful forces, and their potential for the developing world needs to be understood.

The enthusiasm expressed by the author of this chapter, a West African inhabitant, appears to mirror the enthusiasm felt in the developed world in the 1990s when the power of the Internet was beginning to be realized. The chapter stresses newfound capabilities capable of being delivered through the new technology that are real and powerful. However, it pays little attention what may be lost in terms of traditional culture as a result. Perhaps this reflects the environment of revolution, and if so, in the future there will probably be an assessment of what may have been lost, possibly irretrievably, by the introduction of the disruptive and seductive technologies discussed here.

*Chapter 14* contains some conclusions and implications for the future that may be helpful in focusing upon the current state of ICTs in development. It also reflects upon some of the fundamental changes that are occurring with respect to the use of ICT for development and for assisting poor and marginalized populations and their potential effect on the process.

# CHAPTER 2

# Fundamental Access Issues

*Michael Jensen*

## Introduction

### Responding to the Broadband Imperative

Only a decade ago, at the turn of the millenium, access to the Internet was a relatively simple matter, either you had it or you didn't. Perhaps it was just available at a cybercafe or a library, or on a family member's or a friend's computer, but in any case, if you had an email address, you were part of the Information Society. Today, benchmarks have advanced dramatically, and gained much more in diversity and complexity. Residential Internet speeds now routinely range from 56Kbps (for many who are still unlucky enough to be stuck with dial-up or basic rate mobile access), to 1 Gbps in some of the leading economies such as Hong Kong. Aside from this speed variation of 4 orders of magnitude, "Internet access" now has many other elements, such as download volume limits, bundling of broadband with voice and TV services, mobile versus fixed access, contract durations, local versus international traffic and network latency.

With the dynamism in the market as fixed and mobile voice and pay-TV operators converge, and ever faster and cheaper technologies emerge, the impact of all these factors is not yet well understood, even by the leading fixed and mobile operators struggling to amortize their investments in ever more rapidly ageing equipment. Perhaps the only certainties in this new environment are the exploding bandwidth requirements of the end-user (often called the YouTube effect), and the ever increasing capacity of optic fiber cables to deliver it, initially over the national and international backbones, but increasingly at the metropolitan level and to the end-user.

Simultaneously over the last ten years, Internet access has come to be seen as a basic human right, a key enabler for economic and social development, and expected to be guaranteed by the state. Driven by this 'broadband imperative', developed and developing countries alike have begun, or are envisaging, national strategies to ensure that all members of society have affordable access to broadband. However there is no common consensus on the best means of achieving this, nor what the targets for coverage, quality of service and affordability should be. These issues assume even greater significance in disadvantaged populations, where unmet demand for Internet is much higher, and the opportunities to use information technology to accelerate development are perhaps greater.

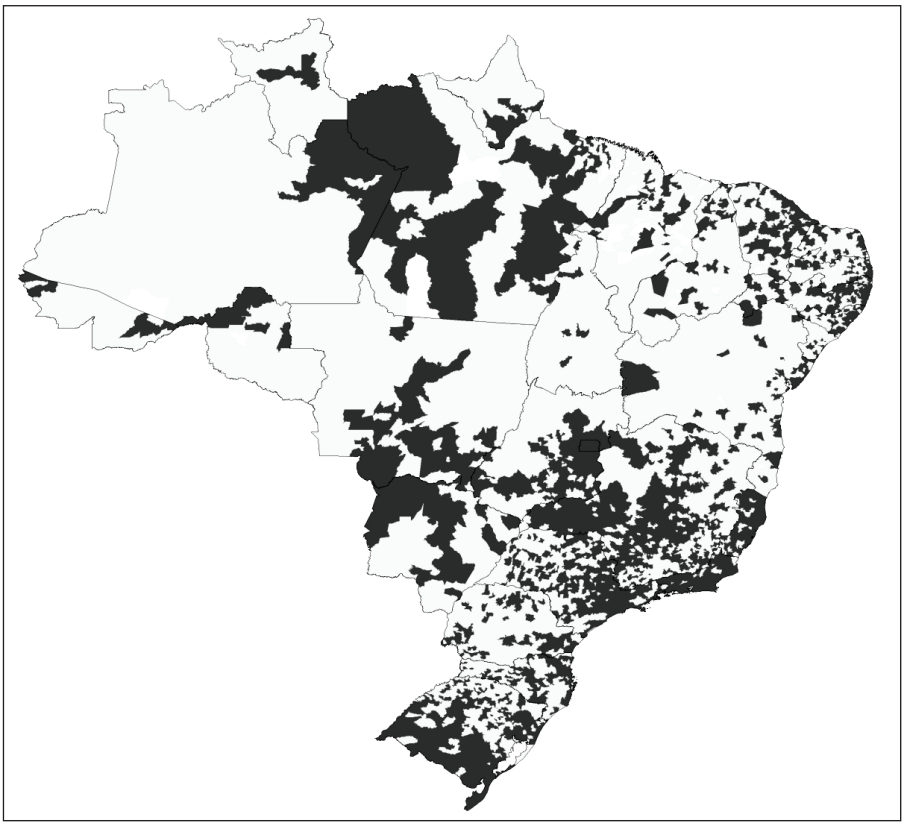
This chapter describes how Internet access is evolving, covering the major constraints affecting access levels today and the measures that can be taken to ameliorate them, using a 'broadband evolution conceptual framework' to contextualize the factors and identify needs and roles.

## The Evolving Broadband Ecosystem – A Conceptual Framework for Maximizing Internet Access

There are many parallels between the development of Internet infrastructure and the organic growth of living organisms. Adopting a biological metaphor – the evolving ecosystem – terrestrial Internet access generally grows outwards out from the largest and most dense population centres, where speeds are highest and prices lowest, reaching the next largest and closest surrounding communities first and those who are lucky enough to reside along the way in the rural areas in between the population centres.

As prices drop further, economies of scale increase and investment in the network begins to pay for itself, the tendrils of the Internet gradually reach smaller and more remote communities. Initially this is a relatively patchy pattern of distribution, as illustrated in the map of Brazil's 3G mobile coverage below.

Figure 1: Mobile coverage in Brazil 2010



Municipalities in Brazil with 2G and 3G, October 2011
*Source: http://www.teletime.com.br*

The factors and dynamics that allow the network to penetrate to the remaining areas are many, and it remains to be seen how long it will take to reach the most disadvantaged and isolated at an affordable price. Trends suggest that we may be approaching a 'climax' (steady-state) in the most highly evolved broadband pockets around the world, where most people have ***permanent and affordable*** connections to high-speed broadband. Permanence implies high-reliability, which means two physically independent connections are required. In the developed world this would most likely be provided by a DSL or cable-TV service, complemented by a mobile service. This allows for connectivity while on the move and ensuring permanence of connectivity at home or the office during inevitable service disruptions. In the developing world a mobile broadband connection is more likely to be complemented by a fixed wireless solution, at least in the short-to-medium term.

In developed economies, high-speed broadband is not a big cost burden on the average person, but as we move down the income levels, affordability continues to be an issue, not only in developing countries – even in the US, cost is still a significant barrier for some. Nevertheless, ideally everyone on the planet will be able to afford permanent Internet access by the end of this decade; however the routes and speed of getting there will vary considerably, depending on the local context. Institutional delivery models will range from the private to the public sector, and various mixes in between, while technologies will range from 19th century copper, to 21st century mesh wireless, and from TV sets to smart phones or netbooks and e-readers.

To tie all these different elements together, the 'broadband ecosystem' framework is based on a conceptual model in which the Internet is still rapidly evolving in terms of coverage, technologies used and quality of service (speed/latency etc), growing outward from the core, especially along the fiber optic spines which extend toward the periphery, where customers are less densely distributed and generally have lower incomes.

Ideally there is balanced organic growth in supply and demand − ever faster links extending further downstream toward the user, matching the growth in density of end-use as costs decline, coverage extends, and local applications become more widely available or more bandwidth intensive. On the edges of the network, demand is fuelled by a spectrum of connectivity needs, ranging from the exchange of a few Kilobytes of instant messages, to high definition video downloads and real-time 3D visualization that can consume Gigabytes in a matter of hours if not minutes.

Balanced growth in both supply and demand is not always achieved, given that networks take years to plan and pay back investment, while technology developments and bandwidth demands can easily out-pace this timeframe. Thus we have seen the boom and bust in backbone capacity markets when the dot-com bubble burst earlier this century, and now more recently, network congestion created by the rapid growth in smart phones, netbooks, tablet computers and ebooks. Hopefully these oscillations in supply and demand will stabilize as the technologies mature and coverage becomes more universal, however until then, it is likely to be somewhat of a rocky ride, especially in the less developed regions where the distance to be covered to achieve the objective is much greater.

In summary, within the evolving broadband ecosystem, the three main elements that affect the availability of Internet access for disadvantaged communities can be outlined as below:

- Availability of local and global applications and content – principally: telephony and video conferencing, instant messaging and email, social networks, payment systems, educational resources, virtual private networks (VPNs), content hosting and search services. While applications and content are not directly access issues, their availability in local languages directly affects demand for access. And with the move to packet-based networking, telephony can also be seen to be just another application. Perhaps more importantly for disadvantaged groups, in this category are gateways between mobile and fixed voice network services and the Internet – principally VoIP gateways[1] and SMS-Internet gateways, which reduce the cost of telephony, improve end-user reachability and give access to information services from devices that are not Internet enabled.

- Availability of access devices – the emergence of the mobile phone, and in particular the low-cost smartphone, has gained the most attention in meeting the needs of disadvantaged groups for Internet access, to which we are now seeing the melding of the laptop into the tablet computer and the ebook reader. Devices to convert television sets into Internet access devices are also becoming more widely used, as are low-cost desktop PCs and thin clients. When combined with IPTV and voice telephony in 'triple-play' service offerings, the overall cost of access equipment is even further reduced. In addition, taxes and affordable

[1] Skype in/out, SIP gateways, Inbound Direct Dial numbers (IDDs) etc.

consumer credit, including bundling of laptops as part of the broadband service, have further reduced the cost of entry for low-income groups, to the point where the cost of the device is no longer a major part of the cost barrier to Internet access[2].

- Availability of bandwidth/connectivity – this is where most civil society effort and public resources are being applied to address disparities in access levels, mainly because, as mentioned above, this is the largest cost element for low-income users, or in terms of coverage is the element that is the least under some control by the end-user (for example even a wealthy farmer in rural Europe may still have difficulty obtaining access to broadband).

There are a large number of other elements that can be considered part of the broadband ecosystem. Among the most important of these are radio spectrum and energy supply (electricity).

With the growth in use of wireless technologies, radio spectrum has become a particularly vital part of the broadband ecosystem. Disadvantaged communities are especially vulnerable to poorly managed spectrum because they are less likely to have any fixed line alternatives. But although there is also more spectrum available in disadvantaged communities because there are much fewer existing spectrum users, this has not translated into better spectrum access. Lack of awareness by national policy makers of the need for low cost spectrum for wireless operators is a key factor, along with lack of capacity to update spectrum plans as new technologies emerge, as well as resource constraints in spectrum regulation enforcement. Probably the most severe of these problems is linked to the slow move from analogue to digital TV in developing regions, delaying the availability of the important 700-800MHz[3] wavebands , which are particularly suitable for high-speed wireless broadband services. Allocation of the 2.6 GHz waveband is important for broadband in urban areas is also subject to allocation delays in many countries.

The high cost of spectrum licenses is also a major problem, constraining the deployment of wireless broadband services, and increasing end-user costs. High spectrum prices are also linked to the continued dominance of the mobile operators in the broadband market. Having paid millions of dollars to the state for these licenses, the mobile operators are able to convince governments to limit the entry of other new fixed or mobile wireless players in the market. Many have claimed that the license fees were only paid on the basis of a limited number of market players and that the market size is insufficient to support more operators.

Energy dynamics are becoming increasingly linked with Internet connectivity at many different levels. The impact of energy supply and energy costs on Internet access is a well-recognized issue for disadvantaged communities, most of which suffer from high energy prices and lack of, or unreliable and/or poor quality grid power. This even includes capital cities and other major urban areas in many developing countries.

These energy constraints not only affect end-users needing to provide power to their access devices and run them reliably, but they also have a deep impact on operator costs to deploy and maintain their networks. One of the reasons why mobile access charges are higher in many developing countries is the need to install generators for base stations, and to operate an entire supply chain to replenish them with diesel, often over difficult and remote terrain. Even when power is there but is unreliable, operators have much higher capital costs for network deployment just to install backup power facilities which may be only infrequently used. The stronger radio signals used in 3G and LTE services require more power than 2G services, so upgrading mobile networks for high-speed Internet will usually require additional power facilities and increased on-going power consump-

[2] As an indication from the mobile market, Nokia's most recent Total Cost of Ownership assessment for low-income mobile phone users estimates that the cost of the phone itself only represents about 7% of the cost.
[3] Often called the 'Digital Dividend'.

tion costs. Fortunately, renewable energy options for powering network operator and end-user equipment are beginning to see greater use, most especially where countries have adopted Independent Power Producer Policies (IPPPs) which allow the cost of renewable power generation facilities to be defrayed by selling any excess power generated back to the grid.

The power consumption of access devices and the battery life of mobile devices is another aspect of the energy/access dynamic. Technology evolution is seeing major reductions in the power requirements of network and access equipment, which makes renewable energy installations for disadvantaged communities less costly, as well as improving the utility of mobile devices. Combined with improvements in battery life, this is substantially increasing the length of time mobile access devices are in use, especially in off-grid locations. As this trend continues it will increase the bandwidth load on networks, especially in the more remote areas, where there is a lack of grid power and where older networks have been dimensioned for more infrequent use.

New models for supplying energy in disadvantaged communities are also emerging. In many developing countries, energy kiosks are now available where people pay to have their phones recharged with an adapted car battery or solar panel.

At a very different level, energy distribution grids (high tension pylons, local electricity distribution poles, and oil/gas pipelines) are a vital resource for minimizing the cost of backbone optic fiber deployment. Up to 80% of the cost of laying fiber lies in the civil works – the trenching, ducting, permitting and obtaining the rights-of-way. These costs are avoided by using the energy grids, thereby making it much more economic to deploy fiber. In addition, many electricity distribution grids already have fiber installed on them (to control power distribution sub-stations) and can provide excess fiber pairs at very little cost. Unfortunately, the level of awareness of the potential of this 'alternative infrastructure' is low in most developing countries and where it exists, the energy operator often does not understand the market dynamics for telecom capacity and wishes to charge excessive amounts for access. For example, in Brazil, the average cost to use electricity poles is about $10/pole, while in the US it is about $1/pole.

Electricity grids can also deliver high-speed Internet directly to the end-user, by using a technology known as Broadband over Power Line (BPL) or Powerline Communications (PLC). So far relatively few deployments have been made, mainly because of problems with radio interference, and also because providing broadband services is outside the core-business of the energy suppliers. But considering that electricity grids are often more widespread than fixed lines in disadvantaged areas, there is still considerable interest in the technology.

The widespread availability of low latency high-speed fiber links has combined with increased concerns over operating costs and climate change/carbon footprint,[4] creating new dynamics around the need for, and location of, data centres. Large organizations are seeing that it is more energy efficient and cost effective to house their data in the cloud, and data centres are proliferating rapidly to meet this need. Data centres need lots of cheap and reliable power, ideally generated from a renewable resource. While developing countries and disadvantaged communities may have access to the latter, they rarely have access to the former. This creates both a challenge and an opportunity, the responses to which will deeply affect the topology of their network access, and opportunities to generate revenue from cloud services.

Within the context of this book's objective to shed light on issues for disadvantaged communities, the following are probably the most important of the many other institutions and dynamics in the broadband ecosystem:

- **National governments.** The trend in the 1980s, 1990s and 2000s was for governments to withdraw from the communications sector, privatizing the state owned operators, and leaving competi-

[4] In the USA ICTs are now responsible for almost 10% of total energy consumption.

tive pressure to develop the market. However, we are now seeing many governments take on an increased role, establishing 'National Broadband Plans'[5] and even re-entering the market as a state provider to compete with the private sector, for example in Australia and Brazil where it is felt that the commercial providers have not performed adequately in bringing broadband to the masses.

Traditionally, the main role of government is in setting policy and regulating the sector, in particular to encourage adequate competition and to ensure a level playing field with the incumbent operators. In developing countries, and even in developed countries, this has not always been entirely successful. Another known role of government in this context is in helping to ensure 'digital inclusion' by finding resources for connecting disadvantaged communities. A variety of means to do this have been tried, most notably state support for backbone networks, license conditions which require the operator to cover under-serviced areas, and Universal Service Funds. The latter take a small proportion of operator profits and apply them to projects to connect the remote areas. So far these funds have not been particularly successful, often because there is little consensus about how best to use money, and also because regulators often do not have the capacity to evaluate or ensure implementation of the proposed projects.

State fiscal strategy can have a strong influence on the broadband ecosystem. Governments in developing countries, which usually have poor tax-bases due to the prevalence of the informal economy (and generally low levels of wealth), have tended to see connectivity providers as easy targets for tax collection. As a result some countries have even imposed special additional taxes on the sector. However this is increasingly being seen as short-sighted, and making tax exemptions for the ICT sector is now gaining credence as a better long-term approach.[6] This extends to dropping import duties on ICT products, often combined with tax incentives for local manufacture (for example Brazil has taken this strategy).

Finally, governments can stimulate demand for access, as one of the biggest customers for connectivity, and by investing in applications development for e-government and open-data provisioning.

- **Incumbent operators.** Traditionally these are the formerly state-owned national fixed-line monopolies, which are now privatized in almost all developed countries and in many developing countries. With some exceptions, they are seen as the dinosaurs of the broadband ecosystem, especially in developing countries, where they are usually still focussed on selling voice minutes, especially where they have managed to maintain their monopolies on the international gateways. Or they may be trying to exploit their hold over the nation's backbone infrastructure with monopoly prices, (but poor service levels), especially for the mobile operators, which were never expected to grow so fast or so large. The privatization of incumbents has often taken place before market liberalization, and in developing countries they are most likely to be sold to a foreign multinational telecom operator (at a relatively high price considering the poor state of most of these operators, usually in exchange for at least a decade of continued exclusivity). The outcome of this has been to swap a state monopoly for a private monopoly, now backed

[5] Even the more advanced economies have established regional or national broadband development programmes based on public and private sector funding, these initiatives include:
European Union (27 Countries) – "Digital Agenda for Europe 2020 Strategy", South Korea – National 1Gbps network for end-users by 2012, Japan – "eJapan Priority Policy", Singapore – "Next Generation National Broadband Network", Australia – "National Broadband Network" New Zealand – "Ultra Fast Broadband Initiative", USA – "National Broadband Plan", Canada: - CRTC National Broadband Policy, Brazil: – "Plano National de Banda Larga", Argentina – "Argentina Conectada".

[6] In an admittedly self-interested study, the Global Mobile Service Association (GSMA) found that for every dollar reduced in mobile phone related taxes, emerging markets will generate additional GDP ranging between US $1.4 and US $12.6, and the foregone tax revenues will be partially or totally compensated by taxes collected on a larger GDP.

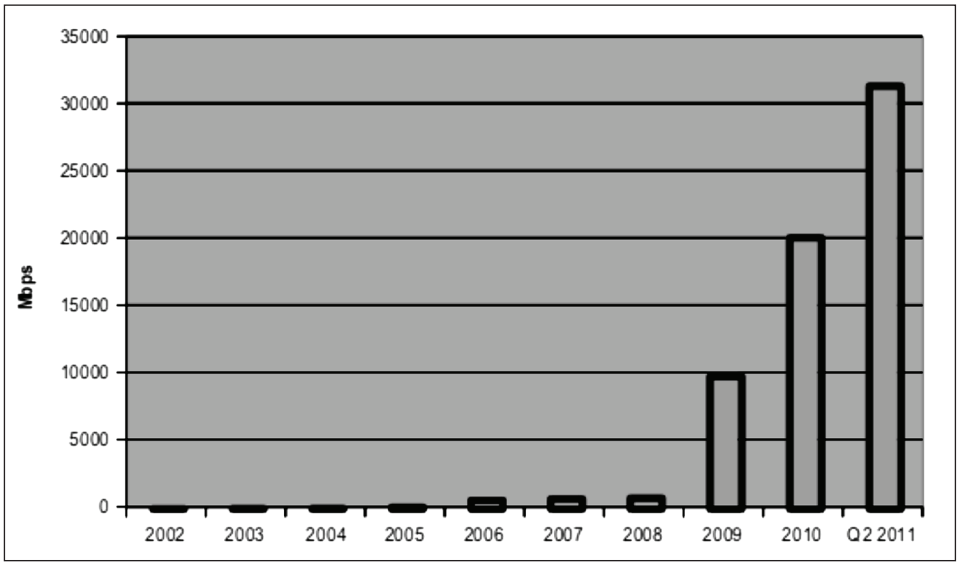
with considerable foreign resources to resist any further efforts to introduce competition. Or they may be able to exploit the conflict of interest of governments which may still be major shareholders, earning significant revenue streams for state coffers. And with the limited human resources that characterize the ICT sector in disadvantaged regions, the staff of policy making bodies and national regulators are often drawn from the incumbent operator. More generally, many policy makers and regulators lack sufficient human capacity and financial resources to establish Significant Market Power (SMP) and wholesale/retail price determinations on the incumbents, or even to enforce acceptable levels of interconnection with other players.

- **Mobile operators.** As the 'new incumbents' the mobile operators have by now made about 20 years of investment in their industry, much of it in business models, technology and other infrastructure that is relatively old (considering the velocity of evolution in the ICT sector). Often the largest businesses in the country, the mobile operators are able to use their considerable resources and market position to protect their franchise. This can be seen in their resistance to pro-competition regulations such as number portability or the opening of spectrum licenses to new players, and in the advertising expenditure or sponsorship funds provided to maintain their public profile. Another aspect of this dynamic can be seen in their purchase of other broadband operators using different technologies and in the industry consolidation currently taking place between mobile and fixed operators. Most often majority foreign owned, the mobile operators are also an example of the role of multinational capital in seeking quick returns from poorer nations, often reinforced in ex-colonial ownership patterns, such as Orange/France Telecom with the previous French colonies, and Cable & Wireless with some of the English speaking ones.

- **Market consolidation.** The consolidation of fixed, mobile and cable-TV providers in single integrated companies offering triple-play and quad-play services is becoming a world trend, improving operator profitability with economies of scale, streamlined management and better optimization of investments. Demand for broadband is also an accelerator of this process in the mobile sector - with 3/4G mobile broadband, the only way to scale services sufficiently is to use fiber in the backhaul transmission to connect their cell sites.

- **International capacity.** Low cost international capacity is probably one of the key 'tipping points' for improved Internet access in developing countries and disadvantaged communities. For these groups in particular, there is relatively little national content and applications to stimulate demand, but everyone wants access to international sites such as Wikipedia, YouTube, Twitter or Facebook (except perhaps for some

Figure 2: Growth in International capacity used in Kenya




*Source data: CCK http://www.cck.go.ke*

small low-income countries with unique language groups). In Kenya, fixed and mobile broadband services exploded following the arrival of plentiful and cheap international bandwidth from competing submarine cables. To highlight this, the chart below shows use of international capacity in Kenya between 2002 and mid-2011, showing the massive growth when the submarine cables began to arrive in Kenya in mid-2009. By the time the 2012 figures are in, the 2008 bar will probably be all but invisible (note the 2011 value of just over 30Gbps is after only the first 6 months of the year).

- **National backbone infrastructure.** With broadband being rapidly deployed in the local loop using wireless technologies, increasing attention is being paid to the backbone infrastructure needed to interconnect cities, and especially wireless base stations. In the past this has usually been deficient in developing countries, and based on microwave technology only suitable for voice traffic. But these days national fiber backbones are being built at an unprecedented rate, often with state funding combined with soft funding from the World Bank, the European Investment Bank, the Islamic Development Bank or China Exim Bank.

  As a result most developing regions now have, or will shortly have, access to sufficient capacity, although not necessarily at competitive prices.[7] National fiber backbones are still usually owned by the incumbent operators and there has been little shared backbone infrastructure deployed, making it necessary for competing operators to build their own backbones, wasting resources and keeping costs high. Or, as mentioned above, in some cases the fiber infrastructure of the complementary infrastructure operators (transport/energy) is not reasonably priced or simply unavailable to private operators. In other cases, the fiber may be too old to share using the latest DWDM optic fiber transmission protocols. Or frequent cuts due to vandalism, theft or poor co-ordination of civil works, may have reduced the signal strength to unusable levels. Finally, lack of planning regulations that require all new complementary infrastructure (particularly roads and rail, but also buildings) to have ducts or conduit for fiber, means that there are fewer opportunities for operators to cut the cost of deploying their own fibers – as noted above, up to 80% of the cost of fiber deployment is in the civil works, not to mention the delays created in obtaining new rights of way. Also, it is a common misconception created by the huge capacity of a single fiber, that operators can all share the same fibers. Business practice today is that the major operators need to control and light their own fiber pairs, as this also makes it essential to plan properly for the provision of adequately sized ducting and sufficient power and cooling facilities.

- **Internet Exchange Points.** Usually called IXPs or Network Access Points (NAPs), these are a key part of the broadband ecosystem. Necessary for reducing the costs of transit traffic and ensuring low latency between different networks, they also minimize the flow of data that would otherwise travel outside the country or region to interconnect, which would require payment to foreign operators and result in slower network speeds. So far there are about 350 IXPs worldwide and although most developed countries have at least one IXP, only a minority of developing countries has them. Where they do exist in developing regions, membership has often not reached a critical mass to make them self-sustaining. In addition, few have the other facilities to minimize international traffic, such as caching servers, mirror servers and Content Distribution Network (CDN) services such as the Google Cache or Akamai. As a result, the lack of IXPs and poorly functioning existing IXPs means that millions of dollars annual-

[7] In Africa, the lack of nationally competitive infrastructure compared to the extent of supply and competition in submarine cables, is demonstrated by the fact that capacity from an African submarine landing station to Europe or North America is usually cheaper than the in-country national backbone capacity. This is the case currently in many countries which have competing submarine cables, such as Nigeria, South Africa and Kenya, where it may only cost $100-$300/Mbps/month to get from the coast to London, while it costs $500-$2000/Mbps/month to get to the coast from inland. This trend is accentuated considerably for landlocked countries, which have to pay terrestrial transit across two or more countries to get to the coast.

ly are paid to foreign Internet transit providers for traffic which could stay local and exhibit much better network performance at far lower cost. It has also been found that IXPs with multiple carrier connections create a more intensely competitive environment for capacity, helping drive down the cost of network traffic, as providers can so easily switch from one carrier to another depending on price/performance offered - a simple configuration change in the router is usually all that may be required.

Most IXPs are operated by national associations of Internet Service Providers (ISPs) except in North America where they are usually commercially run. Governments sometimes play a role in providing a neutral facility to host the IXP, but generally, the IXPs that have emerged have not benefited from any specific involvement by government. There are many reasons for the slow pace of IXP development, most of them non-technical reasons relating to capacity building needs, level of trust between competing providers and the ICT policy environment. The high cost of national capacity in particular, often makes it cheaper to exchange traffic at a foreign exchange point.

- **WiFi.** Spread spectrum WiFi has generally been used for Internet access 'hotspots' in public locations and for redistributing broadband connections in households and offices. However, self-organizing 'mesh networks'[8] using low-cost mass produced WiFi routers are now available which can share their broadband link with their neighbors for upstream connectivity and redundant. This allows small entrepreneurs and enthusiasts to easily build their own local networks, providing free local calls and a way to share the cost of Internet links. These networks are especially suitable for providing Internet access in low-income or informal housing areas, for disaster relief and in areas where there is little technical expertise. WiFi is also seeing growing demand from mobile/3G users, especially among low-income groups, who often pay metered access to the Internet (per KiloByte), except perhaps for some sites such as FaceBook, which may be bundled for free[9] with the operator's service.

- **Population density and level of remoteness.** Although not directly related to each other, both of these factors have an impact on the cost of deployment of Internet access – other factors being equally, densely populated urban areas are the least costly to connect, while at the other end of the scale, remote sparsely populated communities are the most costly to reach. Even in developed countries, the very low population density levels in rural areas has created difficulties in supplying adequate broadband services. Fortunately rural population densities are often much higher in developing countries, and as a result Internet services can be sustainably deployed. However the communities in scattered small island nations are particularly vulnerable to being sidelined in the broadband ecosystem. Although there are promises of 'near fiber' capabilities from new satellite systems such as the medium-earth-orbit (MEO) network being funded by Google and HSBC called 03B (the Other 3 Billion), there are still significant performance constraints[10] when compared to fiber, and pricing is likely to be an order of magnitude higher. As a result small islands in the middle of the ocean, such as Principe (the other half of Sao Tome, but with only 5,000 people), St. Helena, and many of the Pacific Islands, are going to have inadequate Internet access until additional resources can be found to connect them by fiber to the global backbones.

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[8] Originally adopted and further developed by the online gaming community to minimize the latency introduced by connecting to their upstream Internet providers, mesh networking protocols are now relatively mature. See for example, 4000 node Freifunk network in Berlin, and the Village Telco Initiative (http://www.villagetelco.org)

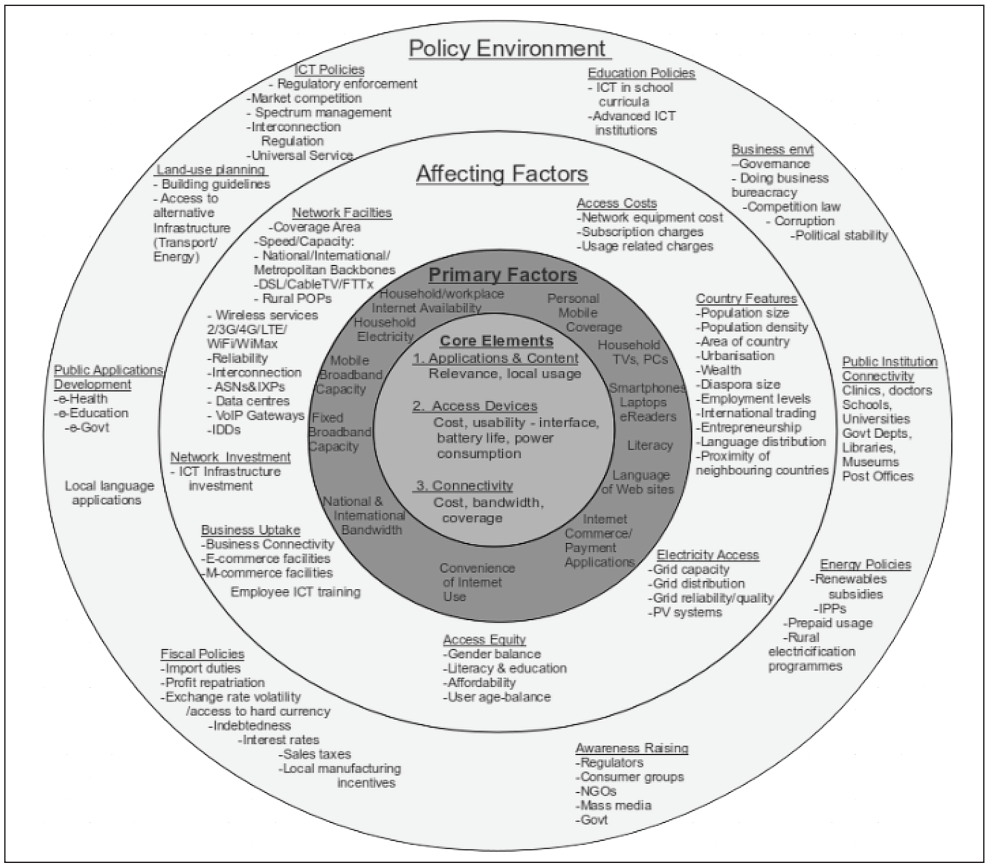
[9] The provision of un-metered Facebook access by some mobile network partially explains why there are relatively high numbers of Facebook users in some developing countries; however the subscribers may use few other online applications due to their high cost.

[10] O3b will have a latency of just less than 200ms compared to 30-120ms on fiber and 600ms on geostationary satellite http://www.itu.int/ITU-D/asp/CMS/Events/2009/PacMinForum/doc/Theme-2_O3b_Latency_White_Paper.pdf

- **Local Content and Applications.** Although not directly an access issue, the lack of relevant content and applications, especially in local languages, often limits demand for Internet access in many disadvantaged communities. By the same token, the lack of broadly available Internet access limits the incentive to produce relevant local content. Creation of e-Government applications (even before there is widespread access) and policies to provide incentives for private local content development are important in helping to break this 'vicious cycle'.

There are many other elements to the broadband ecosystem and to identify and contextualize them for this chapter, the chart below groups them in a hierarchy of influence, with the national policy environment as the underlying basis.

Figure 3: The Broadband Ecosystem




*Source: Jensen*

In summary, the most important factor groups that affect Internet access levels in disadvantaged areas are:

- National ICT market dynamics – mainly influenced by policies on competition, access to alternative infrastructure, and availability & cost of radio spectrum
- Cost and usability of access devices (computers and handhelds – affected by technology trends, taxes and affordable consumer credit, including bundling of laptops as part of the broadband service)
- Availability of reliable low-cost electric energy to power networks and access devices, especially in rural areas

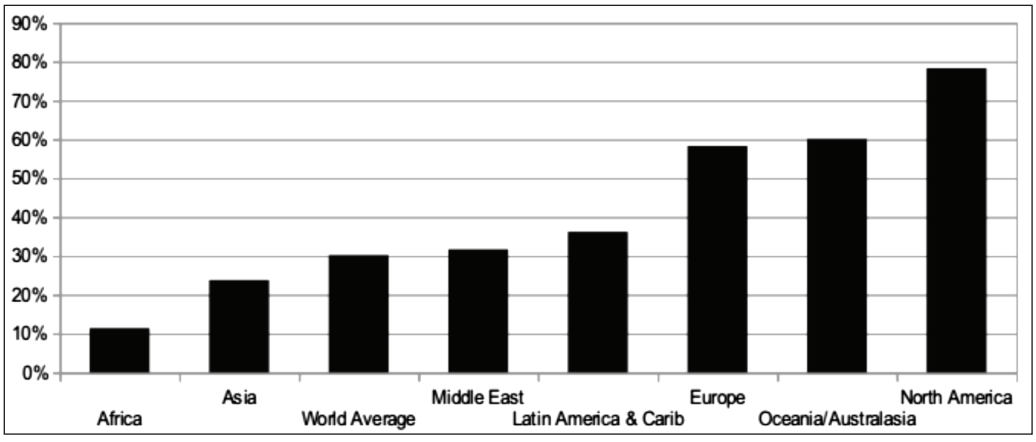
## Current Status and Trends in Internet Access

As alluded to above, the range in Internet access levels has never been greater – on the one hand there are the estimated 2-3[11] billion people who have yet to gain any regular form of Internet access, and at the other extreme, there are a few million urban residents who are permanently connected – with mobile broadband when they are on the move, and optic fiber Internet connections at home and work, capable of delivering high definition TV, often bundled with free voice services and even roaming WiFi hotspot access. This range in access levels is so great, that some households have more broadband capacity than entire countries.

Looking at the overall trends in the numbers of Internet users in 2010, there were just over 2 billion users globally, or about 31 percent of the world's total population according to Internet World Statistics[12] which, for developing countries, are largely based on ITU country reports. This figure is subject to some qualification depending on the definition of 'Internet user' in the market statistics available, where it can be said that even those just with basic feature mobile phones can have some level of access to Internet based services via SMS gateways. The degree of sharing of accounts, which is often much higher in disadvantaged communities, also needs to be taken into consideration. However in terms of the current market definition, Asia leads with 44 percent of the world's total, followed by Europe (23 percent), North America (13 percent), Latin America/Caribbean (10 percent) and the remaining 10 percent is split between Africa, Oceania/Australia and the Middle East.

As shown in the chart below, regional averages showed a wide range in Internet uptake levels, ranging from Africa at just over 10 per cent penetration, to North America at close to 80 per cent. However, even within sub-Saharan Africa these averages obscure wide variations, with 14 countries such as Benin and Tanzania, having less than 2 per cent penetration, and 6 countries with over 25 per cent penetration. About 25 per cent of people in developed countries had fixed broadband access, and more than half had mobile broadband, while in the least developed countries uptake was only about 5 per cent of the population, for both fixed and mobile broadband.

Figure 4: Internet penetration by region

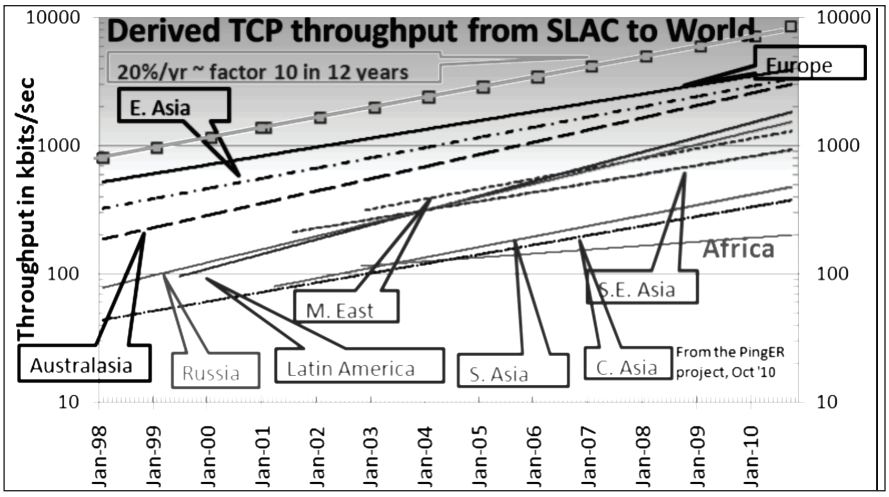



*Source data: IWS, Chart: Jensen*

Looking at trends in connectivity speeds across the Internet, capacity has steadily increased by 20 per cent per year for the last 12 years – i.e. it has improved overall by a factor of 10, as measured by Stanford University's Linear Accelerator Centre (SLAC). However the situation appears less encouraging for Africa - so far it has been falling behind when compared to the rest of the world, as shown in the chart below. Hopefully the recent flurry of submarine fiber and national backbone deployment will change the situation, but if current trends were to continue, Africa will be about 70 times worse off than Europe by 2020.

[11] The figure varies depending on the source and definition.
[12] According to Internet World Stats (IWS) http://www.internetworldstats.com

Figure 5: Regional Speed Trends on the Internet




*Source: SLAC, Stanford, cottrell@slac.stanford.edu*

As the dominant communication device on the planet, the mobile phone is becoming the most common Internet access device as well. By 2010 there were about 5.3 billion subscriptions, compared to 1.2 billion fixed lines, and rapid growth still continues in developing countries. By far the majority of mobile networks today are based on the proprietary GSM network standard called 2G, and while it is possible to use a basic mobile phone to send email or access a web site via an SMS/Internet gateway, this is usually too costly or too cumbersome to use except where there is no alternative. Fortunately most 2G networks have now been upgraded to '2.5G' levels, and with a suitable phone these can provide 'dialup' internet speeds using GPRS or EDGE standards. Most often used for point-of-sale transactions and other low bit-rate applications, performance for Internet access using 2.5G varies considerably, from almost unusable (when insufficient upstream bandwidth is allocated by the provider, or when at the periphery of the signal range) to the equivalent performance of a dedicated 64Kbps leased line, albeit with some additional latency. India in particular has been notable for its low-cost high quality GPRS-based mobile data services.

Nevertheless, by the end of 2010, to meet the thirst for bandwidth while on the move, and to meet the demand for broadband where there are no fixed lines, mobile operators in over 150 countries have now either upgraded or implemented new networks based on the much higher speed data capabilities of 3G (based on WCDMA/HSPA and CDMA/EV-DO). 3G networks are capable of delivering a range of multi-megabit connections and in developed countries speeds currently average about 2Mbps (although the world average for mobile network data is currently only about 200Kbps).

Upgrading network infrastructure for 3G has substantial costs, in equipment, software licenses and spectrum fees, and even new operating licenses in some countries. As a result providers have not all upgraded their networks to 3G on a nationwide basis, but have begun in the areas with the highest demand, usually major urban areas. As illustrated in the coverage map of Brazil above, this means that most of the more remote areas, especially in developing countries, are not yet covered even though there may be a 3G operator present in the country.[13] In addition 3G speeds vary considerably, especially in developing countries, where speeds are usually much slower than fixed wireless or wireline connections.

[13] An open access initiative – opensignalmaps.com – is using crowdsourcing techniques involving a free application downloaded onto the mobile phone, to map the real extent of 2G/3G mobile network coverage.

WiMax, promoted by chip manufacturer Intel, was expected to be the '3G killer', but it has failed to take off as planned, and is only predicted to be serving about 50-120 million[14] customers by 2015. Instead the next generation (4G) mobile standard, called 3GPP Long Term Evolution (LTE) is expected to take over, with speeds between 5Mbps and 50Mbps. LTE is much more than just a better radio interface and will require substantial business and network re-engineering to implement. The specifications for LTE cover an entire new architecture that spans the access network, core network, and inter-working with other networks. In addition, LTE requires substantially more radio spectrum than other wireless technologies, and to handle the backhaul data volumes, base stations will need to be interconnected with fiber. As a result LTE has yet to be fully tested commercially. Although a large number of announcements have been made,[15] LTE trials have only begun in a few countries so far, and about 20 commercial services are in the process of being established.

In comparing fixed and mobile Internet access, 2011 is notable for being the year when mobile broadband subscribers exceed fixed broadband subscribers. By the end of 2011, it is expected that there will be about one billion mobile broadband subscribers (according to equipment manufacturer Ericsson). This is expected to be almost twice the number of fixed broadband subscribers, which had reached 498 million[16] by end 2010, only growing about 12 percent since the previous year. By 2015, between 2 and 3 billion mobile broadband subscribers are expected, depending on which market analyst forecast is used.[17]

Disadvantaged groups and developing countries generally have more limited pervasion of fixed networks, and in the short-to-medium term, mobile will become the dominant form of Internet access in these areas, which also happen to house the majority of the world's population. However, although the number of mobile Internet subscribers exceeds the number of fixed Internet subscribers, due to the overlap in subscribers, this does not yet mean that the actual number of mobile Internet users exceeds the number of fixed Internet users. This is even the case in the developing countries, where fixed networks are much more limited. For example, an extensive 2011 survey of Internet users in India,[18] found that of the 14 million mobile Internet users in the country, just 1.8 million were 'mobile-only' Internet users the remaining 12 million users also had access via a fixed service.

In Europe and North America the majority of Internet users continue to have access from both a mobile phone and fixed access at home or work, so the bulk of the mobile broadband subscriptions worldwide are from people who also currently have access to fixed Internet. However this picture is rapidly changing now that fixed line markets are beginning to reach saturation in numbers of broadband subscribers, and mobile broadband takes off in the developing world. Cisco for example predicts[19] that the mobile-only Internet population will grow 56 times from about 14 million at the end of 2010 to 788 million by the end of 2015.

It should be noted here that while Internet access on the phone itself may be the dominant form of mobile access in developing countries, 3G-enabled set-top-boxes[20] and 3G USB modems (often called dongles) are equipping households and laptop or PC users with high speed mobile broadband connections, and these will actually be responsible for the bulk of the traffic on mobile networks (see below for more details).

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[14] Maravedis estimates 50 million while Informa estimates 120 million, in both cases this represents less than 5% of the expected wireless subscriber base in 2015.

[15] At the end of Q2 2011, 177 operators had announced they would use FDD-LTE, 21 operators committed to TD-LTE, and four operators that have conducted trials of both TD-LTE and FDD-LTE. So far 20 operators that have commercially launched FDD LTE.

[16] Definition of 'broadband' speeds, and 'users' vs subscribers, affects this estimate For e.g. from Point.com, as compared with Instat, for example, which announced that there were 768 million fixed and mobile broadband 'users' in 2010.

[17] Idate says there will be 2.67billion users by 2015 http://www.idate.org

[18] Juxt Consulting – India Online 2011 - http://www.juxtconsult.com

[19] http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html

[20] Such as the Vodcom WebBox which turns a TV set into a data device with internet access, games, email, SMS and FM Radio by plugging in a keyboard with a built-in mobile SIM.

There has been some speculation that 'fixed-mobile-substitution' will increasingly take place as mobile Internet access improves in quality and reduces in cost when compared to fixed-line access. While there have been some indications of this trend in Europe, it is still early days in the evolutionary cycle to be sure of this trend. Reliability needs and greater ease of use, combined with bundling of services and fixed broadband price reductions in response to competition from mobile providers, suggests that most Internet users will continue to have access to both mobile and fixed services if they have the choice. In fact the popularity of Internet access on mobile phones is perhaps leading to the reverse trend, as mobile users switch to fixed WiFi to minimize their mobile data costs and improve performance. And as fixed broadband speeds improve, there is likely to be subscription-TV substitution in favor of IP-TV, either free (e.g. YouTube) or paid. And with the ongoing convergence in fixed, mobile and pay-TV providers, users are also increasingly being offered quad-play or even quintuple play services (fixed & mobile voice and broadband, IPTV, and WiFi hotspot roaming).

Nevertheless, in developing countries access is likely to be dominated by mobile services in the short-to-medium term as wireless broadband continues to respond to the suppressed demand created by the lack of fixed line infrastructure. However, in the longer term it is likely that optic fiber will ultimately reach every business and household to meet future needs for even higher capacity, even in disadvantaged communities. The extent and rapidity with which this will occur is still a matter for conjecture, as it depends, to a large extent, on the capabilities of new wireless technologies such as LTE, which have not been widely tested yet. However, unless some unexpected advances in this area occur, inherent limitations in signal propagation available from the radio spectrum suggest that wireless will ultimately not scale to the level required, and that fiber to the premises will still be needed.

This conclusion is reinforced by the evident growth in deployments of fiber-to-the home/curb/premises (FTTx). While copper-based DSL and cable-TV modem systems are still the most popular fixed broadband technology, with about 350 million DSL subscribers and 110 million cable modems in mid 2011, FTTx is already in third place with over 82 million subscribers, in front of fixed wireless systems such as WiMax. FTTx also has the highest growth rates of the three cable-based technologies, clocking a quarterly increase of about 7 percent in mid 2011, compared to 2 percent for DSL and cable modems.

While the business case for FTTx in disadvantaged communities may be more difficult to make today, national and metropolitan policies and community initiatives have already altered this dynamic in some countries. These include the Chinese government's massive investment in FTTx as part of its national broadband plan to ensure every household has at least a 20Mbps connection, and the many municipal and community projects to install FTTx in Scandinavia and the UK.

Noting that global or regional averages can obscure wide variations within and between countries, other statistics that provide further insights into the current stage of evolution in the broadband ecosystem include:

- Basic 2G handsets still make up the vast majority of handsets in use by mobile subscribers (87 percent in 2010), although the majority of shipments from 2012 are likely to be 3G and 4G capable phones. Significant numbers of 2G and 2.5G phones continue to be made, while smartphones and tablet computers are showing the highest levels of growth in the access device market. Smartphones costing about US$100 are now readily available[21] and Informa Telecoms estimates that 13 percent of the mobile phones in use in 2010 were smartphones, growing by 32 percent from the previous year. At the same time, equipment manufacturers are now seriously attacking the 'bottom of the pyramid' aiming to produce low-cost basic feature phones with a Total Cost of Ownership of US$5. Juniper Research estimates that shipments of these will reach 700 million a year by 2015.

[21] About 350 000 Huawei IDEOs Android handsets were sold in the first six months in Kenya since launching in January 2011 – a large number for a country where 40% of the population live on less than $2 a day.

- In developing countries, Internet access costs are a far higher proportion of average income levels. In the 30 countries with the smallest Internet markets, most of which are LDCs, broadband subscriptions cost over 100 percent of GNI per capita reports the ITU. By comparison broadband subscriptions cost less than 1 percent of Gross National Income (GNI) per capita in the 15 countries with the largest fixed broadband markets, and under 2.5 percent in the next 25 countries. At the end of 2010, the ITU says that in Africa, the average fixed broadband service cost the equivalent of 290 percent of income, although this is down from 650 percent in 2008. Narrowband connections are somewhat cheaper – Nokia estimates that the total cost of ownership (phone included) for a basic rate mobile Internet access package of 2MB[22] usage per month cost an average of about $15/month in 2010.

- Voice capacity needs have become virtually insignificant by comparison to the rocketing network traffic from Internet access, and voice traffic barely features in developed country operator traffic models. Even just on mobile phones in sub-Saharan Africa, Analysys Mason predicts[23] that data will outpace voice traffic by next year (2012). Cisco calculates the average mobile connection currently generates about 65 megabytes of traffic per month, but this is expected to increase more than 17 times to 1.1 gigabytes by 2015. While PCs and tablets are not as prevalent as mobiles, they generate much more traffic per device – for example, in 2010, a tablet generated 5 times more traffic than the average smartphone, and laptops generated 22 times more traffic than the smartphone. Considering that the number of mobile-connected laptops grew by 63 percent in 2010, laptops and IP-based set top boxes are likely to be the biggest contributors to mobile network traffic in future. This explosion in mobile bandwidth requirements is also creating renewed interest in WiFi hotspots. These have now become a more viable business proposition as broadband users on the move seek to minimize their mobile data traffic costs by switching to WiFi when available. As a result, mobile (and fixed) operators are deploying their own hotspots, and/or buying or teaming up with other hotspot operators.

- The decline of the small Internet provider continues, especially in developing countries where mobile providers are taking most of the consumer market share. When combined with the ongoing consolidation of fixed and mobile operators, their massive economies of scale and ownership of the delivery media leaves fewer niches for small providers, who have been largely relegated to countries where local-loop unbundling has taken place. By contrast, in the corporate market, where margins are higher, and tailored products are required, better opportunities for smaller providers still persist.

- The number of facilities which provide public access to the Internet, such as cybercafés and multi-purpose community phone shops, are declining in the wake of increased personal or household Internet accessibility, especially due to mobile phone access. In more remote areas without mobile coverage, these facilities are still popular, however they often face electricity supply problems and the high cost of satellite links, making their presence the exception rather than the norm.

- After some decades of hype, the emergence of machine-to-machine (M2M) communications has now seriously begun and is starting to have a more significant impact on network traffic. The key M2M areas are currently: a) business and consumer security and surveillance b) health care, and c) inventory and fleet management. While the latter two elements are not particularly data-intensive, the impact of security and surveillance applications is particularly pronounced on data traffic. For example, during the 2010 Shanghai World Expo, about 10,000 security cameras were installed on buses, trucks, and emergency vehicles. With live monitoring, video is transmitted at 2 frames per second. If each frame is 0.5 MB, then an hour of

[22] Nokia says this is equivalent to 2 hours browsing or 20 emails or 8 game downloads or 0.4 music tracks.
[23] http://www.analysysmason.com/about-us/news/insight/Is-the-fixed-operator-in-a-position-to-steal-the-mobile-operators-customers/

video generates 3.6 GB. If half of these vehicles transmitted 1 hour of video over the course of a month, this would generate 18 petabytes of data traffic - more than the total global mobile data traffic in 2007. The relevance of this for disadvantaged areas is that there will hopefully be spinoffs in network deployment to more remote areas as operators respond to demand for nationwide M2M services.

In conclusion, it can be observed that over half the world's population is still without some form of regular access to the Internet. Of these, perhaps 1 billion people are too young (or too infirm), and most of the remainder will only have narrowband or irregular access via mobile phones for some time to come. The length of time it will take to reach more widespread high speed access for this group is still unclear as it mainly depends on national policy change. There are few technical barriers to universal Internet access. While there are some affordability and basic literacy barriers, there are plenty of national policy barriers, and national and local government interventions that could help accelerate the massification of Internet access. Many of these have been mentioned in passing in the section above on the broadband ecosystem. The final section below aims to more comprehensively outline the challenges, opportunities and outstanding questions.

## Toward Universal High-Speed Internet Access

Ensuring that Internet access is available to as many people as possible is not just a problem for disadvantaged communities and developing countries. World-wide, national governments, the private sector and civil society are grappling with this issue. The dominant networks, both fixed and mobile, are still in the process of migrating from a voice-centric model to a broadband capacity model, and this affects the provision of infrastructure and services at every level – international, national and local. This stage in the Internet's evolutionary history comes at the same time that LTE begins to take off, the IPV4 address space becomes exhausted, and many different types of national initiatives launched to broaden Internet access.

This all takes place while Moore's law[24] continues to hold, so it will probably be at least 2-3 years before the outcome of this upheaval becomes fully apparent and clear conclusions can be made about best practices to reach the remaining unconnected, and improve the connections of those still on narrowband. However some lessons have already been learned, from which a suggested list of potential actions are outlined below as follows:

**1. Increase competition in the market.** Three activities need to take place in parallel: a) Open the market to more players – issue more licenses, make licenses technology neutral and license fees cost-based b) liberate incumbent backbone networks and fixed line local loops, c) introduce number portability. This may require updated regulations to implement Significant Market Power (SMP) wholesale/retail price determinations, to compel the publication of Reference Interconnection Offers (RIOs), and to compel the unbundling of the local loop. This usually requires support from general anti-competition law and competition commissions or tribunals, which may still need to be established where they do not yet exist. Most developed countries and some developing countries have already instituted most of these measures. Another strategy that has been suggested to limit vertical integration in the market, especially for mobile operators, is to separate the infrastructure, subscriber services and the business services into independent companies. This makes a more level playing field and could make business development more open as smaller firms would be able to enter the market, for instance to deliver focused value-added services, without being absorbed and made invisible behind the operator.

**2. Make better use of existing alternative/complementary infrastructure.** Governments need to ensure cost-based access to existing fiber optic cabling, ducts and rights of way of energy, transport, water and sanitation

[24] http://en.wikipedia.org/wiki/Moore's_law

networks. This may need the adoption of new regulations to allow third party access to this infrastructure and to limit prices charged. Examples include: West African Power Pool (WAPP), Tanzania water distribution control network, Brazil public national fiber backbone (Telebras), Broadband Infraco public national backbone, South Africa.

**3. Implement infrastructure sharing for providers.** This usually applies to provisioning of ducts or conduit for optic fiber in new transport or energy networks, but also applies to water and sanitation pipes in municipal areas, and to wireless base-station masts. Infrastructure sharing can also apply to the optic fiber itself, mainly for FTTx, rural backbones and international/submarine cables, in particular where markets are too small to support multiple competing private initiatives, especially initially, while demand is built. More recently shared LTE networks in rural areas are being discussed. These networks can be public funded, privately funded or a public/private partnership mix (PPP). Updated planning laws may be required to ensure that ducts and fiber are incorporated in all new complementary infrastructure, including to, and inside building premises. Some examples include: Kenya government submarine cable to UAE (TEAMS), Australia Telstra/Hutchison shared 3G network, South African public/private shared rural LTE network (under discussion).

**4. Implement smoother permitting processes and cost-based fees for accessing municipal poles (for fiber and radio transmitters), rights of way and crossing trans-national boundaries.** Example: In Europe it is only necessary for the municipalities on either side of a national border to be informed of planned cable laying by operators.

**5. Liberate more radio spectrum for broadband.** Implement Analogue-to-Digital TV migration, update radio spectrum band plans and ensure cost-based spectrum license fees.

**6. Provide public support for extension of connectivity to disadvantaged communities, especially in remote and rural areas.** This can use universal service funds for disadvantaged community network deployment. Example: In France operators must provide a quote in response to a request for service in any part of the country. The regulator deducts the national average cost of providing a connection (determined by the regulator's own benchmarks) and gives the difference to the operator who must install the connection within a specified time period. Reverse auction for provision of service in under-serviced areas is another mechanism.

**7. Promote demand for Internet access.** Support relevant local applications development, maximize use of the networks for e-Governance and civil-service networking, eliminate any restrictions on VoIP services[25] (including ensuring that numbers are available for VoIP/PSTN gateways) and open up international gateways. Minimize taxes on Internet access services and equipment, and provide tax incentives for local manufacture and network deployment. The fiscal measures being implemented in Brazil to support the National Broadband Plan provide some good examples here, including tax breaks for providers deploying services in previously unserved areas.

**8. Make electricity cheaper and more available in rural areas.** Increase public sector investment in energy generation and power distribution network deployment. Encourage investment in alternative/renewable energy production, especially in off-grid areas. Provide grants toward capital cost and installation in households and business, adopt IPPPs. Encourage availability of public charge-up services in off-grid areas. Example: IPPPs and grants in South Africa, UK, Japan, UNIDO support for energy kiosks in East Africa run by small businesses.

**9. Ensure better strategic decision-making.** Establish up-to-date market and infrastructure data availability and analysis systems. Normally this involves quarterly reporting of network and subscriber status from providers to the national regulator, geotagging and merging the data with GIS data from other sources – population,

[25] The ITU estimated that in 2009 only 92 countries allowed VoIP.

complementary infrastructure etc. May require updated regulations or license regime to compel provision of the data. Examples: Many - Europe, Brazil.

**10. Encourage rapid policy implementation and regional harmonization of policies.** Decide on targets/benchmarks on cost, service quality and coverage. Implement public connectivity policy health-checks, publish regular evalutions of the status of implementation of the measures described above. Peer review and ranking of health checks provides incentives for regional policy harmonization and for laggard governments to catch up to the leaders.

Other important activities:

- Improve co-ordination of infrastructure deployment. Ensure civil works co-ordination and information sharing between different industry sectors and national ministries to share costs and reduce the number of accidental cuts in fiber infrastructure.
- Support the emergence of more Internet Exchange Points (IXPs) and improve the capacity of existing IXPs.
- Implement strong penalties for theft or vandalism of fiber cable and other connectivity infrastructure such as solar panels.
- Ensure that handheld access devices can be easily configured for use on any network so as to maximize choice of service providers for consumers.

## Institutional Roles in Maximizing Internet Access

### National Governments and Regulators

The role of sovereign governments would mainly be to:

- Develop national broadband strategies including targets, and establish or use an existing agency to implement the plan
- Minimize the licensing burden and other barriers to entry for providers in order to maximize competition in the connectivity market
- Align taxation policies with the plans and objectives for increased Internet access
- Adopt appropriate land use planning regulations at the national level as well as metropolitan and rural district authorities
- Facilitate transboundary infrastructure deployment and cost-based access to rights of way
- Facilitate access to alternative infrastructure
- Be responsible for the incorporation of regional institutional directives into national legal and regulatory frameworks
- Be a model customer for Internet services
- Ensure transparency of decision-making

Within this context, the role of the national regulatory authorities (NRAs) is to ensure the necessary sector regulations arising from the policies described above are in place and ensure that all actors abide by them, in particular the incumbent operators. This requires that NRAs be given sufficient financial resources and legal tools to enforce adherence to the regulations. According to the Broadband Commission, NRAs will need to be able to prevent the following activities from dominant operators:

- Refusal to supply (grant network access)
- Predatory pricing (providing services at less than cost)
- Mandatory product bundling (requiring end users to take products in which the operator is not dominant, in order to access products in which the operator is dominant)
- Price discrimination (applying different prices and terms and conditions to favor or disadvantage particular customers), and
- Cross-subsidization (using profits generated in one service market, in which an operator is dominant, to subsidize its operations in a competitive market).

Also, NRA support for improving the use of radio spectrum is essential for deployment of cost-efficient wireless broadband access. Of particular current importance is to ensure that the spectrum freed up from Analog to Digital TV migration is made available for broadband.

## Providers/Private Sector

Network providers are among the main actors in broadband development, offering connectivity services and investment in infrastructure. Providers are able to identify the bottlenecks that hinder the deployment of infrastructure and can be involved at both national and regional levels in terrestrial infrastructure projects. In addition, providers are likely to be subject to licensing conditions that may include some requirements to support access in disadvantaged communities, or they may be paying a portion of their revenues toward Universal Service Funds.[26] As a result policy makers and regulators need to ensure there are adequate mechanisms to establish formal multi-stakeholder consultation procedures with the industry, which would include the alternative infrastructure providers with facilities for providers.

## Civil Society

Civil society has a strong role to play in helping to identify needed infrastructure and policy changes. Aside from highlighting inequalities in Internet access, civil society organizations can help to represent the concerns of under-resourced individual citizens regarding proposed new projects in their locality, and in raising their awareness of the benefits of the infrastructure being put in place, thereby helping to secure it against accidents, pilferage and vandalism. In addition civil society can even support implementation, such as the local villagers who organize trenching teams for fiber cable deployment and other ancillary support. Civil society consultations and public hearings are normally an inherent part of a national regulator's work in Internet access policy and regulatory development, but in many cases low financial and human resources results in limited effectiveness of this process.

[26] These are a small tax (usually 2-3%) on operator revenues that are applied to subsidize the cost of deployment in unprofitable areas.

### Development Community and Development Finance Institutions

These institutions can have an important role to play in accelerating access to the Internet for disadvantaged communities. The two most important aspects are a) capacity building and awareness raising – of policy makers and regulators to help them most effectively achieve their objectives, and b) provide soft financial resources to invest in infrastructure where the private sector is unlikely to make the required investment.

## Some Outstanding Questions and Potential Research Topics

To improve decision-making on the best strategies to improve Internet access for disadvantaged communities, a number of general questions and research areas have been identified where there are gaps in existing knowledge. The most important of these are:

- What should the goals be in the short and medium term for Internet access speeds,[27] traffic caps (volume quotas), price, geographic coverage and household penetration in disadvantaged communities? How does variation in each of these factors affect the extent of usage? There are a variety of related questions for which answers could assist in helping to identify appropriate goals:
- To what extent does the bottom of the pyramid need Internet access, at what price, and on what type of device? In other words, what is the expected development impact, considering, at least in the short to medium term, the potentially high data costs, energy consumption, low functionality and small screens of handheld devices?
- Is Nokia's $5/month TCO threshold to reach 'low-income groups' accurate?
- What is the critical threshold for village size and distance from existing backbones to interest the private sector in providing services? (Especially once the impact of the factors listed below is better understood and more detailed census data is available).
- How can price targets for Internet access accommodate bundled services (triple-play/quad-play etc)?
- Where is public finance still required to support Internet access infrastructure and service uptake – rural backbone fiber networks? Shared rural wireless networks? What other criteria should be applied? (e.g. would the European Union's black/grey/white area criteria apply in a developing country context?
- Do subsidies or soft loans and guarantees for equipment for low-income end-users work? Is duplication of backbones in disadvantaged areas good for competitive pricing or a waste of resources?
- Are Universal Service Funds effective tools for improving access in disadvantaged areas, or are there better mechanisms?
- What are the most effective technologies and business models for deploying broadband in sparsely populated low-income rural areas? - Shared wireless networks? Spectrum hosting?
- What is the role of gender, age, literacy, language, cultural group and income levels on the level of access uptake under more ideal access cost and coverage scenarios? - (These factors are often not well understood in developing countries because so far, they have had little impact on broadband penetration due to avail-

[27] The Broadband Commission recommends individual homes and small businesses should have 4 Mbit/s downstream and 1 Mbit/s upstream, "with a road map to much higher speeds over the next decade".

ability and cost constraints which have created high levels of suppressed demand). A related question is "What are the missing content and applications that will encourage more members of disadvantaged communities to come online?"

- How can the constraints on use created by metered access (pay per byte) on mobile networks be overcome to encourage greater use? Metered access presents special issues because it creates two-sided markets (both sender and receiver pay) which, for realtime communications, such as VoIP or video means that the receiver also pays for the cost of the call. By entering into agreements with individual network operators, some content providers such as Facebook have overcome this problem, however it is unclear if this is a model that is scalable beyond a few advertising supported web sites.
- What are the benchmark prices for basic infrastructure resources around the world? – Ducts, poles, overhead pylons, spectrum fees, municipal permits etc. There is a wide variation in fees charged for these resources and lack of consistency and clarity over costing/pricing models.
- Will the market size/economies of scale of the mobile operators result in their continued dominance of the Internet connectivity sector? Or are there other disruptive technologies and business models that may emerge to compete more effectively with them, for which provisions in market liberalization strategies need to be made? What potential do new technologies such as mesh-WiFi networks, Ultra Wide Band and software radios have in meeting the needs for connectivity in disadvantaged communities?
- Is network neutrality an issue in provision of access to under-serviced areas or other disadvantaged communities? Network neutrality could create disincentives for operators to provide service, but the advantages may outweigh the disadvantages.
- Are privacy concerns a constraint to provision of Internet access in disadvantaged communities? Perhaps of particular relevance in developing countries is the link to the formal economy created by trackable e-payment systems.
- Are regulators identifying the right spectrum bands to maximize support for wireless broadband, and what model should developing countries adopt for the 700/800 MHz band plan? What role can whitespace, Ultra Wide Band (UWB) and dynamic use of spectrum play in maximizing spectrum efficiency? What is the role of unlicensed spectrum in disadvantaged areas? What is the most efficient means of allocating spectrum to providers for disadvantaged communities – incentive auctions etc? What are the priorities for trans-national spectrum management harmonization?
- How can the performance of Internet Exchange Points (IXPs) in developing countries be improved? Many IXPs lack full membership by the local ISPs, do not switch all the local traffic and provide few other additional shared services such as DNS, time servers and caches.
- Is there a need to continue government support for public access facilities or are they unnecessary now that that mobile broadband is so prevalent?
- What resources can be made available to ensure that the remote island communities are able to benefit from the broadband revolution?
- Where are the disadvantaged population groups at most risk of being left behind? Island nations? Special language or cultural groups?
- Are there significant cost savings to be made by supporting local assembly/manufacture of Internet access devices in developing countries?

# CHAPTER 3

## Technical Access Issues

*Alan Greenberg*

### Introduction

Technology in general, and more specifically the Web and related communications technologies, have the potential for altering people's lives in both radical and subtle ways. Positive impacts include increased livelihood opportunities, education, communications with family and colleagues, access to health and other essential services and the improved ability to participate in and influence the world outside of their local environments.

However, all of this pre-supposes that the people involved will have the ability to effectively interact with the new technologies. Although some benefits can be gained by acting through intermediary agents, that is, having others with better skills use the technology on their behalf, the true benefits will often be realized only by hands-on interaction.

A discussion on ease of use cannot be restricted to just the ease of use of the Web and similar interfaces. To use a somewhat dated paradigm, an easy-to-use web application is of little use if the person cannot power on the computer, boot up the operating system and start the web browser. Ease of use must be considered for the entire eco-system on which the Web is based. As such, it is important that the overall environment be conducive to using the Web for web applications to be useful.

Usability is not an exact science. There are abundant guidelines and possible techniques for making things usable, but ultimately they must be experienced by real users to allow for their validation (or not). This is made particularly difficult because ease of use is a relative concept, and how well any device or web site proves to be easy to use will depend not only on how well it is built, but also on the experience and knowledge of the user. Put simply, what is easy to use for one user may be confusingly complex for others. Users with minimal technology experience, and often those who have no desire to become technologically proficient, are likely to be most affected by ease of use issues. Although this review will include a wide range of usability issues, a prime focus will be on those issues and technologies that can make Web access practical for those most challenged by usability.

*Ease of Use vs Ease of Learning*

What is often referred to as "Ease of Use" is often a combination of Ease of Use and Ease of Learning. The two are actually quite different, as it is possible to have something that is incredibly hard to learn but then easy to use once it is mastered. Similarly, you can have something that is easy to learn (or so intuitive it requires little learning), but awkward to use.

In the context used here, a device or application that is "Easy to Use" is one with a practical learning curve (depending on the intended audience) and once learned, is considered natural to use.

Ease-of-use issues are gated by access issues. As access increases and technologies are available in previously underserved geographic regions or socio-economic groups, and as device and access costs drop, new potential users will often have fewer relevant skills. Ease of use issues thus become more relevant and critical. Accordingly, the target is not to just address the problems encountered by today's users, but those that we foresee when access restrictions are far reduced.

## Current State of Play

Within developing regions of the world, access to and use of mobile voice telephony has increased radically over the last decade. Although service is not ubiquitous (even in developed countries it is common to have no coverage in less-populated areas), increasingly most people have some access to voice telephony. The technology used to deliver voice services can also carry data services, often at very usable speeds[1].

Lack of adequate and affordable communications is the largest impediment to easy web and Internet access. Improved technology, different business models and sometimes support from universal access funds[2] are addressing the access problem, and to some extent, the cost problem. As access becomes less of a problem, it is necessary to look at the other factors that make the Web and related services *effectively* inaccessible.

Usability is impacted by a very wide range of considerations. There are a variety of factors that must be considered in order to understand the strengths and weaknesses that relate to ease of use. In addition, there are a number of critical technologies that will be important in improving usability.

### Controlling Factors

Controlling factors are either problem areas that impact ease of use, or are important characteristics that need to be understood when considering usability issues.

**Access Devices:** Until recently, the Web has been limited to those with access to traditional (desktop, laptop) computers. In many developing countries, Web access is limited to that available in public facilities (telecentres, Internet cafés, free or fee-based) and to those who have access at work or at home. The latter are generally well educated, and at least moderately affluent – a clear minority.

The cost, care and feeding of such platforms, regardless of whether they have been Windows PCs, Apple Macintoshes, or more recently Linux-based, coupled with their electrical power requirements, has made them a resource that would always be in short supply in developing economies. As the power and sophistication of mobile telephones and tablets increase, and the prices decrease, this limitation will diminish. Mobile devices now have far more computing power, memory and storage than the traditional platforms did just a few years ago and do not require land-line connectivity. This is opening up a whole range of previously unimaginable possibilities.

**Language and Character Set Support:** Virtually any script in use in the world can be represented in digital format. The standard governing the how scripts are represented (encoded) with a computer, processed and displayed on a screen or printed is called Unicode[3]. Although a standard, there are a number of different character-encoding methodologies defined within Unicode. Different operating systems and applications (including web

[1] Many networks in developing countries are use 2.5G technologies, which will only yield data speeds in the "dialup" range – 64 kbps, but increasingly 3G systems are being deployed which will give at least 200 kbps and often as much as 2 mbps.
[2] http://www.rural21.com/uploads/media/R21_Universal_Access_Funds_0608.pdf
[3] http://en.wikipedia.org/wiki/Unicode

browsers) use different encodings, which at time results in interoperability problems. Although the current situation is rather confusing, most of the newer mobile devices (such as smartphones and tablets) theoretically can operate with Unicode to properly interact with most of the world's languages. Thus a smartphone purchased in the US fully operates in English, one purchased in China presents a consistent and usable interface to its Chinese user, and one purchased in an Arabic-speaking country functions fully in Arabic.

However, there are many different components (both hardware and software) that need to come together to allow these three vastly different scripts to operate. As a result, it is often non-trivial to retrofit a different language or script to a device that was not manufactured with the intent of using that language. The situation varies from device to device and even based on the operating system level and what application programs are required. As an example, if one wants to take a smartphone marketed in North America and retrofitting Chinese to it, it can be made to work in many cases, but even then, there may be aspects of the phone or its applications which are still in English (or whatever languages it was manufactured with). And even though such a retrofit is possible, it is not something that a typical user could do.

The end result is that if a language is not supported by suppliers, there may be significant difficulties in retrofitting a script or language so that it can be used for the full set of the devices functions. In summary, allowing devices to operate in a language or script that the supplier did not see as being a sufficiently large market may be problematic.

*Jailbreaking/Rooting*

Many mobile devices are not designed to allow a user to easily install a new language or character set, and particularly not one where the rules are very different from the languages ordinarily supported by the device. Often to do such an installation, core features of the system must be adjusted or augmented, and virtually all mobile devices are do not allow such changes. Such changes are forbidden because the vendor is trying to ensure that no one alters the device maliciously, or makes changes that break its functionality. This unfortunately may also inhibit making the changes needed to install a new language or character set. Devices running Apples iOS operating system (including the iPhone and iPad) and those running Google's Android operating system (various smartphones and tablets) are delivered with the core operating system protected. Various techniques have been developed to bypass this protection and gain access base system ("root access"). For iOS, this has come to be called "Jailbreaking" and for Android, "Rooting". Both processes can make the devices more vulnerable to problems, and in some cases may void the warranty. Jailbreaking and Rooting may be illegal in some jurisdictions (but no longer in the US). On the plus side, it allows the owner to install software that is not authorized by the supplier. However, it is clear that it is not a technique that can be carried out by a typical end-user.

**Mobile Device Physical Size:** The small screen mobile phones can be problematic. The very small screens used on low-end phones are very limited, and even the larger, high resolution screens on current smartphones are not nearly the match for traditional computer screens. There is a limit to what can be displayed, and in many cases, web sites and application programs need to be conscious of the small screen size to allow them to be used effectively. Moreover, in an attempt to pack a reasonable amount of information on a screen, character font size tends to be quite small. This can be problematic for anyone with even moderate eyesight problems, and can render the technology near useless for those with significant visual disabilities.

**Computer Literacy:** In the context of end-users, computer literacy[4] is defined as having the skills necessary to perform relatively simple and perhaps routine operations. Traditionally, access to the Web has been limited to those with at least a modicum of computer literacy. In theory, as computer systems improve, the specific skills required decreases – such systems are often referred to as "intuitive" in that specific instruction is not needed.

[4] http://en.wikipedia.org/wiki/Computer_literacy

Even with such intuitive "no skills needed" systems, the lack of comfort dealing with unfamiliar and possibly frightening technology can be problematic. Regardless, there will be a requirement for technology skills for some time to come, both for users of complex applications (or those that have not yet been targeted at unskilled users) as well as mentors, developers, support staff and champions.

**Language Literacy:** Access is generally limited to those who are literate in some language that is commonly in use on Web. There are multiple factors that make up language literacy from a technology point of view: i) the user has sufficient reading skills in a particular language/script; ii) the language can be readily represented in a computer-based script; iii) the language can be represented on the devices available and can be used by the particular application program; and iv) for Internet access, the language is actually in use on the Internet. Unfortunately this excludes the languages used by vast numbers of people within the developing world.

**User Experience Design:** User Experience Design[5] (UXD) is a complex field, part science, part art, related to how users interact with devices or systems. Perhaps counter-intuitively, software and computer experts are often not adept at good UXD, since their knowledge tends to make it hard for them to understand novice user perspectives. There are insufficient people with this experience, and perhaps more important, the need for them is often not understood in application and software design initiatives.

**Usability Through Guidelines:** Abundant guidelines exist for increasing web accessibility[6]. Much of this is specifically targeted at making the web more accessible to those with specific disabilities (including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations and motor difficulties)[7]. To the extent that they are used, they will ameliorate some access issues – specifically for those with the targeted disabilities, and to a lesser extent, general users as well. But it is clear that there will always be abundant content that does not meet accessibility standards, and even when met, the issues raised in this section are still inhibitors that make effective use of the web difficult.

**Moore's Law:** Moore's Law[8] is a term that is often used to summarize a wide number of predictions that all imply that aspects of computing technology (speed, capacity, cost per unit, etc.) will double (or halve for things like cost) every one to two years. The predictions have held true for over 50 years and there is currently no indication that that this will change any time soon. Many of the changes that we are seeing are attributable to this effect. As a simple example, it takes a large amount of computing power to manage a graphical user interface or a touch panel or speech recognition or language translation. Even though all of these were possible on desk-top (or room-sized) computers, it was unimaginable that these tasks could be carried out on an affordable, handheld device ten years ago, but all of this is possible today. Some of the limitations that we see today can and will be addressed by the faster, higher capacity, and cheaper devices that we can reasonably expect to be available over the coming years. We need to not only design with an eye to what is possible today, but what will be possible tomorrow.

[5] http://en.wikipedia.org/wiki/User_experience_design
[6] http://www.w3.org/TR/WAI-WEBCONTENT/, http://www.usability.gov, http://ist.mit.edu/services/consulting/usability/guidelines
[7] http://www.w3.org/WAI/
[8] http://en.wikipedia.org/wiki/Moore%27s_law.

## Technologies

The concepts and technologies referenced here have the potential to radically improve certain aspects of usability. At the same time, poor implementations may frustrate both novice and experienced users[9].

**Graphical User Interfaces:** Graphical User Interfaces (GUIs)[10] have been the norm for operating system desktops for well over two decades. The important characteristic of a GUI is that the user interacts via pointing to pictures (icons) instead of with text-based commands. Over that period, the use of GUIs has increased markedly, and many web applications include their own GUIs. GUIs have also appeared in various dedicated devices - typical examples are interactive games, GPS-based navigation devices, self-checkout shopping terminals, and more recently automobile readouts. We have understood the need for using symbols instead of words for many decades, as demonstrated by road signs, airport direction signs, and the icon-based dashboard indicators in automobiles, but it is only relatively recently that we have had the tools available to use them with computers.

**Widgets:** The term Widget was coined in the early 1900s and originally meant "An indefinite name for a gadget or mechanical contrivance, esp. a small manufactured item."[11] Over the years the term has been used in a wide range of different ways, but often meaning something that is seemingly simple but may be complex in unspecified ways. In the context of computing devices (including desktop, laptop, tablet and phones), it tends to mean an icon which when invoked (clicked on, touched, hovered over) invokes a program. In the context of smartphones and tablets, Widgets often link to applications that are single-purpose, easy to understand, easy to use and often easy to install[12]. In short, they often have many of the characteristics that we want in out ideal, computer interface.

**Voice Input and Output:** There have been remarkable improvements in speech recognition[13] over the last several decades. Rudimentary speech recognition is already deployed in many mobile telephones for hands-free operation. Google has offered voice-enabled search capability for smartphones (maps, telephone numbers, web) and has recently made it available on its Chrome web browser (English only for the moment). With more generalized implementations, it may be practical to use speech recognition for all manner of applications. That being said, there are potential problems that will still need to be addressed. Not everyone agrees that computers will ever be able to recognize speech in the general case, and recognition for languages where there is not already a vast body of knowledge and literature is likely to be quite problematic[14].

Text-to-speech or speech synthesis[15] is now increasingly common. Automobile GPS devices read out street names to the driver and a relatively inexpensive Apple iPod has the capability of reading the titles of albums and songs and artists names to the listener. Voice characteristics and the quality of pronunciation have improved as well. Clearly text-to-speech is in the process of making the transition from use largely as an adaptive technology to situations where computers can be used by those who cannot read or where it is impractical to focus on a screen.

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[9] Many readers will be familiar with telephoning for customer service and being confronted with an endless stream of automated questions requiring voice response which is then often misinterpreted.
[10] http://en.wikipedia.org/wiki/Graphical_user_interface
[11] Oxford English Dictionary
[12] http://www.w3.org/TR/2011/PR-widgets-20110811/#the-widget-family-of-specifications
[13] http://en.wikipedia.org/wiki/Speech_recognition
[14] http://web.archive.org/web/20110715105955/http://robertfortner.posterous.com/the-unrecognized-death-of-speech-recognition
[15] http://en.wikipedia.org/wiki/Speech_synthesis

**Global Positioning System (GPS):** Many smartphones now include GPS capabilities, and it is expected that this trend will include other mobile devices as well. The ability to determine position, and by implication how that position is changing over time opens up a wide variety of new location-aware applications, and moreover frees the user from the need to enter location information – a requirement in many applications. Although stand-alone GPS devices still cost hundreds of US$, GPS capability can often be integrated into other devices for quite minimal costs. It is noteworthy that two of the three real-life examples highlighted in this chapter utilize GPS capability.

**Social Networking:** Social networking applications, with a particular focus on Facebook and Twitter, but including others, have proven to be very popular, both in developed and developing countries. They address a need for human communication and interaction which may not be of immediate financial value to people but is crucial to their emotional satisfaction. Telecommunications carriers have targeting these groups with preferential rates. Device vendors have also made it particularly easy to use these applications, and one can expect both trends to continue.

**Low-bandwidth Text:** Low-end voice mobile telephones have two capabilities for transmitting and receiving short text messages. The most common is SMS (Short Message Service)[16] which can be used to asynchronously transmit and receive messages with any other mobile telephone or with centralized services interfaced to SMS. The other service is USSD (Unstructured Supplementary Service Data)[17], available only on GSM phones, which provides synchronous communications (send out a message and await the reply) between a user and a service. Users of prepaid GSM phones will be familiar with entering codes of the form *xxxxx# to query balances or add credit. However, both SMS and USSD have been used for a number of applications far more powerful than how they were originally conceived. These include micro-finance transactions, stock quotations, sports scores, receiving updates from Twitter and Facebook, and even targeted web services[18]. These low-bandwidth text services are particularly well suited to allow traditional users with low-end mobile phones to interact with traditional web applications in specific, targeted ways. There are also many applications that only need simple text input and output, and SMS or USSD can suffice.

*Text Messages*

With the advent of color touch screens and GUIs, it is easy to forget that there are many potential applications where a small text message is all that is required. Twitter has had a noticeable and profound impact on society, including arguably being given credit for the success of a number of recent government overthrows – all with short text messages. Several systems have recently been created which either augment or build upon SMS: FrontlineSMS (http://www.frontlinesms.com/) is a messaging system which supports message between individual users and a central system as well as distribution of messages to large groups of recipients; Ushahidi (http://ushahidi.com/) is a system whereby the text messages (among other media sources) can be collected, categorized and visualized in a number of ways, including geographic mapping. SMS-based financial transactions and banking has revolutionized how individuals can access and use services that they were previously cut off from.

In summary, ease of use issues, coupled with lack of access to usable facilities (both computer terminal and telecommunications) severely limits the number of people who can benefit from emerging new technologies. That being said, each of the many roadblocks are being addressed, there has been remarkable progress in some areas in recent years, and there is a potential for very significant progress in the near future.

[16] http://en.wikipedia.org/wiki/SMS
[17] http://en.wikipedia.org/wiki/Unstructured_Supplementary_Service_Data
[18] Two examples are Hewlett Packard India's **Site**on**Mobile** - http://siteonmobile.com/ and Google's SMS Search - http://www.google.com/mobile/sms/search/.

## Impediments to Progress

There are a number of impediments to making ICT and particularly Web access universally available and usable. Some of them will decrease in importance due to the evolving progress in a variety of technologies. Others may gradually decrease on their own, but can be greatly impacted by local policy and investment. Some in the latter group will only respond to monumental policy and investment initiatives.

### *Impediments where change is inevitable*

There are a number of impediments to progress which are in the process of changing. It is important to note, however, that this doesn't mean they can be ignored, as explicit action can expedite progress greatly in targeted areas.

**Price:** With the exception of rudimentary voice/SMS mobile phones, end-user equipment (computers, tablets, smartphones) prices are still generally too high to allow widespread deployment. Prices are going down, although there is a natural tendency in the market to keep prices relatively high by adding functionality. Nevertheless, especially in the tablet and smartphone market, there are an increasing number of vendors competing with each other. This will ensure that at least some vendors will view the low-end market as one where they can profit by capturing market-share[19]. There is something "magic" about some price-points. Above these points, devices are deemed to be expensive and only for the rich. Below, they are accessible to all. The actual price will vary depending on the geographic region and the perceived value in the device. Basic mobile phones are clearly in the group of devices deemed to be affordable. Once there are a number of entry-level smartphones and tablets below these critical price-points, this impediment will be drastically reduced.

**Computer Literacy:** The computer skills required to use most applications and perhaps more pointedly the lack of familiarity with computers, is still a problem. However, just as the overall population has become used to mobile telephones, more complex technologies will also be accepted. A key way that computer literacy can be addressed in any population is to ensure that all students are exposed to ICTs in school. As these students interact with their families and enter the work force, they not only take with them the ICT skills gained in school, but act as ICT ambassadors to those without ICT skills. To a large degree, the sooner that all primary and secondary students become familiar with new technologies, the sooner this issue will become irrelevant. As a start, it is imperative that all post-secondary school graduates have been exposed to computers and the Internet.

### *Impediments where change is coming but can be greatly helped by policy and investment*

**Perceived Value:** The growth rate in apps for smartphones in developed countries is the kind of growth that one can expect when there is a large perceived demand. Although there is abundant anecdotal evidence of benefits of using ICTs to improve income, health care and education, there seems to be relatively little interest (or perhaps ability) to develop such applications at a really high rate. This is changing as the number of success stories grows, but the rate of such development is not nearly at the rate that is predicated by the potential benefits. There are likely a number of reasons for this, including the lack or qualified developers and the lack of seed money to fund development and pilot projects. But ultimately, all reasons devolve into a lack of perceived benefits for society in general, and for profits for commercial organizations. More efforts need to be put into identifying opportunities and encouraging their development and deployment. Moreover, there it needs to be viewed as a marketing issue to ensure that the people in positions of authority are aware of the potential benefits.

[19] Often referred to as "Bottom of the Pyramid" markets - http://en.wikipedia.org/wiki/Bottom_of_the_pyramid.

**High-Level Computer Related Skills:** There is still a lack of people with moderately high levels of computer literacy to design applications, oversee projects and act as local experts to provide advice, maintenance, infrastructure, etc. The lack of computer literate and technology-capable people is typically seen as a problem in its own right. That is, for a region or country to participate in the modern-technology-based world, technological skills need to be available. But it is perhaps a larger problem, and an ironic one, in that the lack of such people, particularly in outlying areas, can severely limit the deployment of people-friendly technologies. To successfully deploy new technologies that do not need a high-level of skill to use, there need to be infrastructure people who do have a high-level of skills to support the new technologies.

**Interface Design Skills:** The design of easy to use applications requires specialized skills which are often different from "computer literacy" skills. In fact, often those with the best computer skills are poor at interface design, because they are so far removed from the novice user. It is a skill which is generally not taught in schools, but that needs to be changed.

**Literacy:** The lack of literacy is of course a major impediment to widespread Web deployment. Universal primary education is one of the key Millennium Development Goals[20], and it is one of the Goals that has seen marked improvement over the last 20 years. However, despite progress, it is now predicted that the goal of universal primary education by 2015 will not be met, with the problem being largest in sub-Saharan Africa and Southern Asia, and with girls still trailing boys. Moreover, just as in many developed countries, some students who get through school still have significant literacy problems. On the plus side, the MDP education goal has led to a better understanding what can be done to improve both the number of students attending primary school, and what needs to be done to make that attendance more effective.

**Language:** Even when literacy is not an issue, language itself can be a pervasive impediment to using the Web and related technologies. For many people, their native language is either rare or non-existent on the Web. Moreover, for many languages their non-Roman character set is not commonly represented on many access devices, particularly mobile devices. Since this problem is by definition a local one affecting only a relatively small population, it will require a local focus to address. Both governments and NGOs in regions where this is a particular impediment need to work with hardware suppliers and software developers in order to, one-by-one, reduce the instances of populations being excluded from new technologies.

**Wireless Providers:** In many cases, wireless providers can either facilitate or hinder the development of applications using their infrastructure. Although it seems natural that they would encourage such use, they are often very reluctant to give other entrepreneurs access to sufficient low-level function or access to their billing mechanisms to allow such development. The SMS-based financial transaction application sited earlier is a good example. To build such a system often requires the direct involvement of the wireless provider and in many cases could not be done without their direct involvement (such as by a bank). A regulatory requirement that they make low-level functions and access to billing available (at reasonable prices) would open the market to entrepreneurs.

Sri Lanka has a population of 21 million, three-quarters of which speak Sinhala, a language spoken only in Sri Lanka and the Sri Lankan diaspora and written in a unique, non-Roman script. (See http://en.wikipedia.org/wiki/Sinhala_language. Sri Lanka boasts a relatively high degree of education and literacy (>90%). Although the population speaking Sinhala is as large as that speaking all of the Scandinavian languages combined, support for Sinhala on computer systems has been slow to develop. Currently no smartphones are available with native Sinhala support. There are several efforts underway, led by local vendors, NGOs and universities, to build web browsers which can properly display Sinhala, and not require specialist skills to install. (See http://code.google.com/p/sett-browser/, http://www.lakapps.lk/clsa/slides-10/5_2.pptx).

[20] http://www.un.org/millenniumgoals/

## Current Work to Ameliorate Impediments

Despite all of the impediments to progress, there are a number of developments which promise significant potential ease of use improvements.

### *Access Devices*

Handset prices are dropping rapidly. The market for smartphones is a fiercely competitive one, with both traditional and new players fighting for market share. Much of the focus is on advanced design and features, but an inevitable result will be that prices will drop, particularly for "next-to-last-generation" handsets. Relatively sophisticated handsets are now available for under $100[21], and the price will undoubtedly go lower over the next few years. That is a price that will start to approach affordability, but it will still require that some "killer application" or a combination of smaller ones makes the device truly useful to its owner.

Although tablet computers have been around for decades as prototypes or as devices targeted at specialized professions or applications, they were generally unheard of until the release of the Apple iPad[22] in early 2010. In the short time since then, tablets have become one of the hottest areas of development and merchandising. Having some of the same characteristics of recent smartphones, but with a more practical screen size, they have caught the imagination of many users, developers and marketers. Although the gestation period has been far shorter than for smartphones, the current situation is remarkably similar. There are increasing numbers of suppliers entering the market and an extremely competitive market has evolved. All of this will serve to increase functionality and decrease prices, both at a fast rate.

### *Input and Output Interfaces*

One important common factor between smartphones and tablets is the touch-sensitive screen[23]. Touchscreens have become very common with recent smartphones and tablet computers, are a key improvement which will allow many who cannot use traditional computers to access technologies including the Web. Pointing with a finger is an innate human capability, and required no education. Using a mouse or similar device to move a cursor on the screen is a far more abstract process and is often not intuitive. Icon-based interfaces will allow those who are neither literate nor computer-literate to interact. Widgets, which access an application through a specific icon, have proven to be very effective on current high-end smartphones and hold great promise as the technology finds its way into entry-level devices. Another innovation is motion sensitive touch recognition. Single finger motion recognition has long been used on touchpads or trackpads which replace a mouse on many laptops. Although a concept that has been used sporadically for decades, multi-touch capability[24] has recently become common, allowing more complex messages to be delivered based on the relative motion of multiple fingers. Both single finger sweeping inputs and multi-finger techniques can allow quite sophisticated commands to be given which are intuitive in nature and yet powerful.

Speech recognition and speech synthesis are both maturing and can be expected to play an increasing role in easy-to-use applications, further reducing the need for specialized training and computer literacy.

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[21] http://www.cnbc.com/id/45433194/100_Smartphone_to_Shake_Up_Asia_Telco_Sector_in_2012, http://www.youtube.com/watch?v=f0NH09ynvCw

[22] http://en.wikipedia.org/wiki/IPad

[23] Although they have received increased visibility with new smartphones and tablets, touchscreens also have a long history, with the first practical use being on the Plato computer assisted instruction system in the early 1970s and more recent applications being ATM baking terminals and supermarket self-check-out terminals - http://en.wikipedia.org/wiki/Touchscreen

[24] http://en.wikipedia.org/wiki/Multi-touch

### *Access through Intermediary Services*

As new technologies and services are developed, there is always a time-lag from the point at which some leading-edge users have access to the time when the technology or service is generally accessible. For Internet based-services, it has become standard practice to develop ways of delivering at least some aspects of the service using already-deployed infrastructure. Two decades ago, e-mail was already in common use, but access to Internet content such as the Web or FTP (file transfer protocol) was not common. Services were set up to allow a user to send an e-mail message requesting that the desired content be send via a return e-mail message.

According to ITU estimates[25], sub-Saharan Africa with a total population of about 816 million people has an estimated 433 million mobile phone subscriptions (53 per 100 inhabitants or averaging more than one per family), all with SMS capabilities. Only 13% of African's have Internet access, and in many cases, such access is not readily available on a regular basis. SMS/USSD message texting and related technologies have the potential for opening up increased application suites to users of traditional voice mobile phones. The concept is not new, in that telephone companies have long offered value added services using text message to provide, for example, sports scores. More recently, SMS has used it to deliver micro-finance transactions[26]. SMS can also be used as an intermediary service to access web-based services. E-mail and weather queries are two examples, but the potential is quite large. Google and France Telecom have recently partnered to provide Gmail Chat service via SMS in Africa, and other Google services are to follow[27]. In addition, since mobile phones are inherently audio instrument, SMS requests can be returned not only via text, but also via voice response.

### *Effect of Improved Access*

Competition and effective regulation will increasingly allow communications costs to drop and for facilities to be deployed in less-populated areas. Increased access will make technologies available to less-educated and less sophisticated audiences. This will to some extent increase the pressure to address ease of use issues so that these new populations can use the now available communications effectively.

### *Synergistic Behavior*

Several of these improvements will work together in a synergistic manner. As an example, icon-enabled touch input coupled with speech output offers intriguing possibilities for user-friendly applications. The end result will be the ability to address many of the ease of use issues for those applications that are suitably enabled.

Specifically, an application that uses icon-based input coupled with touch input (including motion as appropriate); along with speech recognition and voice response output could effectively avoid all of the literacy, computer literacy and language issues.

The same technologies that can address the disadvantaged can also be used, often in tandem, to support access for those who are physically disabled. The details of the implementations may vary, but many of the technologies will be the same. Accordingly, it is likely that many applications written for those who lack literacy and computer literacy may end up being directly usable by those with some classes of physical disability, without the requirement for additional hardware or software.

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[25] http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html

[26] M-PESA is a good example – see http://www.youtube.com/watch?v=zQo4VoLyHe0 for a quick tutorial and http://www.strathmore.edu/pdf/innov-gsma-omwansa.pdf provides an interesting perspective.

[27] http://online.wsj.com/article/BT-CO-20110727-705815.html

The Igliniit Project in Clyde River (Kangiqtugaapik), Nunavut in Northern Canada is an interesting example of how far one sometimes needs to go to make something "usable". (See http://nsidc.org/research/projects/Gearheard_Igliniit_Project.html, https://gcrc.carleton.ca/confluence/display/ISIUOP/Igliniit+Project, http://www.nunatsiaqonline.ca/stories/article/8567_handheld_field_computers_record_inuit_knowledge

The intent of the project was to allow Inuit hunters to record their environmental observations including weather conditions and wildlife encountered in such a way that it could be readily mapped and used. Such data would be instrumental in refining the weather forecasting in the far north, and in understanding the impacts of changing weather patterns on wildlife and therefore on the populations that depend on them. The challenges were large in that the devices to be used had to function in extreme weather conditions, had to operate using the non-Roman character Inuktitut language as well as icons and be operable by hunters dressed for temperatures as low as -40°C. (See http://en.wikipedia.org/wiki/Inuktitut) The hunters were intrigued and cooperative, but had no prior computer skills. The ruggedized handheld computers and GPS to document were used to input weather, wildlife, landmarks and other sightings which would automatically be tagged with time and location. Interestingly, the GPS location was not available to the hunters who had no need of it – despite the lack of what non-natives would consider landmarks, and the weather conditions which obliterate what could otherwise be seen, they can find their way to their hunting grounds and back home again without such gadgetry.

## Important Gaps in Knowledge

As mentioned at the start of this chapter, usability is not an exact science, and what proves to be easy to use varies based on the particular user group. Over time, designers can come to understand what may likely work and what may not. The type of application that is envisaged (icon based, touch screen, voice response, perhaps speech input) is currently relatively uncommon and there is not a lot of experience in building them and understanding what works and what doesn't. Because of the advent of the current generation of smartphones and tablets, we are just beginning to gain some experience, but even those do not tend to include the aural components. To become widely used, end-products (both applications and software) must be reasonably low-cost. However, it is important to realize that the cost of building experience and developing prototypes may well be expensive, and it will take some time for this body of knowledge to coalesce.

To facilitate this happening, we need to build online communities and databanks to share experiences, methodologies, toolkits and guidelines for targeting disadvantaged communities. Topics should include, but not be limited to:

- finding smartphone and tablet vendors that are interested in joint ventures to serve under-served linguistic or other disadvantaged communities;
- successful applications that can be replicated;
- open-source resources with which to build these applications;
- toolkits and guidance on how to build applications accessible to those without high-end terminals and ICT skills.

Modern translation software[28] is not based solely on tables of word correspondences and grammar rules, but on statistical analysis of the languages and on knowledge gained by the analysis of documents that are available in multiple languages. For grammar based translation, the rules need to be created by people who both understand the translation process and are fluent in the language. The specifics of this vary depending on which one of several translation methodologies is being used. Regardless, this body of knowledge may not exist in a usable form for many of the indigenous languages found throughout the developing world.

[28] http://en.wikipedia.org/wiki/Machine_translation

Fishing is a key industry in Trinidad and Tobago. mFisheries is a project to provide a variety of resources to this industry. (See https://www.edu.tt/cirp/mfisheries/, http://www3.sympatico.ca/alan.greenberg/W3C/TrinidadTobago.htm) mFisheries is a suite of mobile applications developed for persons involved in fisheries such as small scale fisher-folk, processors, retailers, wholesalers and consumers. The full version, which requires an Android-based smartphone, includes a virtual fisheries market place, daily fish market prices, GPS navigation, a compass, first aid companions, SOS emergency signal and more. Selected functions are available on the Web from any computer (for example for retail stores, wholesalers and consumers) and the virtual fisheries marketplace is available from any mobile phone via SMS. The hope is that with mFisheries, fisher folk can improve their catch and revenue; and those purchasing fish can get fresher fish at lower prices. For the initial trials and deployment, communications services are provided at no cost by a local mobile provider.

## Future Prospects and Promising Areas of Future Work

As described in earlier, there is a lot of work going on, all of which will increase the potential for disadvantaged people to benefit from the Web and related technologies.

The possibilities associated with text-messaging based services must not be ignored. They can reach vast populations virtually immediately and with minimal training requirements. Examples such as weather and market prices sent to farmers and fisherman, and SMS-based e-banking have easily demonstrated the benefits.

The sheer numbers of smartphone and tablet products which will be available at rapidly decreasing prices, all with voice-in and -out capabilities and all with high resolution touch and motion sensitive screens should set the stage for a rapid growth of applications that will not be nearly as limited by literacy, computer literacy and language.

One of the prime challenges in this new environment will be to maximize the number of quality uses of these new technologies. Although smartphones at under $100 and tablets under $200 will be affordable by many, the price is sufficiently high that the investment will only be made if there are sufficient beneficial applications to use, and of course, if telecommunications access is available and affordable.

That will require tools and development guidelines for developers, suppliers who are prepared to build equipment for specialized environments, and an overall environment that can support the increased number of devices (smart phones and tablets).

It is clear that there will be three distinct markets:

- Those where literacy (in a language available on the Internet) and moderate computer literacy can be assumed;
- Those where literacy (in a language available on the Internet) is assumed, but with virtually no computer literacy;
- Those which will not require either.

The requirements for the three may differ markedly, but all are important markets and will need to be developed in parallel.

An area that will need further study and then development is related to the education and tools that designers and developers will need to build these applications. If we are really to see a substantial increase in the number of applications that use sound, icons and touch screens effectively to allow those with little training and technology knowledge to use them effectively, the potential developers will need to be provided with various forms of guidance and tools. They will not themselves be experts in the use of these new interfaces, but it is crucial that the applications they produce be done well.

Security and protection of information and personal data may become an issue and research into the potential problems and solutions should be undertaken. It is unclear to what extent identity theft and related issues will be relevant in areas where credit cards are not common, but they cannot be ignored. Adequate solutions need to be built-in and not later added in reaction to problems.

One issue that will need to be investigated is ensuring that the devices that we are discussing are not prone to be stolen. The theft of desktop computers has been a problem that is generally addressed by tying them down and locking them up. The theft of traditional mobile telephones is generally not an issue - with their low capital cost and the typical low prepaid recharge balance, they are not a major target for thieves. That will not be that case with new smartphones or tablets. Many of the techniques that are used to reduce theft may not work in the environments that we are looking at, so new techniques that diminish the value of a stolen unit must be developed and deployed.

Lastly, it has become common that devices such as laptops, tables and smartphones are viewed almost as disposable items in developed countries. They tend to be deemed to be obsolete and replaced quite often, and if they break, they are often replaced instead of being repaired (partially driven by the relatively high ration of repair cost to purchase price once the warranty expires). Although it is expected that tablets and smartphones will become affordable in developing economies, they will still be relatively expensive and if the only alternative to replacing a one-two year old device is to replace it, the viability of such devices may be questioned. Alternatives must be found.

## Organizational Actors: Their Roles and Responsibilities

There is much work ongoing to address ease of use issues and some of it will proceed without any explicit intervention by institutional players. As mentioned in the previous section, there will be a need for additional standards and guidelines related to input and presentation interfaces, since it is expected that the application developers will not all be experts in what works well with specific classes of users.

The process of determining what does and doesn't work with this brand new set of terminals, application and users will require experimentation and tracking of results. This is a perfect opportunity for donors to fund pilot projects. Unfortunately, the funding of small one-of projects is now somewhat out of vogue, but that is exactly what is needed to encourage experimentation. Fortunately, the now popular funding of startups does provide another vehicle for experimental application design.

Although it is expected that we will see more applications that do not need real computer literacy, there will still be a very pressing need for computer literate people. The need will be threefold:

- Although the focus here has been new and intuitive ways of having users interact with computers, not all applications will be appropriate for new input and output modes. Eventually, it is imperative that most of the population be familiar and comfortable with using technology.

- To design, build and support the myriad of applications and systems needed by a society that uses technology to its benefit, there will need to be a significant group of people who are skilled technologists. It is crucial that every country and community have local people doing this, since it is only those who are embedded in the society who will be able to effectively gauge what is needed and how the technology must interface with that population.
- It is people who understand the benefits of technology who will become the local champions that are so crucial to the success of new initiatives. It is these computer-literate people who will be the enablers for more wide-spread use of the Internet and the web.

Governments, with support of donors must:

- Increase overall computer literacy of those involved in secondary education. Primary education is the ultimate goal, but that is too far out to consider a short-to-medium term goal for most countries.
- Increase computer literacy of those involved in tertiary education to ensure that all those who graduate do so with reasonable hands-on experience and a good appreciation of what ICT can do.

The two tasks are related but the former will be significantly more difficult in most countries than the latter. There are proven models[29] of how moderate levels of funding can transform a college or university from one that is still effectively operating in 19th century environments to one that is adapted to the 21st century. Along with the benefits to computer literacy, the overall academic level and administrative efficiency of the university also improves markedly.

Telecommunications vendors can have a significant impact not just on transmission facilities, but on how they are used. Vendors in both the developed and developing world have already targeted social media with "all you can eat" pricing plans. The result has been a high rate of uptake of these plans. Similar marketing plans aimed at different sectors can have a similarly large impact. Telecommunications vendors need to understand that they will ultimately benefit from a population that uses ICTs well, and it is to their advantage to provide attractive access plans to allow innovating applications that grow and thrive. Vendors who consider themselves part of the local community should even consider subsidized support of targeted efforts to improve and energize high-profile local industries. They must also be receptive to cooperative ventures at all levels.

## Recommendations

1. Donors in conjunction with governments should ensure that all universities have an adequate computer and networking infrastructure and that their staff, students and researchers have liberal access to them.
2. Donors should fund the pilot development of innovative applications of mobile computing with a focus on making technology useful to those with little ICT knowledge or inclination. Such pilot projects must include provisions for more widespread deployment if they are successful. The approach should focus on high-end smartphones and tablets as well as low-end SMS-based technologies to ensure the widest possible penetration.

[29] http://www.sida.se/Global/Partners/Universities%20and%20researchers/Assisting%20Makerere%20University%20in%20Uganda.pdf

3. Governments, through reduced taxation, regulatory or other measures, should make it attractive for technology and communications vendors to support innovative use of ICT to "push usage out to the edges". Such incentives will make the private sector more likely to take risks in exploring new markets.
4. Donors or other research funding groups should fund studies on the use of speech for input and output techniques and on touch input with the goal of developing guidelines and/or standards for their effective usage.

# CHAPTER 4

# Internet Access: Policy Issues for Persons with Disabilities

*Cynthia Waddell*

## Introduction

> "If anybody asks me what the Internet means to me, I will tell him without hesitation: To me (a quadriplegic) the Internet occupies the most important part of my life. It is my feet that can take me to any part of the world; it is my hands which help me to accomplish my work; it is my best friend - it gives my life meaning."
>
> Dr. ZhangXu, China[1]

### What is at Stake for Web Users with Disabilities?

For the first time in history, the Web provides possibilities for users with disabilities to more fully participate in society and for society to be enriched by their diverse contributions. A Web strategy that accommodates the functionality needs of persons with disabilities – such as hearing, visual, cognitive and mobility disabilities- means that many of the barriers that contribute to the disadvantages they experience can be avoided or reduced. Some of these disadvantages include: poor health outcomes; lower educational achievements; lower employment rates; higher rates of poverty; and not being able to live independently or participate fully in community activities.[2] Unless ease of use and functionality is addressed for Web users with disabilities, they will most likely not benefit from Web initiatives supporting economic and social development.

Today, more than 1 billion persons around the world live with disabilities[3] and if this number is to include their extended families, it is estimated that over two billion people daily live with disabilities. Persons with disabilities often live on the margins of society and make up the world's largest and most disadvantaged minority. Perhaps not surprisingly, the literacy rate for adults with disabilities is as low as 3 %, with the rate down to 1 % in some countries for women with disabilities.[4]

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[1] Dr. Zhang Xu, "No Disability in Digitalized Community" January 2001 at http://www.icdri.org/inspirational/no_disability_in_digitalized_com.htm.

[2] *World Report on Disability*, World Health Organization and The World Bank, 2011(Report), p. 263.

[3] *Ibid*. p. xi.

[4] *From Exclusion to Equality, Realizing the rights of persons with disabilities, Handbook for Parliamentarians on the Convention on the Rights of Persons with Disabilities and its Optional Protocol*, jointly produced by the UN Department of Economic and Social Affairs, the Office of the UN High Commissioner for Human Rights and the Inter-Parliamentary Union, p. 1

Did you know?

- 20 % of the world's poorest are persons with disabilities
- 80 % of persons with disabilities live in low-income countries and experience social and economic disadvantages and the denial of rights
- 98 % of children with disabilities in developing countries do not attend school
- 30% of world's street children live with disabilities[5]

## What is Disability?

Historically, many societies have used the medical model approach that focuses on diagnosis and disability in the context of welfare, charity and institutional care. Rather than focusing on the ability of the person and their human rights for equal opportunity and full participation, the focus on the medical model has tended to isolate and segregate persons with disabilities because of ignorance, neglect, superstition or fear.[6]

There is evidence of a paradigm shift underway moving from the medical model to the social model where disability is viewed as an evolving concept with disability resulting from the interaction between the person and attitudinal and environmental barriers.[7] Yet, some believe that disability should be viewed neither as purely medical, nor as purely social, because persons with disabilities can often experience problems arising from their health conditions. The 2011 World Report on Disability calls for a balanced approach that assigns appropriate weight to the different aspects of disability.[8]

## What Drives the Development of Public Policy for Ease of Use?

Even though there may be differing views as to what constitutes a disability, there is a growing recognition of the importance of mainstreaming the disability perspective for sustainable development. Accessibility to information and communications technology (ICT) requires public policy recommendations to include the disability dimension in a broad spectrum of social and economic concerns.[9] In fact, three overarching public policy drivers now inform our public policies on ease of use for the Web:

> **Disability and Human Rights**, including the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD);[10]
>
> **Disability and Development**, including the bidirectional link to poverty;[11]and
>
> **Disability and Demographics**, including global ageing and economic sustainability.[12]

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[5] Ibid.
[6] Waddell, Cynthia D. "Overview of Law and Guidelines" in *Web Accessibility: Web Standards and Regulatory Compliance*, Thatcher, Waddell et al. (Apress, 2006), p. 54.
[7] See UN Convention on the Rights of Persons with Disabilities. (UNCRPD) Article 1 provides that "persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others."
[8] See Report, infra.
[9] United Nations Commitment to Advancement of the Status of Persons with Disabilities at www.un.org/esa/socdev/enable/disun.htm.
[10] See UNCRPD website at http://www.un.org/disabilities/default.asp?navid=14&pid=150.
[11] See Report, p. 10.
[12] *Ibid.,* p. 34.

The UNCRPD is the first comprehensive human rights treaty of the 21st century. The purpose of the Convention is to promote, protect and ensure the "full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities."[13] It also seeks to combat stereotypes and prejudices and promote awareness of the capabilities of persons with disabilities.

The UNCRPD contains significant information and communication technology (ICT) and accessible Web requirements impacting ease of use and these treaty provisions will continue to exert ongoing pressure on legal, legislative and public policy systems to update laws and policies for compliance.[14] As we shall see below, availability, affordability and accessible web design and content are critical ease of use issues for sustainable development.

Any effort to make the Web more effective to support economic and social development must recognize disability and its bidirectional link to poverty. We know that disability may increase the risk of poverty and that poverty may increase the risk of disability.[15] It may be possible to break the cycle of economic and social disadvantage by making the Web more effective for supporting economic and social development. We also know that national populations are ageing at unprecedented rates and that older persons are at risk of acquiring disabilities.[16] At the same time, social attitudes concerning whether or not older adults should work and contribute to society are being challenged.

## Current State of Play and Impediments to Progress

Today, accessibility barriers to print, audio and visual media can more easily be overcome through Web technologies. This is an improvement from the early years of the Web when the Graphical User Interface (GUI) contributed to the "disability digital divide" - where persons with disabilities could be connected to the Web, but not be able to use it. This public policy problem was the subject of a report commissioned by the National Science Foundation and the U.S. Department of Commerce for the first U.S. conference on the Digital Economy.[17] Since that time, the Web has evolved to support multiple user platforms with voice, text and video that support inclusion.

The Web has increasingly become a channel for obtaining information and services in all sectors of society including banking, education, employment, transportation, health, and government services. We have seen major societal changes in how consumers, including persons with disabilities, conduct transactions, communicate, and access information on the Web around the clock using multiple devices. Yet, at a time when the Web is capable of providing the greatest flexibility for users with disabilities, ease of use issues particular to users with disabilities continue to prevent the Web from being fully supportive of economic and social development for all.

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[13] UNCRPD at Article 1.

[14] See Dion, Betty and Cynthia Waddell "Technical Paper on Accessibility and the United Nations Convention on the Rights of Persons with Disabilities: For an Inclusive and Accessible Society for all," commissioned by the United Nations UNCRPD Secretariat, at http://www.un.org/disabilities/default.asp?id=1537.

[15] Ibid.

[16] Ibid.

[17] Waddell, Cynthia D. "The Growing Digital Divide in Access for Persons with Disabilities: Overcoming Barriers to Participation", commissioned in 1999 by U.S. Department of Commerce and the National Science Foundation at http://www.icdri.org/CynthiaW/the_digital_divide.htm.

## Availability

> "I never knew that I would be employed after I dropped out of the university. ATCB [Adaptive Technology Centre for the Blind] has not only trained me on how to use computers and Adaptive Technologies, but the centre also employs me and is my sole source of income. I travel 25 km every day and I do it with pride and unguided. I have become more independent and I am recognized within my peers (blind friends)."
>
> Hanna Bekele, Ethiopia[18]

Recognizing the importance of the Web, the UNCRPD requires nations to promote access to the Internet for persons with disabilities[19] and recognizes the importance of international cooperation in supporting effective measures for the realization of the treaty.[20] It should not be a surprise that the call for action came from the developing world where the majority of persons with disabilities live. As of July 2011, at least 149 nations have signed the treaty with 102 ratifications.[21]

The lack of Web connectivity in developing countries impacts everyone, including persons with disabilities. But even if Web connectivity and the ICT infrastructure support problems were overcome,[22] the Web might still not be available for users with disabilities who require assistive computer technology (AT).

For example, a person with a visual disability may need screen reading software, a refreshable Braille display or screen magnification software. A person with a mobility disability may need speech to text software, a headstick pointer, or a switch or adaptive keyboard. A person with cognitive or specific learning disabilities might require screen reading software or other aids.[23] Unfortunately, some of the major impediments to progress include the lack of assistive technologies and web development tools available in the local language.

Steps for removing barriers to Web availability might include the following:

- If Web connectivity is via a specific facility, such as a school, Multi-media Center, Tele-center or Internet Café, provide an accessible building for the Web connectivity, including an accessible path of travel, accessible door and accessible computer workstation so that persons with mobility disabilities can access it;[24]
- If Web connectivity is via the mobile phone, ensure that the mobile phones are designed for accessibility so that persons with visual disabilities can use all of the phone features, such as text-to-speech for menus and digital displays, font size/contrast and screen magnification options;
- Ensure that Telecommunication Operators do not inadvertently block hardware and software accessibility features of mobiles upon deployment;

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[18] Statement cited with permission from ATCB, Ethiopia. The International Telecommunications Union (ITU), together with the Adaptive Technology Centre for the Blind (ATCB), initiated a project called the Computer training and Braille transcribing service in Arada sub-city, Addis Ababa in 2008. The objective of the project was to assist persons with visual disabilities to access and use ICTs and to facilitate their integration into the main stream community. See http://www3.sympatico.ca/tamru.

[19] See UNCRPD Article 9: Accessibility.

[20] See UNCRPD Article 32: International Cooperation.

[21] See http://www.un.org/disabilities/. The European Union is also a signatory to the UNCRPD.

[22] For a toolkit on Policies and Regulation to Promote School Connectivity in developing countries, see http://www.connectaschool.org/itu-module/1/2/en/schools/connectivity/regulation/introduction/.

[23] See Mariger, Heather. "Cognitive Disabilities and the Web: Where Accessibility and Usability Meet?" at http://new.ncdae.org/resources/articles/cognitive/.

[24] See Dion, Betty and Cynthia Waddell. "Accessibility Guidelines for Multimedia Centres" UNESCO.

- If Web telephone services are available, ensure that they are compatible with hearing aids[25] and that Total Conversation[26] is provided for people with hearing and speech disabilities;
- Ensure that Web browsers, user agents and mainstream Web software have incorporated accessible design or universal design features;[27]
- Ensure that Web devices have mainstreamed accessible design features;
- Ensure that Web terminals available to the Public have AT that enable persons with disabilities to access the Web such as screen readers, refreshable Braille Displays and Magnification software for persons with visual disabilities; and switch interfaces, alternative keyboards or other AT for persons with mobility disabilities.

One interesting outcome for addressing accessibility is that persons with low literacy also benefit from these same features. For example, cell phones that have text to speech features for menus and displays enable persons with low literacy to access content as well as consumers with disabilities. Also Web content displayed via captions and subtitles on movies, television programming and multi-media assist persons who are learning to read as well as persons with hearing disabilities.

Unfortunately, mainstream ICT Web devices are often incompatible with AT. This problem requires attention to:

- Designing mainstream features for the widest possible range of user capabilities;
- Ensuring Web devices are adaptable for an even wider range of capabilities; and
- Ensuring Web devices can connect with a wide range of user interface devices.[28]

The UNCRPD recognizes the value of the Universal Design of products, environments, programs and services usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. UNCRPD Article 9 on Accessibility also promotes the design, development, production and distribution of accessible ICT and systems at an early stage, so that these technologies and systems become accessible at minimum cost.

Finally, under the UNCRPD, it is not necessary for AT to satisfy the Universal Design definition, since it recognizes that AT may be needed for particular groups of persons with disabilities.[29] It also provides that AT may be a reasonable accommodation to support not only work and employment, but also maximum independence for an individual with a disability.

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[25] Note that in the U.S. hearing aid compatibility is required for IP telephones under the 21st Century Communications and Video Accessibility Act, enacted by Congress in October 2010.

[26] Total Conversation is an International Telecommunication Union service description in ITU-T Rec. F.703 that covers videophone with real time text. It is an audiovisual conversation service that provides bidirectional symmetric real-time transfer of motion video, text and voice between users in two or more locations. It is not only useful for persons with disabilities, but also for anyone requiring textual back-up, technical data, language translations, verbal or signed conversations. See http://www.itu.int/ITU-T/studygroups/com16/accessibility/covnersation.html.

[27] See U.S. Electronic and Information Technology Accessibility Standards at http://www.access-board.gov/sec508/standards.htm.

[28] Report, p.184 citing Best Practices *infra*.

[29] See UNCRPD Article 2 Definition of Universal Design.

## Affordability

> "When we need to use the Internet, we have to come here. Because in other Internet cafés, usually all the computers are occupied and more than anything, it is very rare to find an Internet café where they will let us use JAWS (a screenreader). So our only medium is this (technology community) center."
>
> Tania, Guatemala[30]

> "JAWS costs around 15,000 pesos [$1,000] on average. . . . There is a free version in Spanish; we can download it on the website of ONCE. It is a demo version that works for 34 minutes [thereafter you need to restart the machine to make it work again]."
>
> Alonzo, Mexico[31]

A second major issue in policy and regulatory impact is how to make our use of the Web affordable in developing countries. A growing number of Telecenters, Multimedia Centers or Technology Community Centers have been established in developing countries due to government and UN sponsored projects. Universal Access and Service Obligations (UAS), as well as AT software strategies, can play significant roles in affordability due to the nature of technology and the rapid pace of technological developments.

### *Universal Access and Service Obligations (UAS)*

Looking across the globe, there are no standard definitions for UAS since they can support a number of different goals such as providing a basic service at an affordable price, ensuring comparable retail prices in urban and rural areas, and enabling support for services to schools, libraries, hospitals and the disadvantaged.[32] Many regulators have begun to re-examine traditional UAS since only a decade ago the Internet was beyond the scope of developing countries. UAS definitions and national legislation and policies have been changing to include the Web, as well as persons with disabilities.

Today the Internet is considered a utility and essential tool for social and economic development. Out of 132 countries worldwide with UAS policies and regulations, more than two-thirds include Internet access in the definition of universal access and/or universal service.[33] In addition, as of 2009, at least 30 countries mandate access to broadband, including Brazil, China, Ghana, Kazakhstan, Malaysia, Morocco, Nigeria, Peru, Sri Lanka and Uganda.

According to the June 2011 report, Broadband: A Platform for Progress, the Broadband Commission for Digital Development found that the strategy of relying on Universal Service Funds to promote universal access is being questioned due to market competition and convergence. On the other hand, partnerships between local service providers and municipalities, schools and libraries have provided evidence of the potential to bridge digital divides. The Broadband Commission also noted the close relationship between broadband and UAS policies in that they influence each other and can facilitate better access at lower prices.[34]

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[30] Pal, J., Freistadt, J., Frix, M., & Neff, P. (2009). "Technology for employability in Latin America: Research with at-risk youth and people with disabilities." Seattle: Technology & Social Change Group, University of Washington, p. 67.
[31] Id.
[32] Waddell, Cynthia D. "Meeting Information and Communications Technology Access and Service Needs for Persons with Disabilities: Major Issues for Development and Implementation of Successful Policies and Strategies," Lusaka (Zambia), July 2008, International Telecommunication Union. (Best Practices).
[33] "Universal services" refers to telecommunications services provided to all households within a country, whereas "Universal access" refers to the use of telecommunication services on a shared basis, such as the use of public payphones or public call offices in a rural area. See *Ibid. p.*14.
[34] *Broadband: A Platform for Progress, A Report by the Broadband Commission for Digital Development*, June 2011, ITU and UNESCO.

Notwithstanding the fact that persons with disabilities tend to be poor in developing countries, costs for access to fixed broadband services still demonstrate a digital divide, mainly between Africa and other regions. Broadband access remains the single most expensive and least affordable service in the developing world.[35]

### *Free and Open Source Software (FOSS) AT*

It has been recognized that there is a lack of affordable AT solutions and that it is difficult to bring AT to developing countries when there are very limited resources for expensive technologies such as screen readers or virtual keyboards. Although AT hardware costs have been coming down, there is an increasing concern that there is a need for an AT strategy for free and open source software (FOSS) rather than relying on multiple devices, donations or discounted proprietary software. To the uninitiated, FOSS technology does not mean it is "free" without cost; because the word "free" in FOSS means that the software is freely available for copying, modification or improvement.[36]

One writer argues that reliance on proprietary software in developing countries is ineffective and only postpones tragedy, since it "creates dependency that will block access to educational and employment opportunities as soon as the student needs to upgrade his or her AT or install it in a new machine."[37] Along these lines, one view is that the real obstacle to Web usability has been the lack of awareness of the benefits for supporting and using FOSS AT. For example, one award-winning practice is to provide persons with disabilities with a USB drive containing FOSS so they can utilize the Web; individuals with visual disabilities benefit from FOSS on a USB drive such as a word processor, screen reader and speech synthesizer.[38]

One significant problem is that there is not a central global database that identifies and catalogues the availability of FOSS AT and related foreign language support capabilities. The author has anecdotal evidence of government officials in developing countries calling for FOSS solutions, but not knowing where to get them. This problem comes at a time when iOS and Android applications are exploding with dedicated solutions for mobile devices that are considered expensive in the developing countries. The irony is that affordable "apps" are now available for persons with disabilities on these expensive devices. For example, there are apps for speech augmentation, paper money readers, speech to text dictation and even medical diagnostics for people with hearing and visual disabilities.

### *Accessible Design*

> "When I try to login to http://indianrail.gov.in/, I find it very difficult to book a ticket on account of many inaccessible features on the website. The lack of page headings makes it difficult to navigate and many sub-navigation options are not accessible via the keyboard. . . .[P]ersons using screen readers often cannot complete online transactions successfully and independently. I need to call upon sighted family members to help me with such transactions, which is extremely frustrating as I could easily do all these myself, if only the website were accessible!
>
> Anonymous User, India[39]

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[35] *Measuring the Information Society* 2010, ITU.

[36] See Botelho, Fernando H. F. "Open Source Software-Based Assistive Technologies" in ITU-G3ict *eAccessibility Policy Toolkit for Persons with Disabilities*; Global Initiative for Inclusive Information and Communication Technologies (G3ict), July 7, 2010 at http://www.e-accessibilitytoolkit.org/toolkit/promoting_assistive_technologies/open-source. (G3ict Policy Toolkit for Policy Makers). This concern was one of the drivers for the U.S. Congress to enact the Section 508 legislation discussed later in this chapter. Government agencies would invest in AT only to find that "upgrades" in mainstream software would cause AT used by employees with disabilities to no longer work.

[37] Botelho, Fernando in "We Need an Assistive Technology Strategy not Devices" at https://edutechdebate.org/assistive-technology/we-need-an-assistive-technology-strategy/.

[38] Ibid.

[39] Personal statement submitted to author on condition anonymity.

A third major problem regarding ease of use concerns accessible web design. Whether or not a website is visited for information, entertainment or a transaction, if accessible web design is not implemented, then individuals with disabilities may not be able to use it. In 1995, a blind City of San Jose Commissioner filed an Americans with Disabilities Act complaint that led to a public policy solution and the adoption of the first accessible web design standard in the U.S. for local government.[40]

The following year the World Wide Web Consortium (W3C) launched the International Program Office for Web Accessibility Initiative (WAI)[41] with the support of industry and government funding. Subsequently, the first W3C draft guidelines for accessible web design were published in 1998.[42] Today the W3C continues to lead the WAI and develop guidelines through industry consensus that are regarded as the leading international standards for web accessibility.[43]

Recognizing in part that accessibility standards were needed for mainstream ICT, the U.S. Congress in 1998 amended the Rehabilitation Act of 1973 and directed the U.S. Access Board to conduct rulemaking on ICT accessibility standards, including the Internet. Known as Section 508, the Electronic and Information Technology Accessibility Standards became effective in June 2001 and provide a marketplace incentive to design accessibly by using the power of the purse for procurement of accessible products and services, including the Web.[44] As the largest procurer of technology, the U.S. federal government spends almost $80 billion a year on technology.[45]

Before the UNCRPD opened for signature in 2007, at least 26 countries and jurisdictions had accessible web design laws or policies already in place.[46] These laws or policies followed the W3C Web Content Accessibility Guidelines (WCAG) 1.0; the U.S. Section 508 Web standards, a variation of these rules or rules particular to that jurisdiction. However, harmonization of accessible web design standards and problems of implementation continue to be ongoing issues.[47]

On 3 May 2008, the UNCRPD entered into legal force. Articles 9 and 21 are of particular note:

- Article 9.2(g) requires States parties to promote access to new ICTs and systems, including the Internet; and

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[40] Waddell, Cynthia D. "Overview of Law and Guidelines" in *Web Accessibility: Web Standards and Regulatory Compliance,* infra, p. 56. See also Silicon Valley Business Journal at http://www.bizjournals.com/sanjose/stories/1997/10/27/focus3.html. According to the National Council on Disability (an independent federal agency that monitors the implementation, effectiveness, and impact of the ADA and advises the President Congress), "These [Waddell] standards were important for two reasons: first, because they constituted an acknowledgment of the legitimacy of claims by people with disabilities for access to the Web; and second, because they demonstrated that objective and workable criteria for vindicating these rights could be devised. See *When the ADA Goes Online: Application of the ADA to the Internet and the Worldwide Web*, National Council on Disability, at http://www.ncd.gov/publications/2003/July102003.

[41] See W3C press release at http://www.w3.org/Press/IPO-announce.

[42] See W3C press release at http://www.w3.org/Press/1998/WAI-Guide.

[43] See W3C Web Accessibility Initiative at http://www.w3.org/WAI.

[44] See Waddell, Cynthia. "U.S. Web Accessibility Law in Depth" in *Web Accessibility: Web Standards and Regulatory Compliance* (Apress: 2006).

[45] See Espinel, Victoria. "Making Technology Neutral IT Procurement Decisions" at http://www.whitehouse.gov/blog/2011/01/07/making-technology-neutral-it-procurement-decisions.

[46] See Waddell, Cynthia D. "Worldwide Accessibility Laws and Policies" in *Web Accessibility: Web Standards and Regulatory Compliance* (Apress: 2006). The countries and jurisdictions identified are: Australia, Austria, Belgium, Brazil, Canada, Denmark, European Union, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Thailand, United Kingdom and the United States.

[47] See Assessment of the Status of eAccessibility in Europe webpage at http://ec.europa.eu/information_society/activities/einclusion/library/studies/meac_study/index_en.htm and W3C "Why Standards Harmonization is Essential to Web Accessibility" at http://www.w3.org/WAI/Policy/harmon.

- Article 21(d) provides for States parties, including providers of information through the Internet, to make their services accessible to persons with disabilities.

Later that year, W3C WCAG 1.0 was succeeded by WCAG 2.0 on 11 December 2008. Even with the widespread ratification of the UNCRPD and the updated accessibility guidelines, accessible web design efforts continue to be affected by a number of problems, including:

1. Lack of legislative adoption of accessible web design standards and funding support for implementation and enforcement;[48]
2. Lack of policy guidance and funding for the maintenance and enforcement of accessible web- sites where legislative adoption of accessible web design standards is already in place;[49]
3. Lack of education, training and web development tools in the local language;[50]
4. Lack of business incentives for upgrading and investing in accessible business websites; and
5. Proliferation of mobile devices, as well as web development software and content management systems that do not mainstream accessible design requirements.

## Accessible Content on the Web

> "Due to the lack of captioning in our part of the world, I've turned to downloading subtitles (some are CC) from various websites such as Subscene.com. I depend so heavily on captions that I can watch an entire movie at a friend's house (without captioning) and have no idea what the entire dialogue is about. In my view, there is a gross lack of information about services for the deaf on the Web for the Gulf region and there is no guidance for websites on how to provide access to content, such as the captioning of multimedia or television programming streamed on the Web. . . . Private media corporations here need to start using CC for their entire programs, so we all can have access."
>
> Rashed Al-Foudary, Kuwait[51]

> "Lack of accessible material is hindering my progress in my PhD research since I need to refer to many music books and manuscripts, in different languages, many of them centuries old. However, such materials are not available in accessible formats. Ironically, even projects supposed to make material accessible to everyone end up excluding people with disabilities. For instance, there is a Digital Library project (http://www.dli.cdacnoida.in/) funded by the Indian Ministry for Communication and Information Technology (MCIT) and supported by the Indian Institute of Sciences (IISC), with the stated mission of providing a 'free-to-read, searchable collection of one million books, predominantly in Indian languages, available to everyone over the Internet.' . . . [Ev]en a strategic large scale project promoting free access to literature to the public, has ended up excluding persons with disabilities, as it does not even take simple web accessibility considerations into account."
>
> Anonymous User, India[52]

[48] For example, see study on web accessibility in European countries at http://ec.europa.eu/information_society/activities/einclusion/library/studies/Web_access_compliance/index_en.htm.
[49] See Lazar, Jonathan. "Federal Government website Accessibility – Still a Long Way to Go" in Disability Blog at http://blog.govdelivery.com/usodep/2011/06/federal-government-website-accessibility-still-a-long-way-to-go-.html.
[50] See 2010 "UN Expert Group Meeting on Accessibility: Innovative and Cost Effective Approaches for Inclusive and Accessible Development, Conclusions and Recommendations" at http://www.un.org/disabilities/default.asp?id=1516.
[51] Personal statement submitted to author.
[52] Personal statement submitted to author on condition anonymity.

The UNCRPD requires that nations take all appropriate measures to ensure that persons with disabilities can exercise the right to freedom of expression and opinion, including the freedom to seek, receive and impart information and ideas on an equal basis. These measures include urging private entities on the Web, as well as mass media providers to provide information and services in accessible and usable formats in a timely manner without additional cost to the user.53

These stories from Kuwait and India are examples of the inaccessibility of Web content encountered by persons with hearing and visual disabilities. Frequently, television programming and multi-media on the Web is not captioned in a local language for users who are deaf or hard of hearing. A similar problem also occurs where there is no audio description for users who are blind and need the action described.

Other types of content barriers for persons with disabilities: Web meetings that display PowerPoint content and stream audio without accessibility; and Online Conferencing software that is not usable with assistive technology and does not allow captioning in a resizable window. In the U.S., educational entities involved in long distance learning are subject to web accessibility requirements, including all educational partners for online courses in developing countries.[54]

### *Communication Access Realtime Translation (CART)*

One significant trend impacting accessible content on the Web has been the provision of remote CART[55] or captioning for online meetings, teleconferences and Webinars. For example, at the request of participants with hearing disabilities, UN agencies[56] are using CART for their meetings. Meeting participants can go online to a secure webpage and view real time text as the remote writer listens to the speakers or to the foreign language translator and writes the words to the webpage. Because writers can be remote, the Web is effective for lowering the cost of captioning. Since remote writers do not need to be on site at the meeting to perform their work, there is no need to pay for their transportation and lodging during the meeting.[57]

In addition to overcoming noise and poor conferencing tool connections, CART can also improve literacy and understanding. For example, after experiencing remote captioning on the Web during their meetings, UN members have requested CART in order to better understand and participate in meeting discussions since English was not their native tongue. CART has also been observed to serve as a tension reliever during international negotiations because arguing speakers with opposing views can see they are being "heard" as their words are displayed realtime on a screen. As a result, skilled remote writers or captioners for the Web are increasingly being needed for languages other than English.[58]

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[53] UNCRPD Article 21: Freedom of expression and opinion, and access to information.

[54] For more, see Waddell, Cynthia D. "Accessible Electronic & Information Technology: Legal Obligations of Higher Education and Section 508" *Athen* Access Technology Higher Education Network at http://athenpro.org/.

[55] Communication Access Realtime Translation (CART) or open captioning. For example of CART vendor services, see Caption First at www.captionfirst.com.

[56] For example, United Nations agencies include International Telecommunication Union (ITU) and World Intellectual Property Organization (WIPO).

[57] CART also has benefits for users who do not have disabilities. For example, at the 2010 Internet Governance Forum held in Vilnius, Lithuania, CART enabled participants both online and at the meeting to know what was being said. CART also enabled remote participants worldwide to participate even when the conference tool connection was severed.

[58] Observation of Cynthia Waddell, member of the U.S. Department of State Delegation to the 2009 World Telecommunication Policy Forum in Lisbon, Portugal and the 2010 International Telecommunication Union (ITU) Plenipotentiary in Guadalajara, Mexico.

### *Mobile Devices and Internet Content*

Another significant change in Web content has been the availability of electronic books that can be downloaded and immediately read on mobile devices that are designed with accessible controls and text to speech features, such as the iPad and iPhone. For the first time in history, persons with visual disabilities in the developed world can purchase, download and read an e-book from the Web on their own just like people without visual disabilities. E-books can be purchased at a lower cost and are readily available on accessible electronic readers without having to undergo the costly and time-consuming translation to Braille.

If an e-book is available, a student with an accessible mobile device no longer has to wait for their textbooks to be translated into Braille and be left behind in completing homework and reading assignments. Due to disability rights litigation and the availability of electronic readers in the marketplace that are not accessible, a joint U.S. Department of Justice and U.S. Department of Education letter to college and university presidents has explained the prohibition against the use of the Kindle DX and any inaccessible electronic reader in higher education.[59]

In developing countries, the current cost of accessible electronic readers may be prohibitive. But mobile phone ownership is far greater than household computer ownership, so it is imperative that national policy plans consider the implications for providing CART and relay services as well as accessible electronic books over mobile phone networks for consumers with hearing and visual disabilities.[60] One challenge of providing content on a mobile phone continues to be "how to efficiently render visual Internet content into short, precise, easily navigable, meaningful and pleasant to listen to audio content.[61]

### *Sign Language and Video Communications*

The Web can also provide communication support for people with hearing loss. Although text messaging may be available via cell phone, individuals who are sign-based cannot communicate with each other remotely unless video is available. Yet, even if video were available on a videophone or smartphone, it is a challenge for the deaf community to communicate with the hearing community without relay services.

In developed countries, web video relay services and video telephones may be available for communication in sign language. But in developing countries not only is there a lack of sign language interpreting services, there is also a lack of qualified sign language interpreters. The World Report on Disability finds that rural and isolated communities have difficulty in recruiting and training interpreters and that in a survey of 93 countries, only 30 countries had 20 or fewer qualified sign language interpreters, including Iraq, Madagascar, Mexico, Sudan, Thailand and the United Republic of Tanzania.[62]

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[59] See 29 June 2010 letter from U.S. Department of Justice and U.S. Department of Education to college and university presidents at http://www.ada.gov/kindle_ltr_eddoj.htm.

[60] Connect a School, connect a Community, Module 4: Using ICTs to promote education and job training for persons with disabilities, p. 77 at www.connectaschool.org.

[61] See "Talking and Listening to the Internet: An Application of website Rendering" at http://www.internetspeech.com/rendering_whitepaper.htm.

[62] Report, p. 140.

In developed countries, remote interpreters have been available on the Web to provide communication services when qualified sign language interpreters have not been available locally. In developing countries, the possibilities for training and increasing the number and availability of qualified sign language interpreters could increase significantly if Web support was provided. In fact, there are documented cases in Africa were rehabilitation services were not even available to the deaf community because providers could not use sign language and communicate with them and were unable to assist in providing access to deaf services, information and support.[63]

Finally, the Web can be an effective tool for shared electronic medical records in care continuity for persons with disabilities as well as for telemedicine services and consumer health informatics. The World Report on Disability provides extensive information about how the Internet can play an important role in providing general health care as well as rehabilitation through telemedicine and service delivery.[64]

## An Important Gap in Knowledge

In this chapter we have seen some of the challenges in providing ease of use for persons with disabilities in the developing world. However, there is a significant gap in knowledge that needs to be addressed since it is critical to informing our web policies and strategies for maximizing economic and social development.

This primary challenge is the lack of metadata and ICT indicators on web connectivity and use by persons with disabilities. For example, the publication, **Partnership on Measuring ICT for Development: Core ICT Indicators, 2010**, provides comparable statistics on access to and use of ICTs, including the Internet. The report breaks down Internet individual use and data by age, gender, labor force status and occupation, but fails to collect data on individual disability and/or use of AT.[65]

This issue must be addressed. UNCRPD Article 31 on Statistics and Data Collection seeks to correct this gap in data. It requires States Parties to undertake collection of appropriate information, including statistical and research data, to enable them to formulate and implement policies to carry out the Convention. The information is to be disaggregated, as appropriate, and used to assess the implementation and to identify barriers for removal. Article 31 also requires that this data be available in an accessible manner for persons with disabilities.

This challenge can be addressed through international cooperation and resource sharing. UNCRPD Article 32 recognizes the need for international cooperation to facilitate capacity-building, cooperation in research and access to scientific and technical knowledge, and the provision of technical and economic assistance, including the sharing of accessible AT and technology transfer.

## Current Work to Address Impediments and Future Prospects

A paradigm shift is underway in accessible ICT. In this section we highlight efforts to address problems in ease of use for persons with disabilities in five areas: 1) UNCRPD Country Reports on Ease of Use; 2) ITU Convention Accessibility Resolution 175; 3) Accessible ICT Standards and Procurement; 4) U.S. Accessible Web Legislation and Regulatory Activities; and 5) Private/Public Partnerships.

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[63] Ibid., p. 141.

[64] Ibid.

[65] See http://new.unctad.org/upload/docs/ICT_CORE-2010.pdf. See discussion about the gap in accessible ICT indicators in *G3ict Toolkit for Policy Makers* at http://www.e-accessibilitytoolkit.org/toolkit/developing_policy/Step_1:_identifying_priorities#Analysis.

## UNCRPD Country Reports on Ease of Use

As required under the UNCRPD Article 35, each nation is to submit a report on measures taken to carry out its obligations under the Convention. This report is due within two years after ratification and at least every four years thereafter. These reports as well as comments by the Committee can be found at

http://www.ohchr.org/EN/HRBodies/CRPD/Pages/Sessions.aspx.

For instance, on 14 July 2010, Tunisia reported that some of the schools now have Internet and that persons with disabilities enjoy a discount on Internet services. Tunisia has also established a national strategy for making government websites accessible and is offering incentive grants of 4,000 Tunisian dinars to assist associations in making their websites accessible.

China reported on 11 February 2011 that government websites are now required to conform to WCAG 1.0 and that they will be tested and optimized for screen readers and screen magnifying software, including Chinese JAWS 10. China also reported that a pilot program for webcasting and captioning is underway and that 31 public libraries in Hong Kong are provided with AT and Internet connection with Chinese input software customized for persons with visual disabilities. In fact, over 80 Internet express terminals with AT are now provided in 64 public libraries.

## ITU Accessibility Resolution 175

Both developed and developing countries are members of the International Telecommunication Union (ITU), the leading ICT agency of the United Nations. The work of ITU includes developing technical standards to ensure that networks and technologies seamlessly interconnect, and improving access to ICTs for underserved communities worldwide. Resolution 175 was adopted by the October 2010 ITU Plenipotentiary Conference in Guadalajara and was the first accessible ICT amendment to the ITU Convention. It sets out the work and direction for the ITU to integrate the disability perspective in all of its work, including the adoption of a comprehensive action plan to extend access to telecommunication and ICTs to persons with disabilities.[66]

## Accessible ICT Standards and Procurement

Since 2004 the ISO/IEC (International Standards Organization/International Electrotechnical Commission) JTC1 Special Working Group on Accessibility has been mapping accessible ICT standards worldwide. For the first time a systemic review of worldwide accessibility standards is underway to identify standards and to analyze gaps in standards.[67]

European Commission Mandate 376 to European Standardization Organizations is another significant activity. Recognizing the need for a public procurement policy and practice for accessible ICT, it was launched to develop a solution for common requirements and conformance assessment. It is expected that this effort will result in a European standard for accessibility requirements in the ICT domain to be used as technical specifications.[68]

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[66] Telecommunication/information and communication technology accessibility for persons with disabilities, including age-related disabilities. See text of Resolution 175 in the *Final Acts of the Plenipotentiary Conference* at http://www.itu.int/pub/S-CONF-ACTF-2010/en.

[67] See JTC1 Special Working Group on Accessibility website at http://jtc1access.org/.

[68] For an overview and current information about Mandate 376 effort, see http://www.mandate376.eu/M376.htm.

Lastly, an IP-based pilot project is underway to address access to emergency services by persons with disabilities. Currently, persons who are deaf or have speech disabilities cannot call emergency services in the EU. Named REACH 112, the pilot project involves five EU Member States to demonstrate the use of Total Conversation™- an Internet-based platform that connects users simultaneously in video, voice and text. This project is expected to serve as a blueprint for the extension of IP-based communications, Total Conversation™ and emergency services in the EU.[69]

## United States Accessible Web Legislative and Regulatory Activities

This past year brought public hearings on the Section 508 refresh on the Electronic and Information Technology Accessibility Standards as well as a new Internet regulatory environment under the 21st Century Communications and Video Accessibility Act (CVAA). The CVAA was signed into law by President Obama in October 2010 and includes provisions requiring that captioned television programs be captioned when delivered over the Internet and that IP telephones be compatible with hearing aids. It also requires accessible user interfaces on mobile browsers that connect to the Internet.[70] These accessibility provisions are in line with the UNCRPD ratified by developing countries and could serve as a model.

## Public/Private Partnerships Impacting Web Ease of Use Policies

***Raising the Floor – International -*** http://Raisingthefloor.org
***and the Global Public Inclusive Infrastructure Project -*** http://GPII.net

Raising the Floor (RtF) is an international coalition of individuals and organizations working to make the Web and mobile technologies accessible to everyone with disability, literacy and age-related barriers, regardless of their economic status. Of particular concern are those that are underserved or unserved due to the type or combination of disabilities they have, the part of the world they live in, or the limited resources (financial or program) available to them.

The goal of RtF is twofold: 1) to raise the level of access technology (the floor) that is available to everyone, even those with the least and 2) to create an infrastructure to facilitate the development, distribution, and support of a wider range of more affordable accessibility solutions internationally.

One project of RtF is the Global Public Inclusive Infrastructure (GPII). GPII will build an accessibility technology and settings delivery system into the Internet, so that people with disabilities can access ICTs anywhere, any device. For example, mobile phones, public computers, and even public transit ticket machines, will automatically adapt their interfaces to provide the features that each user needs. GPII is assembling technology teams from mainstream companies and accessibility developers to design and build the architecture for this new model of assistive technology, and are reaching out to consumers, professionals, advocates, and policy makers to explain and explore how it can better work for them. To view a short video about the effort, see http://www.youtube.com/watch?v=YHXSWQvV39k.

[69] See REACH 112 information at http://www.reach112.eu/view/en/project.html.
[70] For more on the 21st Century Communications and Video Accessibility Act, see http://www.coataccess.org/node/32.

***Connect a School, Connect a Community*** http://connectaschool.org

As described on the website above, ***Connect a School, Connect a Community*** is a public-private partnership launched by ITU to promote broadband Internet connectivity for schools in developing countries around the world. Connected schools serve as community ICT centers for disadvantaged and vulnerable groups, including women and girls. They can also serve as hubs to support indigenous peoples and persons with disabilities. Connected schools benefit not only the youth and children who attend them, but also the broader communities where they are located.

The objective is to provide improved access to the latest ICTS and to leverage ICTs for improving the economic and social development of their communities. This is done by providing ICT-based training on basic life skills (language literacy, numeracy and basic ICT literacy), along with training that develops business and ICT-specialized skills.

An online tool is provided online to promote understanding and awareness among government decision makers, donors and partners on the need for coordinated policies, regulations and practices that promote school connectivity and community benefits. This tool includes Module 4: Using ICTs to promote education and job training for persons with disabilities.

***Project F123 -*** *http://f123.org*

Based in Brazil, **Project F123** makes educational and employment opportunities accessible to persons with visual disabilities through affordable software that is developed, distributed, and supported through large scale partnering. More than a product, Project F123 is a scalable strategy to bring free and open source (FOSS) assistive technologies to the masses.

Project F123 was inspired in part by a report from the International Council for Education of People with Visual Impairment (ICEVI) that nine out of every ten children with visual disabilities in developing countries have no access to any education.[71] Project F123 won "A World of Solutions" Award from the Inter-American Development Bank for innovation on low cost assistive technologies for persons with disabilities due to its use of USB drives (or pen drives) to make a complete software solution easy-to-use and accessible for people who do not own a computer.

Project F123 offers a sustainable strategy to dramatically lower the cost of assistive technology, ensure ease-of-use for non-technical persons, provide cultural relevance for the diverse world-wide population of blind individuals, and enable the widespread dissemination of both software and training materials.

The initiative achieves scalability through decentralization or what is called "massive partnering." Through direct partnerships with foundations, NGOs, and government agencies,[72] Project F123 is able to sustain day-to-day operations and receive feedback on needed improvements to software. By using FOSS licenses for their software and Creative Commons licenses for their training materials, they ensure the widest possible dissemination, as well as long-term competitive pricing.[73]

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[71] See International Council for Education of People with Visual Impairment "Strategic Goals 2002-2005" report, published in 2002 at http://www.icevi.org.

[72] For a discussion on some of the other benefits to governments for using free and open source technologies, see Botelho, Fernando H. F.; "R&D and Public-Private Partnerships for Low and No-Cost Assistive Technologies"; Botelho & Paula Consultoria; 2008 at http://www.itu.int/dms_pub/itu-t/oth/06/27/T06270000060042PDFE.pdf.

[73] See Botelho, Fernando H. F. "Open Source Software-Based Assistive Technologies" *infra.*

FOSS licenses also allow for low-cost "localization," or the practice of translating and adapting software to the needs of indigenous and other linguistic minorities so that they too can benefit from modern technology.[74] For example, Project F123 has developed sophisticated tools that include the use of the eSpeak speech synthesizer to offer languages that are not considered financially viable for conventional proprietary software solutions.[75]

## Organizational Actors: Their Roles and Responsibilities

Policy formulation and implementation involves a range of organizations and stakeholders. Overall responsibility will most likely be held at the ministerial or regional government level, depending on the size and autonomy of regions. Since Web ease of use falls within the domain of the UNCRPD, then the Article 33 provisions of national implementation and monitoring will be triggered. Each nation designates one or more focal points within the government for matters relating to implementation. In addition, each nation also establishes an independent mechanism for monitoring the UNCRPD implementation and submitting Country Reports. Civil society, including persons with disabilities and their representative organizations will participate fully in the monitoring process.

## Recommendations

**Recommendation 1: Provide Funding Support for the ITU Connect a School, Connect a Community Project**

Rationale: To support a sustainable strategy for web connectivity and the availability of assistive computer technologies and technical support for schools and communities in developing countries.

**Recommendation 2: Provide Funding Support to Project F123 to bring free and open source assistive computer technologies to developing countries in the local language**

Rationale: To support a sustainable strategy for lowering the cost of assistive computer technologies in developing countries for Web ease of use and to enable the widespread dissemination of both software and training materials in the local language.

**Recommendation 3: Provide Funding Support for Raising the Floor and the Global Public Inclusive Infrastructure Project**

Rationale: To support a project that builds accessibility features into the Internet so that persons with disabilities can access ICTs anywhere, anytime, on any device as described in this chapter.

[74] For example, work was done to translate software to the Quechua language which is spoken by indigenous populations in Peru and other countries in the region. See http://www.taringa.net/posts/linux/1153373/Software-Libre-en-Quechua.html
[75] See http://espeak.sourceforge.net/.

**Recommendation 4: Provide Funding Support for Accessibility Experts with Disabilities to Participate in ICT Standards Setting Organizations**

Rationale: To encourage and promote representation by persons with disabilities in order to ensure that their experiences, views and opinions are taken into account. This is a problem in both the developing and developed world and impacts all persons with disabilities in their use of the Internet. Currently, government and commercial interests pay membership dues, expenses and staff time for their employees to participate in technical standards setting work. Accessibility experts who have disabilities and work as consultants or for not-for-profits lack a funding vehicle to add their voice and experience to standards development from the user perspective. For example, ITU PP10 Resolution 175 established a voluntary trust fund to support accessibility activities such as an expansion of the ITU fellowship program to include delegates with disabilities.

**Recommendation 5: Provide Funding Support for Accessibility Experts with Disabilities to Participate in National and International Web Policy and Legislative Development**

Rationale: To encourage development of inclusive Web policies and legislation that take into account the needs of the community of persons with disabilities. This is a problem in both the developing and developed world and impacts all persons with disabilities in their use of the Internet. Currently there are a number of fellowships available from different organizations to fund experts but they do not designate any spots for applicants with disabilities. The establishment of a funding vehicle for this effort would support the goal of integrating the disability perspective.

# CHAPTER 5

## Good/Democratic Governance

*Raúl Zambrano*

### Introduction

The concept of governance is central to the organization of human affairs. Forms of governance have always existed within families, villages, tribes, religions, nationalities, and nation states. The forms themselves can include elements of autocracy, totalitarianism, democracy, oligarchy, theocracy, meritocracy, libertarianism and anarchy. Elements of control and operation defined by those forms may be exercised centrally or with some degree and pattern of decentralization. Governance rules or structures may be rigid, or may have degrees of freedom that allow them to adapt at varying speeds to changing external or internal circumstances.

Although the concept of governance can be applied to all sorts of processes, institutions and organizations, it is certainly not a new one (Rhodes 1997). The same cannot be said about "good" or "democratic" governance, as this is a specific term that emerged less than 20 years ago.[1]

For the purposes of this chapter, governance is defined as the exercise of political, economic and administrative authority to manage the affairs of a nation-state. Governance encompasses all of the processes, relationships and institutions through which citizens and stakeholders articulate their interests, exercise their rights and obligations and mediate their differences (Pierre 2000). Governance is thus the *distribution of power* among competing groups of actors and networks within a given national (or international) political environment.

Two important points emerge from the above statements. First, governance is quite distinct from government. While the latter certainly does its fair share of governance, not all governance requires the presence of government. Secondly, good governance is a special subset of governance.

From the human development perspective, 'good' governance is indeed democratic governance. Democratic governance entails respect for human rights and fundamental freedoms where people also have a say in the decision and policy making processes that affect their lives. Democratic governance thus feeds into economic and social policies that should be responsive to people's needs and expand the choices they have to improve their own lives. Principles such as transparency, accountability, responsiveness and inclusive participation are core trademarks of democratic governance (UNDP 2002).

There is now substantial evidence that countries can have rapid economic growth without necessarily having to embrace good governance mechanisms and principles (Przeworski 2000). In fact, it is quite feasible to have accelerated growth while both poverty and inequality increase, thus leading to lower levels of human development. These are precisely the gaps that good governance can help to close.

The evolution of the concept of good governance has also seen important shifts where both the globalization process and the emergence of the Internet and new Information and Communications Technologies (ICTs) have played important roles.

[1] Although not exactly the same, this chapter uses good governance and democratic governance as synonyms.

## Context

Whereas in the 1980s most development assistance was mainly centered on economic policies and issues, as reflected for example in the main tenets of the so-called Washington Consensus, the last decade of the millennium brought forward the need to focus more sharply on institutions and institutional development to guarantee the long term sustainability of short term development gains. The rapid evolution of the Internet in the early 1990s coincided with the resurgence of good governance as one of the key aspects of the human development paradigm.

To be sure, institutional development *per se* was not a new issue. There is, in fact, a long tradition in this area, supported by a solid school of thought (Veblen et.al.). But many institutions had disappeared from the development scene since the late 1970s and only those that were linked to economic policies and market development were considered relevant. Be that as it may, the real governance innovation of the 1990s was the introduction of human rights principles, in general, and the participation of additional stakeholders, in particular, into the governance agenda. A shift in the development agenda from pure public sector management to broader good governance approach took place at that time.

The Internet played a key role in this shift. As a new and disruptive technology, the Internet opened up new channels of information, communication, networking and human interaction - among many others, channels that potentially allowed stakeholders anywhere in the globe to have a voice and even take concerted action on global and local issues. In this context, the Internet brought forward *a first wave of "democratization"* in the access to new Information and Communications Technologies (ICTs) and new media channels that were beyond the direct control of both governments and the private sector. By enhancing the potential participation of stakeholders and the general public, the Internet has become a critical factor in the strengthening democratic governance agendas throughout the globe.

Perhaps the best example here is captured by the way in which Internet Governance has evolved since 1995; this subject is handled in brief in Chapter 1. Although this topic goes beyond the scope of this article, it will suffice to say that Internet Governance is the first *successful* example of multi-stakeholder and participatory global democratic governance where a level playing field exists for all sectors and countries involved. Albeit counter-efforts may have started to change this, the evolution of Internet Governance demonstrates that better polices and development outcomes can be achieved if all those who are the direct and indirect beneficiaries of them are part and parcel of the process throughout. Internet governance is an example of democratic governance at work.

Can this be replicated at the national level? The focus of this chapter is to explore the relationships between good governance and the emergence of the Internet and new ICT tools that seemingly empower those at the bottom of the socio-political pyramid and open new ways to distribute power within national and international contexts. The analysis will center on how the critical pillars of democratic governance can be supported (or not!) by the rapid evolution of new ICTs in general and the Internet in particular.

## Millennium 2.0

Although the new millennium brought forward the infamous dot-com crash and a well-known backlash against the use of ICTs for development, the ICT sector as a whole quickly recovered in ways that were not foreseen. Two distinct but related evolutions took place in the first decade of the 21st century.

The first was the enhancement of the World Wide Web, which brought forward a more powerful and empowering platform often characterized as Web 2.0. Social networks are the epitome of such enhancements and are

perhaps the best known example. Simply put, Web 2.0 is the new face of the Internet in the new Millennium. The social networks that Web 2.0 has enabled comprise two core aspects: user-generated content, riding on ICT platforms designed for such purpose and mass communication (Castells 2009) which, using the Internet, allows any user in the network to reach millions, if not billions of people at once and in real time.

The second development relates to the accelerated evolution of mobile technologies and mobile phones in particular. Latest estimates suggest that over 5.5 billion people in the world have access to a mobile device (ITU 2011). Indeed, it is the first time in history that a communication technology has been diffused so quickly to so many people in so many countries in such a short period of time (World Bank 2009). Although some of the numbers quoted in terms of users seemed to be overestimated, there is no doubt that we are witnessing a "wireless revolution" — the second such revolution in 110 years, as the early 1900s brought us the "wireless" telegraph (Headrick 1991).

It is important to bear in mind that wireless technologies have provided a new way, linked to new networks and new technologies, of connecting to the Internet. Wireless networks are today more pervasive than traditional fiber or other fixed line networks, particularly in the developing world. At this time, most mobile users are in possession of basic mobile devices that only provide voice and SMS access. However, even with such basic capacity, new platforms such as Frontline and Rapid SMS provide Internet gateways that allow short text messages to become part of the global Internet, at almost no cost, and be accessed by millions on web sites and social networks. By the same token, "crowd-sourcing" platforms such as Ushahidi empower SMS users to furnish information *en masse* ranging from electoral observation to health monitoring thus gathering intelligence and data that would otherwise be unavailable. Ushahidi, an open source platform developed in Kenya now in use in over 100 countries, is an example of innovation from the Global South.

Furthermore, the rapid development of wireless broadband technologies such as 3G and 4G is starting to provide fast and relatively affordable Internet access. Recent studies indicate that mobile Internet access will be pervasive in less than five years (Cisco, 2011)

## New ICTs, Freedom and Equality

We are now seeing a *second wave* in the "democratization" of access to new ICTs, and of new means of communication. Both of the democratization processes highlighted have benefitted not only from improved technologies and lower access costs, but also from a new wave in the globalization process which started in the late 1980s, and which has by now interlinked most, if not all countries in the world economically, socially and politically. The Internet, social networks and mobile technologies have made it simpler for atomized communities of people to interact, associate, share and mobilize, thus lowering the barriers to collective action (Coleman 2009).

Events in late 2010 and early 2011 in the Middle East and North Africa, the so-called Arab Spring, have reinforced the view that social networking platforms and mobile technologies are critical tools for participation, empowering not only specific stakeholder groups, but also the general public. However, these views are certainly not new. Strikingly similar views were made many years ago in regards to technologies such as the Telegraph (Standage 1998) and Television (Williams 1975). One should thus avoid falling into the old technology determinism trap — the view that new technologies will inevitably lead to positive change and progress around the world.

There are two additional perspectives on the role ICTs can play in fostering democratic governance on a global scale. The first assumes that ICTs in general and Web 2.0 technologies in particular will by default propel peoples' participation, democracy enhancement, and human rights strengthening, to mention a few desirable

objectives. This view is shared by the "Internet Freedom" perspective that argues that freedom will, again inevitably, come if people effectively use the Internet and/or the new ICTs. This view has two related components: one is the freedom to access and use the Internet, which as we saw in the Middle East is not always guaranteed. The other is promoting and achieving freedom as an end in itself by using the Internet and new ICTs, as we also saw in the Middle East.

The second perspective assumes that ICTs are "neutral," i.e. that the use of ICTs to foster good governance does not depend on socio-economic, cultural or political contexts. The issue of gender equity provides a good example. It is usually assumed that ICTs will inevitably help to close the gap between men and women if technology is deployed effectively. We have learned, perhaps the hard way, that this is a naïve view of the issue, and is certainly not the case in real life (Hafkin 2002). Such viewpoints should not distract from the fact that the same technologies that can empower users, foster participation and enhance democratic governance process can at the same time be used to suppress diversity of opinion and control and monitor people's activities, and now in more sophisticated way than ever before in history. Technology *alone* cannot bring about democratic governance on the one hand, or authoritarianism on the other; it is the interaction between people, states, and technology that will determine the paths taken, now and in the future. (Morozov 2010).

The missing link here is the extent to which *democratic) governance* of the new ICTs and the Internet is practiced at the *national level.* Since ICTs are not neutral, their deployment and use should be placed within open governance frameworks and mechanisms where all sectors, including civil society, are included. Although such multi-stakeholder governance structures can be relatively complex, there is already precedent as evidenced by the participatory budgeting processes that Brazil started in the late 1980s and which today is being used in many countries (World Bank 2007). The overall good governance objective should be that adequate policies and regulations are in place to guarantee open access to networks and are based on solid accountability and transparency principles. The so-called "Internet kill-switch" that has already been used in several countries is a reflection of the lack of adequate and responsive governance mechanisms that should have been in place to prevent the shutting down of ICT networks on a national scale.

## Role of the New ICTs in Democratic Governance

Just like historic ICTs, social networks and mobile technologies are best regarded as a *means* to an end. After almost 20 years supporting the use of ICTs to promote human development, international organizations working on economic and social development are well aware that ICTs are enablers that must be strategically harnessed by all sectors — governments, business, academia, and civil society— to have impact on development agendas and democratic participation. As enablers, ICTs can also provide new solutions to many traditional development issues - without necessarily being regarded as a panacea.

The interactive nature of the Internet and 21st century ICTs, which includes user-generated content and multi-stakeholder mass communication, shows that the new technologies also have the potential of *transforming* the way we interact, not only with governments and other national and global instances of governance, but also with other stakeholders on a global scale. Such transformation goes beyond the well-known transforming of business processes in both private and public sectors that the new ICTs can enable. This is an essential point that is often disregarded when ICTs are seen in a purely instrumentalist fashion.

The new ICTs can thus transform *how* we interact and connect. What they cannot do with certainty is to compel us to participate in democratic governance processes. That is still part of human organization and human contact. For instance, while the Egyptian protesters readily acknowledge the role that digital media played in their actions, they also noted that in the end it was the Egyptian people who took to the streets and public squares in protest who brought down the regime. Furthermore, while officials were able to shut down both the Internet and

mobile networks for some time, this event actually exacerbated the protests. In sum, new networking tools do not take the place of genuine human action — they transform and augment it.

The "democratization" of access to ICTs, especially to mobile communications devices, also opens the door for rethinking the way in which development programs are designed and implemented. With this in mind, one key role is to promote the use of ICTs, social networks and mobile technologies to build or strengthen the dialogue and engagement between governments (national, local), and civil society and non-state actors. This will fortify an already weak public sphere or public space where women and marginalized populations could have louder voices and thus be a critical part of decision and public policies making processes that will directly affect their lives and futures.

Governments, particularly in developing countries, should be part and parcel of this process and need to take action before the window of opportunity closes. In fact, they have perhaps for the first time in their history the possibility of effectively reaching out in a timely and dynamic way to millions of people with information and basic services while at the same time listening to them in an open and responsive fashion. Only in this way it will be possible to jointly build more equitable and resilient societies and reach internationally agreed development goals (IADGs).

## Challenges Ahead

The last 15 years have seen acceleration in the process of convergence of technologies. The emergence and strong development of social media, including mobile technologies, at the beginning of the new millennium indicate a faster convergence between ICTs and media and between traditional and new media. This raises a series of democratic governance challenges, some of which are discussed below.

The first challenge is a recast of the old "top-down"/"bottom-up" discussion, this time in the context of the new ICTs and media. The last 20 years or so have witnessed an increased concentration of media where a few large conglomerates control large segments of the market (Croteau & Hoynes 2011). On the other hand, at the same time there has been a "democratization" in the access and use of new ICTs that empowers people to reach out and be active part of the public space.

A key issue here is if the new and independent media (content) outlets, especially the small and medium ones that work at local level, have adequate resources and policy support to survive increased competition in the sector and the ongoing concentration trend. While content can be made available on the Internet, small media and content providers face critical long term sustainability issues that put their own existence in jeopardy, in spite of the short-term opportunities that the Internet provides; nowadays almost anyone can be a content provider and have potential access to large audiences.

A related issue is the appropriate use of intellectual property protection. Content subject to such protection can be useful in the development process, but it is often protected by copyright and rendered inaccessible by high access fees. Technical and medical journals are prime examples of such content. At any rate, this issue has now been framed within the context of global trade discussions and agreements that go beyond good governance *per se*, The second challenge is the public/private dynamic. The "original" Internet, initially propelled by initiatives such as ARPANET and later on by the US National Science Foundation, built its core strength on an open standards development model that encouraged people from other sectors and countries to join in almost spontaneous fashion. This led to the creation of a complex network of networks where private, public, non-profit and academic networks could easily co-exist and interact in smooth fashion. Being a large and decentralized internetwork, individual networks were able to easily join the existing Internet.

A wide variety of public-private models thus exist on the net, a fact that allows small profit and non-profit providers to coexist with large conglomerates. Contrast that with the current social networks, where network effects and economic externalities work strongly against the coexistence of multiple competing ventures in a given social space. The most well known examples of the latter are for-profit, private companies. As such, they are not accountable to the general public, but rather to private investors and shareholders. This in itself raises a series of interesting good governance issues. One could argue that public space, previously thought of as the "public sphere," is being privatized to a large extent.

A third challenge relates to the speed and the degree to which Internet/Web2.0 applications will be able to transition to evolving mobile technology platforms. The very impressive development of mobile technologies has been driven almost entirely by the private sector. Not even the most optimistic ICT enthusiast foresaw the rapid diffusion of mobile technologies that have opened access to quite a few people sitting at the bottom of the pyramid. As an example, mobiles phones are a global phenomenon, much more than the Internet, at least in terms of numbers of users and *ownership*.

Nowadays, NGOs and small entrepreneurs in developing countries are creating many applications for mobile platforms. Poor farmers can report environmental issues and receive price data using SMS. Messages can now reach millions via SMS gateways provided by crowd-sourcing applications which in turn can also be used to monitor elections, report human rights abuses and corruption, and organize doctors' and nurses' visits to poor rural areas.. Social networks, on the other hand, are not as deeply embedded in poor countries and require fast Internet connectivity, still absent in most poor areas of the developing world. However, when closely linked to basic mobile technologies, they can provide a formidable platform to strengthen the "public sphere", help keep it "public" and open to all, and empower people to be part and parcel of democratic governance processes.

## Concluding Remarks

Good governance is central to the achievement of human development. It provides the platform to empower people to have a say in the determination of their own future and thus be part of decision and policy making processes at the national and international levels. In a similar fashion as the Internet and the new ICTs, democratic governance is still relatively young, but growing fast, especially in developing countries.

The rapid evolution of the Internet and mobile technologies have "democratized" the access to new and diverse communications tools and channels that can provide a voice to those who before had little to none. This evolution has taken place in parallel fashion to that of democratic governance in the last 15 years or so. However it seems clear that the new ICTs, and the Internet in particular, can be critical catalysts in enhancing democratic governance spaces at national and global levels; both empower people and foster inclusive participation and multi-stakeholder approaches to tackle governance processes more effectively. However, in terms of democratic governance, the real innovation brought forward by the Internet and new ICTs is not merely quantitative, as reflected by the billions of users of the various technologies and platforms. It is rather *qualitative*, as it engenders transnational, distributed and decentralized networks of stakeholders who can work together and address specific global or national governance issues. In other words, new technologies can *transform* the way in which democratic governance may be brought to bear in different contexts.

The use of these new technologies to transform governance is neither automatic nor inevitable. In the end, it is up to everyone, working and *networking* together, to make this happen.

# CHAPTER 6

## Agriculture

*Shalini Kala*

Agriculture has been in decline and needs to be rejuvenated, especially for the vast majority of the rural poor dependent on it. Improving information flow throughout the chain of production to market can bring in major gains. Today, the advancements in information and communication technologies, highlighted most by the spectacular penetration of mobile phones, present an enormous opportunity to harness them to aid agriculture. Bringing benefits of decentralization and widespread reach, these tools allow for customized solutions to specific and diverse problems, as well as enhancing the effectiveness of global programmes, connecting old and new players, and helping to improve knowledge flows. What will help harness pervasive ICTs for the benefit of smallholders, in particular, and rural communities in general? With a focus on highlighting the importance of smallholders in revitalizing agriculture and making a dent on rural poverty, this piece explores the possible ways in which ICTs can support this process.

### Introduction

Agriculture has been a key driver of development for much of the developed world. In a large part of the developing world, it continues to contribute significantly to individual and group well being, from the household level to the broader society in terms of food security, employment, coping with shocks, and environmental preservation. "Investing in agriculture can have an enormous poverty reduction 'pay off', not only because of agriculture's importance to food security, but also because of economic dependence on the sector in the poorest countries, its labour-intensity and the high proportion of budgets spent on food by poor rural households" (Oxfam 2009).

The importance of agriculture to rural well being cannot be underestimated. It is the source of livelihood for an estimated 86 percent of rural people (2.5 billion people) and provides jobs for 1.3 billion small landholders and landless workers (World Development Report 2008, World Bank). At the same time, approximately 1 billion people, around 70% of those living in extreme poverty (less that US$1.25/day)1, live in rural areas and are directly or indirectly dependent on agriculture and allied activities.

Globally, the total rural population of developing countries classified as extremely poor has declined from 54 percent in 1988 to under 35 percent in 2008. Yet it remains frustratingly high and tenacious in South Asia, where the incidence is still more than 45 percent (500 million) and in Sub-Saharan Africa, where more than 60 percent (300 million) of the rural population lives on less than US$1.25 a day2. All estimates portend ominously, that majority of the poor will remain so for many years to come.

[1] The United Nations Millennium Development Goals Report, 2010 estimated that 1.4 billion people were living in extreme poverty in 2005.

[2] All figures from Annex 1 of Rural Poverty Report, 2011, IFAD.

## Problem

Recently, there is renewed interest in agriculture. In the future, it is estimated that a 70 percent increase in food production would be needed to feed the global population of 9 billion in 2050 (IFAD 2011). However, with nearly a billion people chronically hungry today3, the ability of agriculture to feed the world is under tremendous pressure. While farmers struggle to produce against changing climate, there is a global alert on the expanding destructive impact of agriculture on climate and biodiversity (State of the World Report, 2011). Production costs are rising and productivity growth is slowing; prices have been rising and are expected to plateau at a high level in the coming years (OECD-FAO, 2011). At the same time, with improving incomes in the emerging economies, the demand for food, feed and fiber is expected to increase sharply in the future.

A few years ago, rising food prices and the associated consequences brought the continuing stagnation of agriculture into sharp focus making it obvious that agriculture needs to be rejuvenated; there is also compelling evidence that it will play a significant role in transforming rural areas and rural lives. WDR 2008 reports that growth in agriculture is on average at least twice as effective in reducing poverty as growth outside agriculture. "Agricultural growth reduces poverty directly, by raising farm incomes, and indirectly, through generating employment and reducing food prices". The experiences of China, India and Ghana illustrate this well. It has also been argued that reduction in rural poverty might reduce pressure on natural resources leading to lower level of environmental destruction (Duraiappah, 1998; Agidelo, et.al. 2003).

Of the 1.2 billion people living on less than a dollar a day, approximately 500 million are smallholders, farm laborers and their dependents. And globally, 90 percent farms are small farms (less than 2 hectare in size)4. And even though they cover only 15 percent of total farmland, they contribute substantially to total agricultural production in many cases5. For instance in India smallholders supply over 40 percent of grains and own most of the livestock. In Sub-Saharan Africa, the agricultural contribution to GDP is at 30 percent (Grewal & Boyera 2011). Thus, smallholders present an opportunity, not only to be a sizeable part of agricultural rejuvenation, but also to uplift rural economy through rural poverty reduction. Within this scenario, women and youth would be important groups. Though their ownership rights to land are limited or inexistent, women are substantial contributors in agriculture and produce the bulk of the developing world's food crops. Furthermore, a large proportion of poor rural populations is young. In Bangladesh 50% of the poor are below 18 years of age, in Senegal the figure is 57% (IFAD 2011).

## Agricultural Potential

*The causes of decline in agriculture are many and its revival will need a multi-pronged effort. Farmer-research linkage has been poor and extension hasn't delivered on its promises[6]; access to markets and credit is weak; appropriate insurance products are not available; and farmer participation in policy decisions relating to farming has been generally insignificant. The vast and expanding reach of information and communication technologies*

[3] FAO reported 925 million as chronically hungry in 2010 in the news report (accessed in December 2011) available at http://www.un.org/apps/news/story.asp?NewsID=35909

[4] Anriquez G. & G. Bonomi, 2007, Long-Term Farming Trends: An Inquiry Using Agricultural Censuses, ESA Working Paper No. 07-20, FAO, www.fao.org/es/esa (accessed in December 2011).

[5] Nagayets O., 2005, Small Farms: Current Status and Key Trends, Information Brief, Prepared for the Future of Small Farms Research Workshop, Organised by IFPRI, Imperial College and ODI, Wye, June 2005.

[6] "Perhaps nowhere has information been used to greater catalytic effect than in the field of agricultural development, such as the rapid spread of some new varieties in West Africa, but also nowhere more than agricultural extension has the importance of context specific information been more underestimated." (Chapman & Slaymaker, 2002).

*(ICTs) have remarkable potential to connect actors and enable revolutionary flow of information. Could ICTs significantly contribute to an agricultural revival[7]?*

Decisions on what to plant, when to plant it, how to cultivate and harvest, and where to store and sell and at what price have long depended on knowledge, communication, and information exchange. However, agriculture is a sector beset by challenging information asymmetries spanning the chain of production to market. Farmers still do not get timely and appropriate information for planting, crop management, harvesting, or selling. Availability of reliable risk and financial servcies suffer from the uncertainity characteristic of agriculture. Thus, in a world irreversibly altered by the information revolution, a large number of farmers continue to depend on traditional knowledge and experience. Not surprisingly, agriculture growth has slowed down, stagnating productivity is a concern and post and pre-harvest losses remain unacceptably high at 30 percent (State of the World Report, 2011).

In the developing world, the connection between farmers and rest of the world has been limited to the inputs of suppliers and traders, whether for information on processing, price, markets, or, increasingly, on how to cope with climate change. Apart from agricultural information, the access of the rural folk to critical services (health care and education), social networks and other information (on farm labor and economic opportunities) has also been weak, preventing them from reaching their full potential in life.

Physical distance has long been a cause for the poor connection between rural communities and the opportunities that the world of information offers. New technologies change this dynamic, both individually and in combination with a range of electronic technologies including computers, Internet, email, satellites, television, mobiles and radio, allowing communication over mountains, across seas and, even amongst people speaking different languages[8]. ICT-enabled systems allow efficient collection, storage, and analysis of a large amount of data and are able to disseminate far and fast. The associated revolution in telecommunications offers new opportunities, "to increase the timeliness and availability of critical information, improve its quality and relevance, and offer more cost-effective methods for empowering and ensuring feedback from previously marginalized communities" (USAID, 2003).

In this context of considerable information asymmetry in agriculture, and the potential to address these through ICTs, it is notable that most of the ideas currently on the table for sustainable recovery of agriculture require information-rich inputs. Information will be critical for farmers' access to markets; productivity improvements; reduction of pre- and post-harvest losses; financial and risk management services for smallholders; improved research and development; and the provision of a greater voice for the poor in decision-making and ensuring the accountability of institutions (WDR 2008, State of the World Report 2011).

Information such as credible and timely weather forecasts help reduce uncertainty helping productivity as well as availability of appropriate risk and financial servcies. Similarly, information on nutrition protocols, disease management, and suitable crop varieties would help increase production and reduce losses. The latter would also improve with information on pre and post harvest handling, packaging, storage and processing. Since, wastage in agriculture is substantial at 30 percent, even a small difference here could mean a big leap forward. Futher, with information on price, quality, buyers and sellers, there can be an overall improvement for all actors involved including farmers, traders and consumers, as prices stabilise and wastage is reduced (Jensen 2007).

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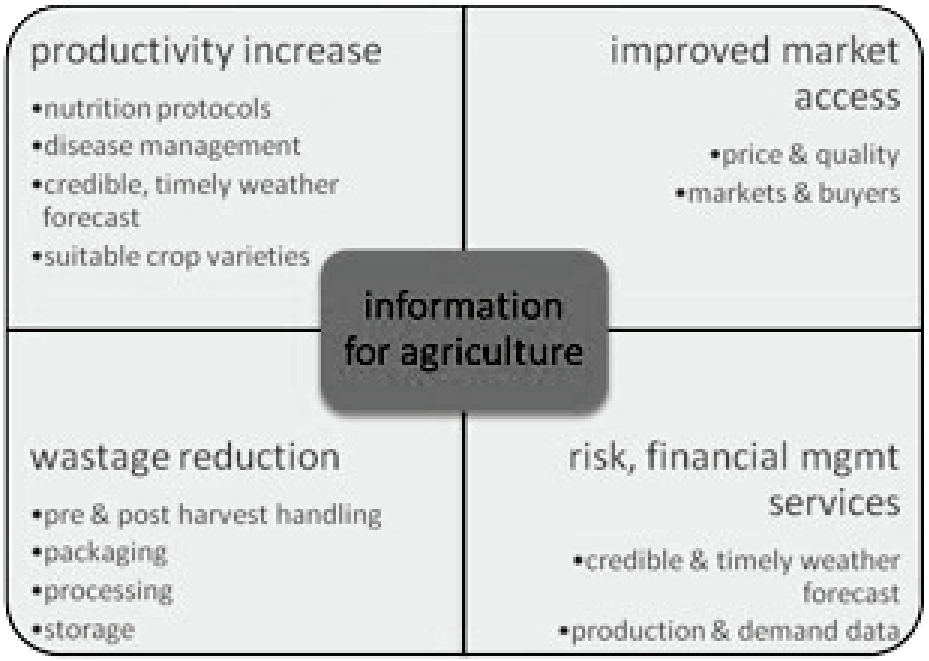
[7] "Information and the technologies that facilitate its use, exchange, and reliability have been important aspects of agriculture and agriculture-related natural resource management for centuries. The importance of information and communication technologies to agriculture is not new, and many traditional methods of managing and communicating information will continue to be critical to developing country agriculture" (USAID, 2003).

[8] There is room for improvement on translation technologies at this point in time.

Figure 1 Information for Agriculture Matrix




Access to relevant information and the ability make timely decisions based on the most current and best knowledge, can enhance farmer incomes through better prices, lowering losses and improving employment opportunities (Aker 2008, Goyal 2010). And in the future, ICT use will continue to influence agriculture economics through better crop and production decisions, as well as land use planning and management of resources. For example, participatory GIS is helping communities manage natural resources of fish, water and forests in new and more sophisticated ways, compared to traditional practices (Quizon, 2009).

In other areas too, ICTs have a powerful effect; for example remote communities are now able to access appropriate and timely health advice in Pakistan and to facilitate changes in health service policies in Uganda (Richard Wootton et. al., 2009). In many places children who couldn't dream of a decent education without moving out of their villages are taking virtual lessons to graduate to higher classes. This is adding to a growing body of evidence that beyond economic gains, access to information can trigger positive changes on other dimensions of farmer livelihood of natural, human, social and physical capital (Grimshaw and Kala, 2011).

Without a doubt, in our world today and in the future, information will remain a strong factor that could transform rural life, whether it is by increasing productivity; lowering transaction and search costs; improving access to health care, education and jobs; securing land titles; expanding social networks; or influencing policies on agriculture and rural development. ICTs present the potential to make this a reality for smallholders and agriculture.

## Agricultural Experience

What do we know about harnessing ICTs to reduce information asymmetries to influence agricultural practice and rural lives? To start imagining the future, let's examine experiences in the past.

Through dramatic increases in mobile penetration, developing nations have only recently felt the promise of connectivity, something that the developed nations nearly take for granted in the 21st century. With the increasing reach and promise of telecommunications over the past twenty years, interest in use of this technology in changing lives has also been rising. There have been several experiments and initiatives exploring use of ICTs in agriculture and rural improvement. The focus, which was on connectivity and access initially, has shifted to applications and use now.

In the early years of the telecom revolution in the developing world, concern about access to connectivity was understandable. Connection to Internet and email was seen as the primary step towards transforming lives and thus, the need for investment in the requisite infrastructure. In this period telecentres – which constituted Internet and computer access points at the village level – were widely experimented with and replicated. While the benefits of information to villagers, farming and rural economies were clearly demonstrated, sustainability and scalability have been of concern. See box below for a comment on the experience of telecentres in improving farmer access to information.

Connectivity continues to expand rapidly in reaching the remotest corners of the world, especially through mobile phones. This has brought into focus beyond connectivity, its use for information, services, networking and capacity building. Initiatives serving specific information needs are growing and have provided early evidence of the benefits of harnessing ICTs to reduce information gaps by improving farmer incomes or reducing loss, leading to increased efficiency (Rashid & Elder 2009; Jensen 2007).

**Telecentres: The promise of agriculture extension?**

Telecentres have been seen as a way to connect remote communities with relevant information for a better life. However, the jury is still out there on how successful they have been in doing so, especially in strengthening agriculture extension. And it is an open question how relevant they will be with mobiles taking connectivity to the remotest corners.

There are numerous examples worldwide, with diverse actors from the civil society, private sector and the government, promoting telecentres. Just like any other essential service for rural areas, ineffective or non-existent agriculture extension could benefit from presence of telecentres if it strongly links research and farmers. While, a body of systematically researched literature on the subject is limited, there are examples, which indicate possibilities. For example farmers in the semiarid region of Kenya are selling their produce directly over Internet through telecentres (http://www.kenyatelecentres.org/telecenters/node/80).

In another Kenyan example, DrumNet centres are helping smallholders become part of the agriculture value chains. Arid Lands Information network or ALIN (alin.net) has been running Maarifa centres in Kenya, Uganda and Tanzania to support rural communities through agricultural information, linkages to market and nurturing info-mediary and community networks for experience sharing. Similarly, e-Agrikultura centres in the Philippines and Nenasalas in Sri Lanka are aimed at supporting farmers with agriculture information. In these cases extension staff members are able to use the centers and help farmers access information as well as send feedback. Further, in collaboration with Indian Council of Agriculture Research and local agriculture universities, Common Service Centers of India are trying to support farmers, with extensionists acting as an important information bridge.

There have of course been disappointments with the telecentre experience. Many a times they remained islands of shiny new technology, or beautiful buildings, out of place in villages, unable to be of much use, let alone support farmers by bringing in relevant information or taking their experiences to others. Sustainability has been the bane of many telecentre initiatives (Etta FE and Parvyn-Wamahu S 2003), and government-sponsored telecentres have often been particularly criticized for this failing (UNCTAD 2010). Moreover, increasing mobile penetration has led to growing number of services using mobiles as the medium bringing information closer to the user, with the ability to deliver a variety of voice and text content, without any additional infrastructure costs.

A wide variety of farmer information and advisory services have become available over the Internet, which have been followed by a shift to short messaging service (SMS), and are evolving to more sophisticated mechanisms using voice and data passing through mobile phones. While Internet-based farmer information systems work well in more developed, literate markets, they have not always proven effective in developing nations[9]. Voice seems to be preferred over text by smallholders in developing countries, and makes it more trusted and viable alternative. While the back-end solutions become sophisticated using advancements in technology, traditional tools like radio and television still have a substantial user-based in rural areas and can offer agricultural information in a timely, readily available and dynamic manner.

Services using such a combination of traditional and new ICTs have also been tested. Farm Radio International (www.farmradio.org) is one example where African farmers receive timely information through radio, the collection of which could involve several other ICT tools such as remote sensing data for weather prediction. In a similar fashion, community radio could become particularly relevant for dynamic information exchange for smallholders residing in low-literacy areas such as Africa and South Asia. Today, "In combination with the Internet and other ICTs such as remote sensors, geographical information systems, meteorological instruments, and satellite imagery, mobile phones are connecting farmers to institutions, relevant information, markets and other farmers faster than any other technology" (InfoDev, 2011).

Increasingly, ICTs are being used to improve delivery of government services by recording and making information available to government officials, managers, and in some cases, the public. Such initiatives include digitizing land records, using GIS to map water resources, other data-driven applications that are useful in designing and monitoring services; providing e-platforms to pay for public services (eg. water, electricity, phones), grievance redressal, citizen engagement in policy formulation, and informing farmers. Tele-medicine and distance education initiatives are targeted at improving the reach of essential services in rural areas.

Thus, increased information flows have simultaneously resulted in reducing vulnerability through better forecasting; optimal use of resources such as water, fertilizer and pesticides; forewarning of cyclones, heavy rain and diseases; and higher productivity for farmers and other rural workers such as artisans through better understanding and negotiation of the market space.

Though the uptake of ICTs to improve information flows in agriculture and rural areas is low[10], Asia (Philippines, India, Sri Lanka, Pakistan, Vietnam, Nepal, China) and parts of Africa (Kenya, Uganda, Tanzania, Senegal) have been the hotbed of several experiments using ICTs to aid agriculture and rural development. InfoDev (2008, 2011), IICD (2006) and IDRC (2008) have been documenting such ICT initiatives and their consequences on rural lives.

This cumulative experience has changed the way ICTs are understood from merely being information tools to social and economic connectors, allowing for networks facilitating knowledge flows amongst a variety of players, affecting development in a more complex way. It's not just about creating large agricultural databases to supply information, but enabling potentially transformative multi-directional knowledge flows among different actors. "Agricultural innovation is understood today to be the result of an interacting constellation of agricultural actors: not just public agencies such as the extension network, but also private firms, NGOs, farmer associations, and others. In this context, ICTs are more than simply a tool to make each entity individually more productive; ICTs offer methods for weaving agricultural actors together into networks that can collectively identify, modify, act on, and implement relevant innovations" (USAID, 2003).

And yet, the use of ICTs in agriculture remains limited.

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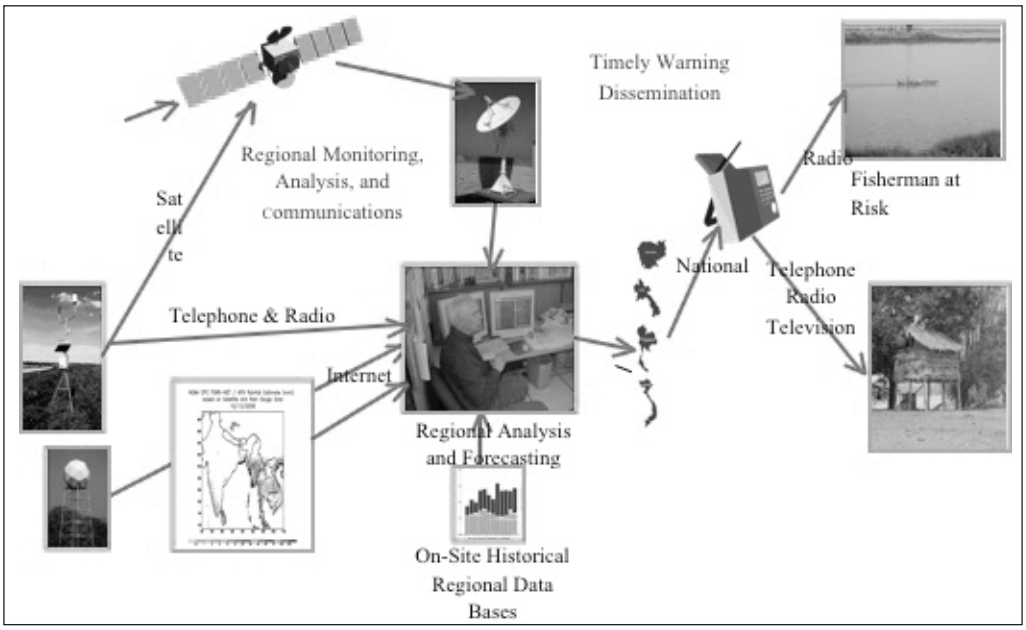
[9] Gakuru et.al, 2009.

[10] Cosoto, M., 2010, "Information flow in agriculture – through new channels for improved effectiveness", Journal of Agriculture Informatics, Vol. 1, No. 2

Figure 2: ICT Ecosystem




An end-to-end system for providing timely warning to communities
*Source: Curt Barrett, Presentation on "Global Experiences to Envision a Cooperative Hydromet System" 4th Abu Dhabi Dialogue, October 2009, Abu Dhabi*

**Information changing farmer incomes and more?**

Several studies on initiative from Asia and Africa have indicated at the possible transformation in farming and farmer lives due to improved information flow aided by use of ICTs. Between 1997 and 2001, mobile phone service was introduced throughout Kerala, a state in India with a large fishing industry. Robert Jensen's 2007 study showed that the adoption of mobile phones by fishermen and wholesalers was associated with a dramatic reduction in the existing price spread in this market and the complete elimination of waste. As a result, the fishermen's profits increased by 8% and consumer prices reduced by 4%.

A pilot project providing latest market price information to farmers in Senegal helped small farmers get higher prices and sell more as their negotiating power increased individually and collectively. It demonstrated the potential for low-cost ICTs to help alleviate rural poverty by creating more efficient markets driven by reliable information and transparent processes. It also demonstrated that rural markets can be economically viable for telecommunications companies that offer innovative applications targeted to local development needs (www.idrc.ca). Expanding over the last several years its coverage to Mali, Ivory Coast and Niger and basket of services, Manobi (a French private telecommunications company) uses Wireless Application Protocol (WAP)-enabled mobile phones to provide information from production through to market, to efficient delivery logistics. Manobi claims that the income of gum growers using its platform to map inventory for exporters using GIS has increased by 40-50% and farmers using market price information service designed to service low-literacy audience have doubled their income.

Soyabean farmers in India's Madhya Pradesh state can access daily prices for all wholesale markets in the state along with agriculture information and weather forecasts through a statewide network of internet-kiosks or e-choupals set-up between 2000 and 2004 by ITC Limited, an Indian multinational company. ITC also offers its own daily price. Aparajita Goyal (2010) showed that "presence of kiosks in a district was associated with an instant and persistent increase of 1.7% in the average price paid at wholesale market in that district. Farmers' profits increased by 33%, and the cultivation of soyabeans increased by an average of 19% in districts with kiosks" (The Economist 2010).

However, there are also findings skeptical of ICTs making a positive change. The most recent amongst these is an assessment of the much-feted.

## The ICT Challenge

*Among the many challenges to the effective and widespread use of ICTs for rural areas are the usual culprits, including illiteracy and weak infrastructure, particularly in electricity and connectivity. Beyond these broad obstacles, lies the question of suitable technologies, relevant content, and applications that are centered on needs of rural communities.*

Looking at a specific example of ICT use and context: handsets are not designed with farmers in mind or with their participation. And the business strategy undertaken in targeting rural markets often doesn't go beyond offering cheap models.

However, it may not be meaningful to offer a cheap phone to farmers which does not run useful applications for farming – if the primary functionality and service offering is talk time, then it shouldn't be a surprise that people will use phones primarily to connect with their friends and relatives, a finding indicated by several studies. However, the dynamics might change if those same phones also offered features and services aimed at small farmers.

Such an effort might also require a redesign of the typical phone, as hot, humid, tropical climates will have an implication on the materials that are used for handsets for small farmers who spend a lot of their time outdoors. Furthermore, content design and delivery needs to take into account social, cultural, language and literacy context, particularly as content is heavily text-based and voice-to-text technologies are still in development. Further, it is important to ensure that content is locally relevant for ICTs to effective support agriculture. For instance, while data collection abilities have increased rapidly due to telecommunication advances, there is limited understanding of forecasting weather for tropical areas, making it difficult for farmers to find useful information. At the same time highly commercialized vineyards in the developed world, stretch the limits of ICTs using mobile computing, telematics, soil and crop sensors, RFID technology linked to regular satellite updates and have the capability of forecasting and managing disease over as short as a 24-hour period[11].

Even with the large and growing IT industry in countries like India and China, applications are predominantly designed in the developed world and tend to focus on the consumer desires and business problems of people in that environment. It would be impractical to expect such product offerings and solutions to effectively address developing country challenges, which exist in a context that is characterized by illiteracy and poor infrastructure. As one might suspect, the World Bank reported a much lower diffusion rate of technologies in developing nations as compared to their developed counterparts (Economist, 2008).

## ICTs and Learning

As we have seen, ICTs remains largely unexploited to support agriculture and rural development. Yet, a body of knowledge from past experience is at hand to guide future developments. It is not surprising that what generally works for interventions targeted at smallholder agriculture – being need-based, localized, and participatory - also applies to those harnessing ICTs. Even though the use of technology and its applications to resolve social problems is a complex process, what is notable is that ICTs are particularly suited to design of interventions incorporating these elements.

[11] J. Burrel. et.al. 2004 and conversation in August 2011 with Kapil Sekhri, Fratelli Wines, India

**Generating Relevant Content: Using and accessing weather information in India**

India is fortunate in having had a vast network of weather stations for decades. It also has a large number of satellites collecting remote sensing information. According to the website of Indian Space Research Organisation (ISRO) India has built and launched "communication satellites for television broadcast, telecommunications and meteorological applications; and remote sensing satellites for management of natural resources". Over the past four decades, more than 60 satellites have been sent to space for applications like mobile communications, direct-to-home services, meteorological observations, telemedicine, tele-education, disaster warning, radio networking, search and rescue operations, remote sensing and scientific studies of space.

Between India Meteorological Department (IMD), ISRO and the Indian Defence Services, a lot of historical and current data exits. However, not only do IMD and the Defence services, both arms of the government, not share data with each other, it is also not freely available to public. Research institutions have access to IMD's data on payment of a fee but cannot share it further and there are restrictions in quoting the information in research papers. Accuracy of the daily weather forecast is still embarrassingly low compared the best available elsewhere in the world; low-resolution mapping is probably one key reason. Since information is not available to others, there is little chance for this to improve outside of that sphere either. Given the size of India, its across-the-board low productivity crop performance, and a sizeable population of the rural poor, losing the information advantage by not making it freely available for research and better predictive ability just doesn't seem to be an option.

There is some change both on the government's side to start releasing data and on the compulsion created by citizens who are increasingly clamoring to access it. For instance, Tamil Nadu Agriculture University has tied up with US based organization (National Centre for Atmospheric Research's Mesoscale and Microscale Meteorology Division, Boulder, Colorado) to provide farmers forecasts - from every 6-hours to three days - up to the village level. They also work closely with IMD to get their data. India Development Gateway also provides similar forecasts for six Indian states. On the other hand some organizations have used the Right To Information Act to access data, but this is probably not the ideal situation to research weather prediction.

**Need-based**: ICT interventions driven by the problems and needs of development are more likely to succeed. Frequently technologies themselves become the focus and fail to satisfy user needs (Cosoto 2010). However, context is critical[12], and tailoring solutions in line with it constitutes the extra set of steps that is needed to make technology socially purposeful and effective. In case of agriculture and rural development, initiatives that have harnessed and packaged technology to address a pressing need were able to demonstrate their usefulness. "The success of community information centres serving small farmers is rural Bangladesh has partly been explained by the careful assessment of client needs…" (UNCTAD 2010). m-Pesa works very well in Kenya, allowing rural consumers to make easy and quick cash transfers. However, similar services have not emerged in India, where an effective and secure system of cash transmission has existed for decades. In Punjab, an agriculturally advanced region of India, farmers didn't use the market prices information service provided by the newly set-up telecentres of Drishtee. Mobiles phones were already available in the area and were being used to access this information through informal networks (Gupta, 2005). However, in other areas of India, Drishtee telecentres were valued as an information access point. Working with local actors in grain trade, e-choupal targeted a specific need of soyabean farmers operating in central India – daily market price information – helping farmers to increase income by making better selling decisions (Goyal 2010).

[12] Among other things, context would include general challenges like poor roads, erratic electricity supply, illiteracy and corruption and could differ over different communities in other ways. It is notable that global connectivity has jumped geometrically compared to progress on these parameters of development.

**Localized**: Farmers find great value in information specific to their needs, supplied in a locally relevant manner[13]. While, it is useful to get general updates on crop or livestock management, timely information on an expected or current disease is valued more as it helps save crops or animals. Similarly, while agricultural information services have been welcomed by users, they work much better when they are in local language, and are voice-based, especially in low-literacy areas, and customized to a particular geographic region. One World's Lifelines and ekgaon's OneFarm are relevant examples. In both cases, farmers find value in the voice-based information. However, Lifelines users in Mewat would like information in the local language specific to their area, whether it relates to agriculture practice or markets. One Farm users have no such issues, as the service is in local language and customized to address each user's farm (Grimshaw and Kala, 2011). Similarly, in much of the low-literate developing world voice-based services are preferred over those sending information through text messages.

**Socially embedded**: While the basket of technologies is changing rapidly[14], the process of applying these technologies to a complex, multi-layered and changing development context is not straightforward. Understanding and addressing this complexity typically involves working with a wide variety of stakeholders, designing appropriate solutions, testing and tracking them. Social innovation and investment are important for effective delivery, diffusion and usability of technology interventions. The Nepal Wireless Networking Project trained local shepherds to maintain remotely placed routers for the wireless system set-up in an isolated mountainous village[15]. MSSRF invited members from the targeted community to operate village knowledge centres that it helped set-up. Since user trust can seriously affect uptake of ICT-based information services, for its OneFarm Service, ekgaon mediated through a farmer federation to strengthen trustworthiness. Several other successful initiatives have partnered with local development players and NGOs.

**Participatory**: Relevant development actors need to be central in defining problems and the path to solutions. Too often, technologies are developed in isolation from those who grapple with development problems. Also, historically, initiatives attempting to address the diverse and complex needs of developing world agriculture have been centralized in nature. Today, however, ICTs make it possible to bring in local information and local actors to add to and improve global efforts[16]. The flexibility of ICTs allows for customizing solutions for specific problems beyond the generic application of broad prescriptions, improving overall effectiveness of agriculture and rural strategies, such as in disseminating information on disease prevention and management, or helping bring back field experiences in order to improve applied research. However, for solutions based on these technologies to become a reality, participation at local level - through engagement of local actors and experts, and through closer connection with local conditions - as well as fostering collaboration amongst key players including development actors, technologists, entrepreneurs and content providers is critical.

The Katalyst program, supporting establishment of community information centres in collaboration with Grameen Phone Bangladesh, illustrates benefits of collaboration amongst different actors for effectiveness and sustainability of information initiatives (UNCTAD 2010). ekgaon's OneFarm service is also a case in point. ekgaon, driven by the lack of customized information packages for farmers, worked with a farmer federation near Madurai in southern India to understand farmer needs, design the information service and deliver it. It collaborated with the local agriculture university - for which it sources weather data regularly through the meteorological station - to get appropriate crop advisory designed. Local agriculture graduates man each of the information call centres of ekgaon. With the help of these partners, ekgaon designed and tested a local-language,

[13] Grewal & Boyera, 2011.

[14] This is particularly relevant for diffusion of technologies. As new ones come up and older ones become obsolete at a fast rate, users find it hard to catch-up.

[15] www.nepalwireless.net

[16] ICTs can be a useful intervention where flow of information, democratic decentralization and good governance are significant factors in effective solutions for development problems (Chapman & Slaymaker, 2002).

voice-based, SMS information service involving software design for the database and tools for the call centre, to send out generic as well as customized information and receive user feedback. Users were involved in both design and tracking of the service and their experience helped refine it. This helped both the fast uptake of the service as well as user willingness to pay for it, thus, making for sustainability (Grimshaw & Kala, 2011).

**OneFarm: Nutrient management information service for farmers**

Given that the agricultural extension system in India has largely failed to deliver appropriate and timely information to farmers, there is a great need for good information. Farmers, especially the small ones, generally do not benefit much from the agriculture research system and also suffer the consequences of remoteness from the market due to both physical distances, as well as the poor ability to negotiate. Lack of information is a key bottleneck in changing this for the better.

OneFarm Services of ekgaon (www.ekgaon.com), is effectively harnessing ICTs to aid farmers. It helps the farmers receive customized and timely information about nutrient management of their farms through personal cell phones as per the crop cycle and variety. The process involved in accessing the service has been made simple, using interactive voice response to capture the uniqueness of each farm. Based on individual farm information, the best possible unique nutrient management solution for that farm is provided in real time.

Information provided is designed for the farm level, is localized, taking into account user needs and characteristics, the content is aggregated and analyzed by local experts, and users have played an important part in design and delivery of the service. The technology solution is closely aligned with local reality and was tested and modified in pilot mode though a federation of farmers. (See more in the box.). Over less than two years after its launch, the service has expanded to several thousand users in Tamil Nadu and to other states such as Rajasthan and Gujarat covering a total of 14,000 users currently . While putting together a judicious collaboration of information providers helped tailor the service closely to farmer needs, user engagement in service design, though time consuming, ensured its high worth and rapid uptake.

The uniqueness of the OneFarm solution lies in the fact that it pulls together a set of relevant and generally missing pieces of information for the farmers, engaging Agriculture Universities, sifting weather data and collecting market prices to provide a holistic and at the same time a customized solution to farmers in real time. OneFarm is particularly innovative in tying all the pieces together to make this a truly farmer-centric and farmer needs-driven service.

## Key Actors

Some of the key actors that could help proliferate and sustain use of ICTs for agriculture include information users, information providers, technologists, entrepreneurs, governments and donors. Several of these entities could, of course, collaborate in supporting farmer needs as well.

**Users:** ICTs allow addressing the diverse and changing information needs of the large number of toiling smallholders in low-productivity agriculture areas. Since localization is key to effectiveness of information services, user engagement is important. Users need to be in a central and leading role, not only in defining needs, but also in identifying entry points for ICT interventions; collaborating with other actors; and aiding with the design, testing and delivery of solutions. Engaging groups such as farmer federations, cooperatives or user groups could provide a practical way to understand needs, deliver services, and receive feedback.

**Agriculture information providers, ICT designers and social innovators:** Working to address user needs, each of these groups have an important role to play. Information relevant for farmers and farming comes from a range of actors. Weather forecasters, soil scientists, seed breeders, crop disease experts, market price providers and others supply different pieces of information. Technical expertise in ICTs is needed for a technology solution to aggregate and deliver on its promise. Social innovators with their knowledge of community behavior help diffusion of technical solutions. While individually these groups are important for creation of ICT solutions, it is the collaboration amongst them and with others that multiplies the benefits of their expertise.

**Entrepreneurs**: While, the benefits of information to agriculture and smallholders cannot be underestimated, designing a profitable information service useful for the farmers is not always easy. The variety of available agriculture information needs to be packaged for users, and most times, is not directly usable like market price. Technology experts are not focused on rural smallholders as technology solutions are mostly driven by rich, urban consumers[17]. As far as the telecom operators are concerned, unless the viability of rural markets is demonstrated, one shouldn't be surprised at their lack of interest in promoting applications for rural users. Thus, it would require an understanding of both technology and the needs of farmers, along with the readiness to tie up all pieces together and the ability to take risks, to generate sustainable ICT solutions for agriculture. Entrepreneurs seem best suited for this and remain vital to the proliferation and sustained use of ICTs for agriculture.

**Government**: An enabling regulatory regime, making available cheap bandwidth, and making public data accessible, is the core responsibility of a government. However, much depends on its political will and management ability (S. Bhatnagar, 2003). Several efforts in India, to digitize land records for transparency, failed before Bhoomi, an initiative of the Karnataka government, managed to put records online. Indian weather data is still not accessible easily. Public funds are critical to create an enabling environment. Sadly, however, The Universal Service Funds (USF) funds lie severely underused in most countries[18] (Pakistan being the exception) which could be used not only for improving rural telecom infrastructure, but also to support the ecology, which allows for pervasive use of ICT tools. For instance, in India, the government invests substantially in developing local language protocols. Notably, government has not been remarkable in implementing ICT for development projects where other development actors have been more successful. For instance, several governments in Asia invested heavily in village telecentres, systematically putting up buildings and equipment, but they struggled with making the facilities work for the targeted community.

**Donors:** Several donors have played a leading role in making critical investments to support use of ICTs in agriculture and over the years their intentions seem to have become more definite. Many organizations started with generalized programs on ICTs for development or placed funds in "ICT" teams. Over time these have evolved into investments marked for specific development sectors such as smallholder agriculture, allowing domain experts to take the lead in collaboration with technologists to explore sector specific solutions. Prominent donors include The World Bank, Gates Foundation, ADB, AfDB, United Nations, Rockefeller Foundation, IDRC and several bilaterals such as USAID, SDC, GIZ, CIDA, Netherlands and Finnish governments. They, directly and through their partners, have been active in encouraging dialogue amongst relevant players, supporting pilots, building evidence for policy, recognizing socially useful interventions (through awards such as Stockholm challenge, Manthan South Asia), and funding ICT initiatives. Lately, mobile companies (Nokia, Vodafone) have also shown interest in supporting initiatives using mobiles. Given the fast changing nature of ICTs, and the low uptake of these in agriculture, donors could perhaps continue to play a role in encouraging testing and validation of interventions, cross-learning and advocacy. Perhaps involving a lab facility, which helps entrepreneurs take ideas to ground such as InfoDev's M-Lab and IDRC's small grants programs, would help entrepreneurs test and modify solutions, and help build evidence for policy makers. Such facilitators may thus assist in helping to establish what works and what doesn't in the user populations; this can be valuable information for private and public actors who are considering their past and future investment decisions.

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[17] In the near future, it would be hard to imagine software developers, competing furiously to create applications for smart phones, to spend some time investigating solutions for developing country agriculturists. Though, of course, they are known to do so for the rich community of large farmers and agricultural companies, where customers, markets and profits are clearly identified. Several developed world companies offer products to automate farm processes, predict disease, and conduct precision agriculture effectively using many different ICT tools. New products are regularly launched.

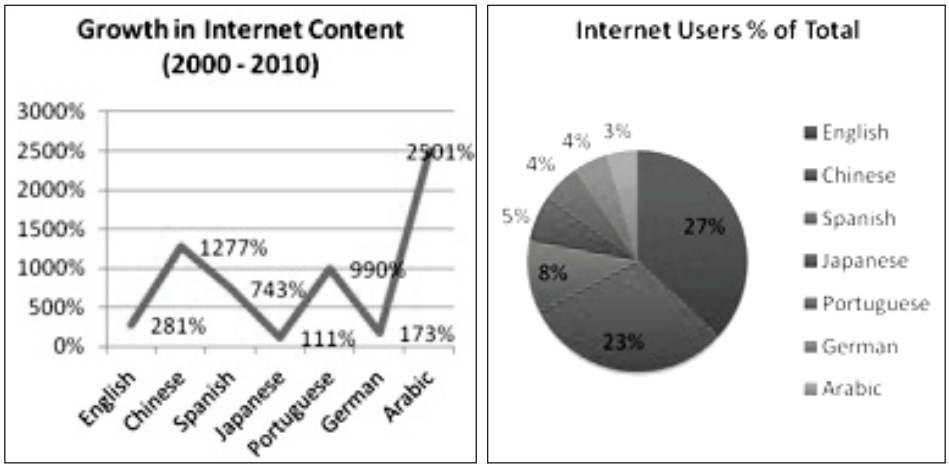
[18] Rohan Smarajiva of LIRNEasia (lirneasia.net) refers to, "…the rule of poorly performing USFs that …(are) good at collecting money, but… terrible at spending intelligently".

## Gaps

Rich learning has resulted from past experiences; yet, there are gaps in our knowledge regarding application of ICTs. A few are described below:

**Information Dissemination**: There is huge amount of agricultural information available in the form of books, reports, and electronic records, including remote sensing and hydrological data. Where and how can this be made accessible in a form that can be used to design better information services to support value chains; and how can the information be reproduced or further processed for wider use? For instance, if it were widely and easily accessible, weather and mapping information could revolutionize agriculture. Real-time weather information helps farmers make informed decisions on how to manage their farms. Forecasts also improve farmers' readiness to deal with diseases or climatic shocks such as heavy rains and cyclones. In the broader market context, access to such information can help firms design insurance and credit products that are suitable for agriculture

Figure 3: Top Languages of the Internet




*Source: www.internetworldstats.com accessed in August 2011*

**Language Barriers**: Localization seems to be an important factor in the uptake of agricultural information service. As far the power of Internet to serve agriculture is concerned, we need to know more about the interaction of local language content with content in other languages and assess the growth of content on both fronts. In the early days, of the Internet, the assumption was that content would predominantly grow in English. It is established now - as indicated in the figures below - that content in other languages such as Chinese and Arabic is growing rapidly and English content on the Net is a much smaller percentage of the total than previously expected. Some information sites offer content in multiple languages www.aaqua.org and local language to transmit voice-based advisory is becoming popular. Internet users on mobile phones are also increasing. Will low literacy restrict Internet use or will text-to-voice technologies create a new dynamic in the growth of Internet content?

**Manufacturing and Application Design for Rural Users**: Mobiles have penetrated spectacularly in the developing nations and yet development of appropriate mobile handsets for rural users lags. Handset makers continue to see this only as a market for cheap phones without any serious attempt to design models driven by user needs. It is similar to the paucity of applications developed specifically to target these groups. What will it take for entrepreneurs to recognize the opportunity of rural information market?

## Prospects

Given the opportunities and challenges that exist today in usefully applying ICTs to support agricultural rejuvenation and rural development, mobile-based endeavors are promising. With their rapidly increasing pervasiveness in rural areas, there is great anticipation not only on how they will be used by themselves, but also in the ways in which they will be combined with other ICTs like radio (Rashid & Elder 2009, InfoDev, 2011). There is growing evidence that a significant number of mobile users are now accessing Internet through their mobile phones. Applications that can ride on mobile phones have the potential to reach farmers and the rural communities and offer the opportunity to aggregate existing content, create new content, allow for user collaboration, and deliver services. Some of the areas ripe for future work are highlighted below.

**Improving information flows** – Farmers need a wide range of information that relates to weather, soil nutrients, crops, varieties, planting and harvesting practices, disease management, storage, grading, processing, markets and prices. There are many information services that are targeted at farmers, mainly ones that supply market prices. However, other needs are not covered adequately as yet; some would entail a more involved process of collaboration with a variety of information sources. In particular, improving weather and climate forecasts can make a significant dent in understanding and managing uncertainty that agriculturists face routinely. ICTs have the potential to energize agricultural extension services and connect farmers and researchers. Additionally, given the nature of agriculture, generalized information services, the kind that are most numerous at the moment, are likely to have a milder impact in absence of those customized for a geographic region involving local actors such as agriculture universities, weather stations, traders and farmers. What kind and range of ICT interventions can successfully improve information flows in agriculture?

**Improving service delivery** – Outreach of government services is typically weak in rural areas. Helping to promote good governance, ICT applications have been successfully used to improve access by better informing targeted beneficiaries, build user feedback to refine design of services, provide services at the door step (railway bookings), improve transparency in implementation, and minimize misuse (electronic voting machines). Improved governance in rural areas is bound to have a positive influence on farmers and the farming environment. The question is how can ICTs help improve services for farmers, or can they?

**Improving accessibility of available information** – On the one hand, uncertainty is characteristic of agriculture increasing risk; on the other, ICTs offer a vastly improved ability to collect, store and analyze related data on weather, water and other natural resources. This has increased the imperative to improve predictability to reduce and manage risk in agriculture. How can available information become more accessible for farmers and other actors in agriculture – for instance crop related information for farmers, or risk assessment information for insurance and credit providers? What would be involved in modifying, processing and repackaging information for application and product design? In the developing world where data is accessible, has this been put to use for improving prediction for farmers, input suppliers, and insurance and credit providers? What research is going on with such information? Are there good models of agriculture risk rating and successful insurance products in the developing world?

**Supporting sustainable models** – ICTs are a dynamic sector with a fast rate of growth of new technologies as well as obsolescence of old ones. Agriculture in particular and rural communities in general have not benefited much from this dynamism, at least not yet. Perhaps these are not seen as profitable markets and the divide between development actors, technologists and entrepreneurs is still too wide to accelerate design of useful applications. The most critical issue is of finding sustainable solutions. What will clarify and highlight the opportunity of rural information market? What will help bring development actors in a central role to harness ICTs for agriculture through sustainable models? What kinds of investment will be needed to trigger collaboration between technologists and entrepreneurs? How can social embedding of technologies be encouraged to improve their chance of success in addressing agriculture and rural development concerns?

Answers to some of the questions raised above and continuing work in the areas suggested will contribute to a better understanding in deploying ICTs to support agriculture and smallholders.

## Emerging Issues

Beyond the specific themes related to agriculture and rural development are the broader questions of applying ICTs to development in general. These have implications for agriculture too. For instance, does piloting work differently for ICTs? Do ICTs, by allowing for close customization, promote solutions that have the ability to go beyond the generic addressing specificities characterizing the wide variety of differing development contexts; and thus making for overall improved effectiveness? Do technology solutions and their social embedding have to move hand-in-hand for effectiveness? Is there a need to support an enabling environment where developers can offer solutions without fear of "failure"? What can "lab-to-ground" efforts hope to achieve, where should they be targeted? Do specific actors have specific roles to play in fully exploiting the potential of ICTs for human development?

These questions too require more research and longitudinal analysis.

## Recommendations

How do we ride the dramatic expansion in telecommunications and associated industry to support agriculture and rural development?

The fast pace of the sector, low entry barriers for individual talent, and evolving profit-sharing models create the challenge of harnessing the full potential of ICTs quickly and efficiently for agriculture. We have learned that beyond the ability to deliver information efficiently to bringing feedback to improve quality of centralized decisions, ICTs can make a fundamental difference to development by allowing the rapid growth of peer networks and virtual collaboration. Even as mobile penetration continues to expand at a fast pace, the regulatory environment and access to infrastructure, road and electricity will remain diverse and challenging for rural areas. The promise then lies in applications that work around these challenges and build on the advantage of mobile telephony to deliver services and information. This could involve a combination of other available technologies and would require innovation in embedding technological solutions for social benefit, as well as entrepreneurial skills in creating sustainable models of ICT use. Supporting an ecology for social embedding of ICTs would include efforts such as promoting user-centric ICT applications through seed support for testing ideas, diffusion of these products and services by encouraging entrepreneurship, and backing mechanisms to build trust and skills among users. How can agriculture benefit from these? Some suggestions follow:

**Support solutions for small holders**: A large percentage of farmers are small holders facing challenges of low productivity and more recently consequences of climate change. Though seen in part as a disadvantaged population, they represent an opportunity to revitalize agriculture. Connecting them to sources of information, networks and institutions can help improve productivity, manage uncertainty and enhance access to essential services. ICTs can play a promising, even transformative role here. Globally, the focus has already shifted to small holders as a necessary step towards progress in agriculture and rural development. This needs to be reinforced in the efforts to employ ICTs for practical and sustainable solutions. Within this group, special emphasis should be placed on women, because they are significant, but often neglected, contributors to the agricultural sector, and also to young people, who constitute a significant percentage of rural poor and are among the most enthusiastic users of ICTs[19]; channeling their energy and curiosity might make for maximum impact.

[19] UNCTAD 2010

**Support efforts to improve accessibility of information:** Farmers and farming are yet to benefit fully from the vast amounts of agriculture information available and being collected. With the advances in modern computing power, the ability to track and generate data at high resolution and great speed, and to access to even the most remote communities, is tremendous. ICTs can be used to make this information accessible for farming. ICTs can help aggregate and deliver information throughout the agricultural value chain to manage cropping; accessing markets; improving accuracy of weather and climate forecasting; and providing timely information inputs for early warning systems. Countries in the developed world have been exploiting ICTs to a much larger extent for this purpose, which has helped spur related services improving productivity and reducing vulnerability in agriculture. The developing world needs more and better services such as in credible weather forecasting.

**Create lab-to-ground facilities**: With technology and its implications for society changing rapidly, the generation of effective ICT-based solutions needs an incubation type of environment. Such incubators offer the opportunity not only to create and test new ideas, but also to discard less effective ones before they attempt to scale. The incubation space is also critical in enabling the development of appropriate business models for the most promising ideas; an imperative at least useful until the recognition of the opportunity in rural information markets can attract funding for such initiatives. The IDRC's R&D grants program (http://web.idrc.ca/en/ev-9609-201-1-DO_TOPIC.html), the Information Society Innovation Fund (ISIF http://isif.asia/groups/isif/) programs, and Infodev's M-Lab are examples of this support system.

**Foster knowledge partnerships**: ICTs allow for the integration of local concerns to convene and lead global efforts on research, dialogue, and policy, facilitating the potential for a decentralized design of solutions. Successful ICT solutions have resulted from collaborations of development actors, technologists and entrepreneurs. Apart from the lab-to-ground facilities, other efforts at bringing these actors on common working platforms to explore partnerships for development could speed up, spread and deepen the use of ICTs. "The need for a concerted effort to build knowledge partnerships and to engage the private sector and technology drivers in the pursuit of rural development goals is paramount if ICTs are to have a role in future strategies" (Chapman and Slaymaker, 2002).

**Build and share evidence continuously**: The exponential growth of digital and telecommunication technologies and the high rate of failure of initiatives attempting to use ICTs for development problems create the imperative to track, build and share evidence on the design and use of applications at a faster rate. How is the technology basket changing – what is becoming obsolete, what is expanding in the marketplace, and what is under development for the future? What social innovations are driving the creation of technology solutions and where are they most effective? What processes work in which situations? What roles are different actors playing? How do we track the changes that technology solutions are bringing about in people's lives? Mechanisms that allow for this type of broad and deep analysis could become important resources for incubating ideas, building partnerships, and informing both policy and practice to harness ICTs for agriculture and rural development effectively.

# CHAPTER 7 

## Health

*Najeeb Al-Shorbaji*

## Introduction

This chapter addresses the use of information and communication technology in health or eHealth. eHealth has been defined by WHO as "the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".[1] This chapter will focus more on the use of Internet to support access to health information and health services. In the core of all this is enabling and empowering individuals and organizations through better access and utilization of health knowledge. "Good health is essential to human welfare and to sustained economic and social development. Knowledge is the enemy of disease, the application of what we know will have a bigger impact than any drug or technology likely to be introduced in the next decade".[2]

In the nineteenth century health was transformed by clear and clean water. In the twenty-first century, health will be transformed by clean clear knowledge. Health is an information-intensive sector that requires extensive data collection, information management and knowledge utilization at all levels and at all times. Information is a major resource crucial to the health of individuals, the population in general, and to the success of the organization. The quality of data and its transformation into information and knowledge are basic to the efficiency and effectiveness of all health information systems and the use of data and information will influence the quality of life of individuals and of health services.

Translating knowledge into action by individuals and to policies by organizations is a prerequisite for success. Timeliness of information and accessing information can be a matter of life or death.

The Information Society, also described as "Knowledge Society", has influenced all aspects of our lives, through the adoption of information and communication technologies (ICTs) in sectors such as government, commerce, banking and education. In the same way that they have become integral to business and government, the use of these technologies in health – eHealth – is our future. This is not unusual as one third of the world population uses the Internet of which 45% are below the age of 25.[3]

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[1] World Health Organization. WHA58.28 eHealth. http://apps.who.int/gb/ebwha/pdf_files/WHA58/WHA58_28-en.pdf

[2] Sir Muir Gray, Director UK NHS National Knowledge Service & NHS Chief Knowledge Officer. http://www.gurteen.com/gurteen/gurteen.nsf/id/muir-gray

[3] International Telecommunication Union. ICT fact and figures, 2011. http://www.itu.int/ITU-D/ict/facts/2011/material/ICTFactsFigures2011.pdf

Transitioning from an industrial society (could be agricultural) to what is known as the 'knowledge society' has been characterized by three interrelated processes, according to Willke[4]:

- The changing contexts and conditions of 'knowledge work', based on specialized knowledge acquired through years of organized professional training and experience;
- The rise of the 'intelligent organization', in which the structures, processes and rule systems have been built in such a way that they can be called 'intelligent', i.e. structures designed intelligently, processes with built-in learning capacity and rule systems that allow existing rules to be changed if necessary; and
- The knowledge economy that comes into being when knowledge work and intelligent organizations are the rule and not the exception

Knowing that health is a basic human right and empowering citizens to get control of and be active participants in their healthcare and wellbeing, it becomes clear that the Internet is one of the major tools to enable a people-centered healthcare system. *The World Health Report 2008*[5] recognized the role of ICTs in improving access, quality and efficiency in primary care as they enable people in remote and underserved areas to have access to services and expertise otherwise unavailable to them, especially in countries with uneven distribution or chronic shortages of physicians, nurses and health technicians or where access to facilities and expert advice requires travel over long distances. While health information has become available in abundance on the Internet, citizens in general and patients in particular have shifted from passive recipient to active consumer of health information. For many individuals and countries spending on health represents an important part of their total expenditure. It is only through high quality information that citizens and governments can make rational decisions on when, what, why and how to spend on health.

## The Web

The Web has become the main vehicle for Internet publishing and dissemination of health information. Anyone, individual or organization, that wishes to publish on the Internet must have a location/address and register their site with the Internet Services Providers. The web is unregulated other than by its users; this is both an advantage and a disadvantage. The advantage is that the philosophy of free speech and provision of information is paramount; the disadvantage is that the user has no guide to the quality or reliability of the output. Most web sites are supported entirely by advertising revenue and this too may distort the policy of the publisher, particularly as the advertising space is often filled independently of the publisher, who may not know what is going to appear there. This means that it is important to choose advertisers carefully and establish criteria for advertising on the site. It is to the publishers' advantage to have a quality site and to adhere to the same standards of production, with due regard for ethics and copyright that they would do if publishing in any other format. Such a site will be accessible to all users, including the disabled and visually impaired, and is designed with readability in mind. For health information perspective this has posed tremendous risk of publishing information that is not necessarily of good quality and might be harmful to people's health. Through the web it has become possible to establish systems such as the Global Health Observatory (GHO) by WHO[6] which is a portal providing access to data and analyses for monitoring the global health situation. It provides critical data and analyses for key health themes, as well as direct access to the full database. Without the web and without such a tool, it would have been impossible to collect, aggregate, compare, analyze and present health data in an easy to use manner.

[4] Willke H (2007). Smart governance: governing the global knowledge society. Frankfurt, Campus Verlag.
[5] More than half of Americans use Internet for health.
[6] WHO. Global Health Observatory http://www.who.int/healthinfo/statistics/en/

The GHO through the Global Burden of Disease (GBD) provides a comprehensive and comparable assessment of mortality and loss of health due to diseases, injuries and risk factors. Global, regional and country estimates are available for mortality, incidence, prevalence, Disability-Adjusted Life Years (DALYs) and other indicators by age, sex and cause.

## Electronic Publishing

Publishers of all types of healthcare and medical education institutions (commercial, academic, government, non-government organizations) are now finding that there is a vast untapped and undeveloped readership around the world, and particularly in developing countries, for online journals, electronic books, promotional materials, news reports, directories and so on accessed through the Internet.

There is no doubt that electronic publishing offers enormous potential for health information delivery. All online journals encourage feedback, discussion and debate and see the Internet as offering a forum for more scientific debate than can be accommodated in a printed version with its limitations on space. In many cases comments on articles are published on the same day as the original article which provides a great opportunity for debate and feedback. Examples of these can be seen in the Lancet (http://www.thelancet.com/) and British Medical Journal (http://www.bmj.com). It also enables them to publish more and faster, and enhances the networking between scientists. In addition to providing search facilities, the inclusion of hypertext links to external sources can transform a journal into a vast databank of navigable information. Links can be included to a range of external sources in addition to links within the journal itself (such as previous editions of a specific column, hotlinks to notes or references and subject threads linking themes across different issues). Instant feedback, real time discussion or electronic conferencing is also possible. The production of full color graphics maybe a cheaper option for an electronic product than is currently possible in hardcopy form. There is the potential for creating multimedia essays combining sound, animation and video clips. One can easily imagine the difference between a printed copy of a book on anatomy and its multimedia version of the same book with 3D animations, audio and video and interactive tests. Software applications could be included to perform data analysis or demonstrate scientific principles. Integration of different products can further enrich the information base by, for example, linking different reference works such as dictionaries and encyclopedias and a number of such products are currently available. Access to raw data in scientific articles in medical journals has been effective in allowing the same set of data to be analyzed by different researchers in different locations. This has substantially increased the value of health data.

## Health on the Internet

There is no comprehensive statistics on the percentage of people using the Internet for health and health related purposes. From some of the countries that have these statistics it is very clear that getting information related to health/health services is one major purpose of using the Internet. Reports indicate that more than half of United Sates citizens use the Internet to search for health information.[7] In 2011, Research by the Pew Research Center's Internet and American Life Project and the California HealthCare Foundation (CHCF) found that 80% of Internet users look online for health information, making it the third most popular online pursuit among all those tracked by the Pew Internet Project, following email and using a search engine.[8]

[7] More than half of Americans use Internet for health.
http://www.reuters.com/article/2010/02/03/us-internet-health-idUSTRE6120HM20100203
[8] http://www.chcf.org/publications/2011/02/health-topics-internet-users-information

Use of Internet in general and for health-related information in particular is influenced by the internet penetration rate in a country. Where internet is not accessible or expensive, we would expect less use for health purposes. Taking the African continent as an example of link between ICT and access to information, the joint ITU/UNECLAC report indicated "The proportion of institutions with websites is low and the content of the sites is frequently limited to generic information. Thus, the resources of the Internet as a tool for business and commerce have yet to make a substantive impact in the pilot countries''. The report adds that in Africa the ICT penetration is generally higher in educational institutions and public administration facilities than in health institutions.[9] This penetration rate has automatically contributed to limiting access to health information and consequently impacted health situation.

## Internet Uses and Services

Different people use the Internet for different purposes whether as a source of health information or as medium for communicating information. Among the top reasons reported[10] are to search for a specific disease or medical problem, a certain medical treatment or procedure, a doctors or other health professionals, hospitals or other medical facilities and health insurance, including private insurance, Medicare or Medicaid.

The following sections will focus on some of the ways the Internet is used to generate, publish, access, communicate, share and use health information. These sections will be supported by examples of the more familiar sites and applications avoiding any commercial or biased sites.

## Access to Health Information

The Internet is a global library of information resources. Access to health information represents a great socio-economic value for human development. Seeking and finding health information on the Internet is influenced by the need for information. The need could be as part of research, to support education, learning, etc. A number of studies have looked into why people use the internet for health ([11], [12], [13], [14], [15], [16]). The following resources are examples of the type of information resources available on the Internet:

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[9] ITU, UNECLAC, national statistical sources and Eurostat (30 November 2007). http://www.itu.int/ITU-D/ict/material/Youth_2008.pdf P. 17

[10] More than half of Americans use Internet for health.

[11] http://www.reuters.com/article/2010/02/03/us-internet-health-idUSTRE6120HM20100203

[12] Sillence, E., Briggs, P., HARRIS, P. R., & Fishwick, L., How do patients evaluate and make use of online health information? Social Science and Medicine, Volume 64, Issue 9, May 2007, Pages 1853–1862.

[13] Why do people go online for health information. http://worldofdtcmarketing.com/why-do-people-go-online-for-health-information/focus-on-patients/

[14] Why do people go online for health information? Part II http://worldofdtcmarketing.com/why-do-people-go-online-for-health-information-part-ii/health-information-online/

[15] Hege K Andreassen, Maria M Bujnowska-Fedak, Catherine E Chronaki, et al. , European citizens' use of E-health services: A study of seven countries, BMC Public Health, 2007 http://www.biomedcentral.com/1471-2458/7/53

[16] Powell, John, Inglis, Nadia, Ronnie, Jennifer , et al. The characteristics and motivations of online health information seekers: cross-sectional survey and qualitative interview study. Journal of Medical Internet Research. http://wrap.warwick.ac.uk/37076/1/WRAP_Powell_fc-xsltGalley-1600-8930-1-PB.pdf

### *HINARI: Health InterNetwork Access to Research Initiative*

HINARI Programme set up by WHO together with major publishers, enables developing countries to gain access to one of the world's largest collections of biomedical and health literature. More than 8000 information resources (in 30 different languages) are now available to health institutions in 105 countries, areas and territories benefiting many thousands of health workers and researchers, and in turn, contributing to improve world health.[17]

HINARI without the Internet would have not existed. Crawford[18] commenting on access to HINARI by developing countries says "of course, before digital dissemination of information was made available via the internet, even to suggest that publishers should make information available in print to the developing world without charge would have been thought preposterous. Publishers have joined with WHO in the HINARI project in the hope that access to digital information will be an important first step in improving health research and teaching in developing countries".

### *International Network for the Accessibility of Scientific Publications (INASP) Programme for the Enhancement of Research Information (PERii)*

Focusing on the needs of people in developing and emerging countries, PERii works with partners to support global research communication by further strengthening:

- The knowledge and skills of people working in research communication
- Participation in international knowledge networks
- Research communication policy and practice

Taking advantage of the possibilities offered by ICTs, the core programme areas focus on access to international scholarly literature, successful writing, publishing and communication of research from developing and emerging countries, effective use, evaluation and management of ICTs to support research, development of modern, digital research libraries and advice and advocacy around the role of research communication and the people engaged in it for sustainable and equitable development.[19]

### *Open Access*

Open-access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions. What makes it possible is the internet and the consent of the author or copyright-holder.[20]

Without getting into the argument of open access vs. other forms of publishing or publishing business models, the health field has benefited from this through improving access to health and biomedical literature as characterized by the many emerging OA journals. The Directory of Open Access Journals[21] includes 757 journals under health sciences of which 78 in dentistry, medicine (general) 463, nursing 38 and 178 in public health.

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[17] HINARI: Research in Health ( http://www.who.int/hinari/en/)

[18] Brian D Crawford, Open-access publishing: where is the value? The Lancet, Volume 362, Issue 9395, Pages 1578 - 1580, 8 November 2003

[19] International Network for the Accessibility of Scientific Publications http://www.inasp.info/file/5f65fc9017860338882881402dc594e4/perii.html

[20] Peter Suber. A Very Brief Introduction to Open Access. http://www.earlham.edu/~peters/fos/brief.htm

[21] Directory of Open Access Journals (http://www.doaj.org/doaj?func=subject&cpid=20)

A listing of free medical journals on the web provides titles of 2423 journals.[22] The site predicts that "Over the next years, the most important medical journals will be available online, free and in full-text. The unrestricted access to scientific knowledge - the new standard in medical publishing - will have a major impact on medical practice".[23]

### *Health science library consortia and networks*

Many institutions and their libraries have negotiated and established formal mechanisms for sharing the existing resources of the health sciences libraries aiming to reduce cost, and increase the number of journals and databases that each library and user can access. All these consortia use the Internet as a platform for making their resources available and accessible. The ultimate goal of these is to improve healthcare services, patient safety and better research. Recognizing that no one single library can serve all needs of its users, health sciences library networks emerged very strongly with greater penetration of the Internet and broadband networks. In addition to the hundreds of networks that most countries have developed to serve national needs, the World Health Organization has developed and maintained a number of them. Most noticeable are the Global Health Library (http://www.who.int/ghl/en/), the Virtual Health Library of the Pan America Health Organization Regional Office for the Americas (http://regional.bvsalud.org/php/index.php?lang=en), the EMLIBNET of the Eastern Mediterranean Regional Office (http://www.emro.who.int/lin/emlibnet.htm), HELLIS of the South East Asian Office (http://www.who.int/library/databases/searo/en/index.html) and African Index Medicus of the African Regional Office (http://indexmedicus.afro.who.int/) in collaboration with the Association for Health Information and Libraries in Africa.

### MEDLINE Plus and PubMed

MedlinePlus is the National Institutes of Health's Web site for patients and their families and friends.

Produced by the National Library of Medicine, it brings to users information about diseases, conditions, and wellness issues in language you can understand. MedlinePlus offers reliable, up-to-date health information, anytime, anywhere, for free.[24]

PubMed Central is a repository of full text, peer-reviewed articles from life science journals. It is not a publisher itself, but instead relies on the willingness of publishers to deposit copies of articles they have published. It is easiest to think of PubMed Central as the equivalent of PubMed, but containing complete articles rather than just abstracts.[25]

## e-LEARNING

**eLearning** or electronic learning is a form of learning whereas electronic media delivers the contents prepared by subject matter experts to one or many recipients through computer networks, most noticeably the Internet. It is learning through the use of modern electronic media incorporating simulations, video, and audio materials, models, demonstrations and animations as relevant, to deliver knowledge. In many cases learning can happen at any place and at any time suitable to the learner's ability. Information can be updated and disseminated eas-

[22] Free Medical Journals (http://www.freemedicaljournals.com/)
[23] Rumi Chunara, Jason R. Andrews , and John S. Brownstein. Social and News Media Enable Estimation of Epidemiological Patterns Early in the 2010 Haitian Cholera Outbreak. Am. J. Trop. Med. Hyg., 86(1), 2012, pp. 39–45doi:10.4269/ajtmh.2012.11-0597. http://www.ajtmh.org/content/86/1/39.full.pdf+html
[24] Medline Plus: Trusted Information for You (http://www.nlm.nih.gov/medlineplus/aboutmedlineplus.html)
[25] PubMed Central (http://www.biomedcentral.com/openaccess/www/?issue=2)

ily and quickly. It meets the need for language, cultural and social diversity. It allows for gender equality and democratization of learning. Some of its major benefits also include the ability of users to communicate with others in real time in different locations, through video conferences, chats or discussion boards allowing for the creation of global communities and communities of practice.

In the African continent where shortage of health workers is a critical issue, Reseau African Francophone de Telemedicine (RAFT) which is an Internet-based learning platform is providing distance continuing education sessions on a weekly basis to several French speaking African countries.[26] The RAFT network is now expanding to English speaking countries in Africa and has the potential and capacity to cover other languages and regions.

The eLearning for Healthcare (eLfH)[27] of the UK National Health Services describes itself as an e-learning programme providing national, quality assured online training content for the healthcare profession. Contributing to the revolution in healthcare training in the UK, e-LfH'se-learning projects enhance traditional learning, support existing teaching methods and provide a valuable reference point which can be accessed anytime, anywhere.

The USAID Global eLearning Centre[28] is a response to repeated requests from field staff for access to technical public health information. Field staff want to be current on global health topics, yet find it a challenge to obtain the information because of logistical and time constraints. The Global Health eLearning Centre provides Internet-based courses that:

- Provide useful and timely continuing education for health professionals
- Offer state-of-the-art technical content on key public health topics
- Serve as a practical resource for increasing public health knowledge.

Most universities have started to offer eLearning programmes parallel to traditional teaching methods in response to needs by students living abroad or those with special needs. Without the Internet, this would have not been possible.

WHO initiated a global e-learning project to support health education and promotion among young generations in a multilingual and multicultural environment. The Health Academy's goal is to improve knowledge about attaining and maintaining good health. The academy's eLearning package of health courses provides more than just distance education. The graphics, animation and interactive features have been designed to engage people so that they can enjoy the learning experience. The package introduces basic principles of health awareness and encourages students to build on their knowledge, which helps them to develop critical thinking.[29]

## Self-Medication and e-Pharmacies

Self-medication may be described as the use of non-prescription medicines by patients on their own initiative and responsibility. In the real life, this is assisted by the pharmacist who could provide advice to the patient as to the purpose, the dose, etc. especially if the medication can be sold the "over the counter". In the virtual world, cyberspace, a patient may directly order a medication based on their own assessment of self-diagnosis

[26] Geissbuhler, A., Bagayoko, C. O. and Ly, O. The RAFT network: five years of distance continuing medical education and tele-consultation over the Internet in French-speaking Africa, more on (http://raft.hcuge.ch/)
[27] eLearning for Healthcare. http://www.e-lfh.otg.uk/
[28] USAID Global eLearning Centre (http://www.globalhealthlearning.org/learnmore.cfm)
[29] WHO Health Academy. http://www.who.int/healthacademy/en/

or according to a questionnaire over the internet. Anand, et al[30] estimated that online pharmaceutical sales have reached more than nearly $50 billion. Diaz et al[31] in their study concluded that Only 9 individuals (out of 512 patients who participated in the study) stated that they had ever purchased alternative and/or complementary remedies from a Web site and only one respondent obtained a medical prescription from an online doctor.

WHO estimates that in over 50% of cases, medicines purchased over the Internet from illegal sites that conceal their physical address have been found to be counterfeit.[32] In many countries, Internet-based sales of medicines are a major source of counterfeits, threatening those who seek cheaper, stigmatized or unauthorized treatments. Some Internet pharmacies are legal operations, set up to offer clients convenience and savings. They require patient prescriptions and deliver medications from government licensed facilities. Illegal Internet pharmacies conceal their real identity, are operated internationally, sell medications without prescriptions, and deliver products with unknown and unpredictable origins or history.[33]

## Telemedicine

Telemedicine simply put is medication at a distance. It is "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities".[34]

A multiplicity of derivations emerged from telemedicine which the telecommunication component is the common denominator including tele-surgery, tele-pathology, tele-radiology, tele-cardiology, tele-dermatology, tele-audiology, tele-dentistry, etc.

Telemedicine is used as a general and inclusive umbrella term to refer to all systems, modalities, and applications for the delivery of personal health services that substitute electronic communications and information exchange for (1) in-person contact between patients and providers, (2) communication among providers, and (3) patient or provider contact with sources of information, decision making, and support systems (e.g., literature, algorithms, electronic websites).[35]

The telemedicine infrastructure required for provision of services between two sites consists of healthcare institutions, human resources and information and telecommunication infrastructure. For this infrastructure to work it requires a suite of policies, protocols, rules and regulations. The Internet protocol, with all security measures, has become the technology of choice to provide telemedicine services vs. satellite, wireless and dialup, ISDN and other services.

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[30] Anand, A., Sethi, N., Sharon, G., Mathew, G., Songara, R., Kumar, P. Internet pharmacy: need to be implemented in India. Chronicles of Young Scientists. 2010;1(1):16-25.

[31] Joseph A Diaz et al. Patients' Use of the Internet for Medical Information. J Gen Intern Med. 2002 March; 17(3): 180–185.

[32] Medicines: spurious/falsely-labelled/ falsified/counterfeit (SFFC) medicines http://www.who.int/mediacentre/factsheets/fs275/en/

[33] Counterfeit drugs kill, (http://www.who.int/impact/FinalBrochureWHA2008a.pdf)

[34] WHO. A health telematics policy in support of WHO's Health-For-All strategy for global health development: report of the WHO group consultation on health telematics, 11–16 December, Geneva, 1997. Geneva, World Health Organization, 1998.

[35] Rashid Bashshur, et al. Policy: The Taxonomy of Telemedicine. Telemedicine and e-Health. July/August 2011, 17(6): 484-494. doi:10.1089/tmj.2011.0103.

## Mobile Health

Mobile health or what has become known as mHealth has been defined as medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices. mHealth involves the use and capitalization on a mobile phone's core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications.[36] At the end of 2011, there were 6 billion mobile subscriptions, estimates the International Telecommunication Union. That is equivalent to 87 percent of the world population. And is a huge increase from 5.4 billion in 2010 and 4.7 billion mobile subscriptions in 2009.[37] The WHO Global Observatory[38] of eHealth reported in its 2010 survey that mobile health applications in the 114 countries that completed the survey were as follows:

- Health call centres 59%
- Toll-free emergency (e.g. poisons) 55%
- Emergency and disasters 54%
- Mobile telemedicine 49%
- Appointment reminders 44%
- Community mobilization 38%
- Treatment Compliance 36%

Implementation of mHealth programmes is not without problems and barriers. The top five barriers identified by the Survey to mHealth implementation as reported by member states were competing priorities, lack of knowledge concerning the possible applications of mHealth and public health outcomes, lack of country or regional eHealth policy to recognize mHealth as an approach to health-related issues, cost-effectiveness of mHealth solutions, absence of legal frameworks and operating cost.[39]

It is expected that the combined power of the Internet and the mobile phone will bring the major change in terms of access to health information in remote areas by both healthcare professionals and the public. Mobile internet access will overcome the barrier of isolation and absence of broadband internet in many countries.

## Electronic Health Records

The electronic health record (EHR) is an evolving concept defined as a longitudinal collection of electronic health information about individual patients and populations.[40] EHR and the many other similar systems such

[36] mHealth: New horizons for health through mobile technologies: second global survey on eHealth. http://www.who.int/goe/publications/goe_mhealth_web.pdf
[37] International Telecommunication Union. ICT fact and figures, 2011. http://www.itu.int/ITU-D/ict/facts/2011/material/ICTFactsFigures2011.pdf
[38] mHealth: New horizons for health through mobile technologies: second global survey on eHealth. http://www.who.int/goe/publications/goe_mhealth_web.pdf
[39] mHealth: New horizons for health through mobile technologies: second global survey on eHealth. http://www.who.int/goe/publications/goe_mhealth_web.pdf
[40] Tracy D Gunter and Nicolas P Terry. The Emergence of National Electronic Health Record Architectures in the United States and Australia: Models, Costs, and Questions. Med Internet Res v.7(1); Jan-Mar 2005 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1550638/#ref2

as electronic medical records, electronic patient records, and personal health records have become a central piece in healthcare delivery. The benefits of EHR have been documented and there has been enough evidence that they bring value to healthcare systems in terms of improvement of quality of services, reducing medication errors and cost reduction. The specific benefits of EHRs may be summarized as:

- Legible. Many medication errors result from illegible handwritten instructions on prescription, diagnosis, drug names or discharge notes on the paper record.[41]
- Accessible from anywhere in the hospital and possible over the internet. Multisite hospitals, and care providers in multiple locations can access the same information in the EHR. This might impose security, privacy and confidentiality issues which the healthcare provider needs to consider.
- Prerequisite for many types of clinical decision making. Computerized Physician Order Entry (CPOE) is enabled through the EHR. CPOE itself has many advantages as it helps in elimination of medication errors through alerting on drug interactions, allergies, overdose, etc.
- Easy to identify patients whenever a medication or device is recalled. The tracking and audit procedures in EHRs allow for linking patients and drug dispensing.
- Easy to produce reports for quality organizations
- Supports graphing of laboratory tests over time.

EMR and HIPPA[42] listed the benefits of using an EMR or EHR over paper charts which included legibility of notes, accessibility of charts, transcription costs savings, space savings, eliminate staff, eligibility for pay-for-performance, new physician recruitment , multiple users use a chart simultaneously, lab results returned automatically, x-ray results returned automatically, save a tree and the environment, electronic prescriptions, spell checking, disaster recovery, drug to drug interaction checking, drug to allergy interaction checking, patient safety, integration with physician dispensing software, quality of care, increased efficiency, better patient services, improved workflow, improved patient communications, improved accuracy for coding evaluation and management, improved drug refill capabilities, improved charge capture, improved claim submission process and reduced medical records transportation costs**.**

## Patient Education and Safety

Searching the internet for health information has become a first choice for many people to learn more about their health conditions, medication, and cost of care, eating habits, food and nutrition and so on. A number of websites have started to offer possibility for "self-diagnosis" and "self-medication" through filling a from or answering some questions on gender, age, some vital signs, eating habits, smoking, life style, symptoms, etc. which would allow the system to provide feedback based on some type of "decision support" and "artificial intelligence". In a study conducted in 2011 Diaz et al.[43] concluded that majority of respondents indicated that they sought information about nutrition or diet, followed by a majority using the Internet to investigate drug side effects or complications of medical therapy followed by, finding information on complementary or alternative medicine and then to obtain second opinions about medical conditions.

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[41] F Javier Rodríguez-Vera, et al. Illegible handwriting in medical records. J R Soc Med 2002;95:545–546. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1279250/pdf/0950545.pdf

[42] EMR and HIPAA: An Open Forum for EMR, EHR, HIT and HIPAA Related Information-EMR! http://www.emrandhipaa.com/benefits-of-emr-or-ehr-over-paper-charts/

[43] Joseph A Diaz et al. Patients' Use of the Internet for Medical Information. J Gen Intern Med. 2002 March; 17(3): 180–185.

### *Internet Protocol Television (IPTV)*

Telecommunication companies which have been supporting Internet access through their infrastructure using Internet Protocol have entered into the mass media communication through the IPTV. It is a technology that supports the transmission of standard television video programs over the Internet and Internet Protocol (IP). It allows a television service to be integrated with a broadband Internet services and share the same home Internet connections.[44] In the heath domain UNICEF and WHO have started to utilize this technology in recognition of its role to reaching out to untapped populations with health messages and information.[45]

### *Social Media and Web 2.0*

The Social Media Guide provides over 50 definitions of the concept "Social media" and calls for its users to provide their own definitions. Solis says "Social Media is the democratization of information, transforming people from content readers into publishers. It is the shift from a broadcast mechanism, one-to-many, to a many-to-many model, rooted in conversations between authors, people, and peers".[46]

The basic premise of social media is that it is user –generated. It is information produced by people for people. Among the most serious criticisms to social media is the quality of information. Information comes from sources that are not being vetted, quality controlled, verified or even referenced. Despite all that, social media has allowed individuals to directly share information, ideas, opinions and experience. In the health field, it has allowed patients to learn about their own health conditions, share lessons learned and seek advice.

Tools of social media have become so diverse and rich in terms of content and use to the extent that they impacted social and political mobilization, analysis of disease trends, and have actually become used more than traditional media. Among the more known tools are **Web 2.0, Facebook**, **Twitter, YouTube, Web log** (blog) and others.

A number of studies attempted to use data from social media to predict, track and map diseases. A study by Chunara, Andrews, and Brownstein[47] examined data from two informal sources—HealthMap and Twitter, made available on the Internet in real-time, to determine whether the trend in volume over time of such reports would correlate with the trend in volume of cases reported through official mechanisms over time. They found that in the 2010 Haitian cholera outbreak, there was good correlation between trends in volume over time of informal data and officially reported case data, during the initial stages of an outbreak or relevant event.

Szomszor, Kostkova1and Quincey[48] analyzed three Million tweets gathered between May and December 2009, as a possible source of surveillance data and its feasibility to serve as an early warning system. They demonstrate that Twitter can serve as a self-reporting tool, and hence, provide indications of increased infection spreading. More interestingly, their initial findings indicate that Twitter can detect such events up to one week before conventional general practitioner reported surveillance data.

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[44] What is TV over IP? http://compnetworking.about.com/od/homenetworkuses/g/bldef_iptv.htm

[45] WHO TV http://www.tvwho.tv/home/en

[46] Brian Solis. Defining social media 2006-2010 http://www.briansolis.com/2010/01/defining-social-media-the-saga-continues/

[47] Rumi Chunara, Jason R. Andrews , and John S. Brownstein. Social and News Media Enable Estimation of Epidemiological Patterns Early in the 2010 Haitian Cholera Outbreak. Am. J. Trop. Med. Hyg., 86(1), 2012, pp. 39–45doi:10.4269/ajtmh.2012.11-0597. http://www.ajtmh.org/content/86/1/39.full.pdf+html

[48] Martin Szomszor, Patty Kostkova, Ed de Quincey. #swineflu: Twitter predicts swine flu outbreak in 2009. Electronic Healthcare: Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering Volume 69, 2011, pp 18-26

Finlayson et al.[49] concluded "… by leveraging the global nature of media such as Twitter, with a large audience and well-defined interest groups, individual scientists could find local collaborators working on similar problems with greater experience in specific areas of their work. By eliminating reams of redundancy from the scientific process, scientists in developing countries may be able to conduct research that is faster, better targeted to real problems, and has less duplication. And in the end, they could disseminate their results more efficiently."

### *Discussion Groups and Online Forums*

Communities and groups are developed and maintained through a number of platforms allowing individuals to share ideas, experience, news and information in an electronic format. Bulletin boards, Listservs, Mailing Lists and News Groups are just examples of what the Internet can offer to patient groups, healthcare professionals and policy makers to exchange information. Discussion groups such as HIFA205[50] represent one of the most active groups in the area of access to health knowledge with a global representation. It describes itself as a campaign and knowledge network with more than **4,000 members** representing **1800 organizations** in **157 countries** worldwide. Members include health workers, publishers, librarians, information technologists, researchers, social scientists, journalists, policy-makers and others – all working together towards the HIFA2015 goal.

Patient support groups on the Internet provide opportunity for patients and their families and loved ones to exchange experience and knowledge on medication, services, social and best practices. Patient groups empower individuals through information, education and communication. Patient for Patient Safety is a World Health Organization initiative[51] that "emphasizes the central role patients and consumers can play in efforts to improve the quality and safety of health care around the world. PFPS works with a global network of patients, consumers, caregivers, and consumer organizations to support patient involvement in patient safety programmes, both within countries and in the global programmes of WHO Patient Safety. The ultimate purpose is to improve health-care safety in all health-care settings throughout the world by involving consumers and patients as partners".

The Implementation of Best Practices (IBP) Knowledge Gateway for Reproductive Health is a virtual knowledge network of over 15,000 people from 195 countries supported by the partners of the (IBP) Knowledge Gateway for Reproductive Health Initiative.[52] It is an easy to use platform (using the Internet) that connects people working around the world in the fields of health and development through virtual knowledge networks and communities of practice. It functions through email linked to virtual workspaces and facilitates the sharing and exchange of knowledge, information and resource materials in and among countries around the world.

## Quality of Health Information on the Internet

At present, much of the information available over the Internet is free for consumers, and a great deal will remain so. Commercial publishers offer a certain amount of free material in order to keep the user interested but would obviously prefer as many people as possible to subscribe, and as more people start using the service and get used to it, with time they may reduce the amount of free material on offer. Many of the health-related web sites are supported entirely by advertising revenue and this may distort the policy of the information producer or publisher. It is to the publishers' advantage to have a quality site and to adhere to the same standards of production, with due regard for ethics and copyright that they would if publishing in any other format.

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[49] Alexander E. T. Finlayson, Katherine E.M. Hudson and Faisal R. Ali. Use social media to strengthen health systems, SciDev NET, September 2011 http://www.scidev.net/en/health/opinions/use-social-media-to-strengthen-health-systems.html

[50] HIFA2015. (http://www.hifa2015.org/)

[51] WHO Patient Safety. (http://www.who.int/patientsafety/patients_for_patient/en/)

[52] Implementation of Best Practices (IBP) Knowledge Gateway for Reproductive Health http://knowledge-gateway.org/

The quality of health information on the Internet has been a subject of serious discussion among publishers, information specialists, researchers, academicians, pressure groups, NGOs, consumer associations, decision-makers and the public at large. A number of organizations have proposed codes to control the quality of health information on the web.

The question will always remain: "is the Internet the right place to look for the best (health) information?" The quality of health information on the Internet has been at the core of a number of codes of ethics or quality standards documents. These have identified various principles that an Internet site should respect in order to safeguard the quality of health products and services on the Internet.

The Medical Library Association (MLA)[53] of the United States issued a user's guide to finding and evaluating health information on the web. The Guide included four major elements:

1. Sponsorship to allow easy identification the site's sponsor as sponsorship is important to establish the site as respected and dependable;
2. Currency as the site should be updated frequently;
3. Factual information not opinion. Opinion information should be clearly identified;
4. Audience as the website should clearly state whether the information is intended for the consumer or the health professional.

The National Health Services (NHS)[54] of United Kingdom as part of its information support programmes titled NHS Choices has issued its "Information Standard" which is a certification scheme for health and social care information. It has been established by the Department of Health to help patients and the public make informed choices about their lifestyle, their condition and their options for treatment and care.

The WHO Regional Office the Eastern Mediterranean[55] has adopted and translated into Arabic the eHealth Code of Ethics of the eHealth Ethics Initiative which describes health information to be information for staying well, preventing and managing disease, and making other decisions related to health and health care. The Code includes the following elements:

1. Candor. Disclose information that if known by consumers would likely consumers' understanding or use of the site or purchase or use of a product or service.
2. Honesty. Be truthful and not deceptive.
3. Quality. Provide health information that is accurate, easy to understand, and up to date. Provide the information users need to make their own judgments about the health information, products, or services provided by the site.
4. Informed Consent. Respect users' right to determine whether or how their personal data may be collected, used, or shared.
5. Privacy. Respect the obligation to protect users' privacy.

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[53] Medical Library Association. A User's Guide to Finding and Evaluating Health Information on the Web. http://www.mlanet.org/resources/userguide.html

[54] National Health Services. The Information Standards. http://www.nhs.uk/aboutNHSChoices/aboutnhschoices/Aboutus/Pages/the-information-standard.aspx

[55] WHO Eastern Mediterranean Regional Office. eHealth code of ethics. http://www.emro.who.int/his/medicalethics.htm

6. Professionalism in Online Health Care. Respect fundamental ethical obligations to patients and clients. Inform and educate patients and clients about the limitations of online health care.
7. Responsible Partnering. Ensure that and sites with which they affiliate are trustworthy.
8. Accountability. Provide meaningful opportunity for users to give feedback to the site.
9. Monitor their compliance with the eHealth Code of Ethics.

According to Health on the Net Foundation[56] there are eight principles.

1. **Authoritative**. Any medical or health advice provided and hosted on the site will only be given by medically trained and qualified professionals unless it is clearly stated that a piece of advice offered is from a non-medically qualified individual or organization.

2. **Complementarity**. The information provided on the site is designed to support, not replace, the relationship between a patient/site visitor and his/her physician.

3. **Privacy**. The medical/health web site pledges to respect the confidentiality of data relating to individual patients and visitors to the site, including their identity. The web site owners undertake to honour or exceed the legal requirements of medical/health information privacy that apply in the country and state where the web site and mirror sites are hosted.

4. **Attribution**. Where appropriate, information contained on the site is supported by clear references to source data and, where possible, has specific HTML links to that data. The date when a clinical page was last modified will be clearly displayed (e.g. at the bottom of the page).

5. **Justifiability**. Any claims relating to the benefits/performance of a specific treatment, commercial product or service will be supported by appropriate, balanced evidence in the manner outlined in 4 above.

6. **Transparency**. The designers of the web site will seek to provide information in the clearest possible manner and provide contact addresses for visitors that seek further information or support. The webmaster will display his/her e-mail address clearly throughout the site.

7. **Financial disclosure**. Support for the web site will be clearly identified, including the identities of commercial and non-commercial organizations that have contributed funding, services or material.

8. **Advertising policy**. If advertising is a source of funding, this will be clearly stated. A brief description of the advertising policy adopted by the web site owners will be displayed on the site. Advertising and other promotional material will be presented to viewers in a manner and context that facilitates differentiation between it and the original material created by the institution operating the site.

A number of other organizations and institutions have developed their own quality criteria for their web sites. While these try to provide the best quality information services and content on the web, the end user may encounter certain risks that result in less than optimum utilization of health information on the Internet. This can happen for a number of reasons, as described by Berland et al.[57]:

[56] Health on the Net Foundation: The HONcode in brief. http://www.hon.ch/HONcode/Conduct.html
[57] Berland GK et al. Health information on the Internet: accessibility, quality, and readability in English and Spanish.

- language and complexity barriers
- inappropriate audience or context
- unavailability of certain services or products in certain parts of the world
- difficulty in interpreting scientific data
- accuracy and currency of information
- potential for source bias, source distortion, and self-serving information.

Countries are encouraged to develop their own quality measures, guidelines and codes of ethics to help their populations make better judgments on what they find on the Internet and more importantly to help them develop health information products and services that provide a high-quality response to the needs of their people.

## eHealth challenges

The health sector entered the "e" world late compared to the banking, commerce, education, government and industrial sectors. A number of challenges have been identified to limit the introduction of eHealth in countries and organizations. These maybe summarized, according to a WHO study[58], as follows:

- Lack of proper needs assessment.
- Lack of vision, strategy, and national plans.
- Lack of information and awareness about ICT applications.
- Computer illiteracy.
- Insufficient resources to meet costs.
- Limited experience in medical informatics.
- Weak information and telecommunications infrastructures.
- Absence of legislative, ethical, and constitutional frameworks

As more eHealth applications and systems being deployed more challenges started to emerge:

- Sustainability of projects as many of them start as pilots and continue as pilots without a funding and/or cost-recovery model.
- Interoperability and standardization as many applications, even in the same organization were not designed to allow for data exchange among them or to be compatible.
- Lack of evidence on value, impact and return on investment of eHealth. Decision maker, planners and donors are still not fully convinced that eHealth can reduce cost, improve quality of service and enable equity.

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*JAMA,* 2001, 285(20):2612-2621

[58] WHO, 2004. eHealth for Health-care Delivery: Strategy 2004-2007. Geneva: WHO http://www.who.int/eht/en/eHealth_HCD.pdf

- Language and cultural barriers as many eHealth solutions were developed in and for environments other than those importing them. The vast majority of the internet content is in English and many computer applications in health are in "foreign languages and made for a different culture".
- Lack of full engagement of healthcare professionals in development of eHealth solutions. This is coupled with an overabundance of commercially driven solutions.
- Privacy, confidentiality and data ownership. Many countries have not developed guidance, policy or regulations to protect personal data on the internet on in electronic health records. This has reduced the trust in eHealth systems by many individuals.

## Conclusion

Information and communication technologies are enablers to management and utilization of health knowledge. The increasing volume of health information and the total dependency of the health sector on information requires proper ICT infrastructure. The use of ICT in health ranges from education, health promotion, medical education, healthcare delivery, surveillance and disease management to diagnosis and treatment of patients. eHealth has the potential to transform the healthcare through its ability to manage health information, reduce medical errors, improve quality of health personnel, contributing to better lifestyle, improve transparency and accountability and reduce cost of care.

The Africa Regional Ministerial Meeting on eHealth held in Accra in 2009[59] concluded that the potential the electronic media hold for developing countries has been a matter for considerable discussion and debate. In general, such media are seen as having positive potential in terms of greater information access.

[59] ECOSOC: Africa Regional Ministerial Meeting Accra, Ghana 10-11 June 2009 (http://www.un.org/en/ecosoc/newfunct/pdf/ghanabackgroundnote.pdf)

# CHAPTER 8

## Education

*Tim Unwin*

### Challenging Educational Norms: Wisdom from the Web?

We learn throughout our entire lives. Hence, any consideration of how the World Wide Web can contribute to economic and social development through education must evaluate a wide range of factors and contexts.

For the Web to be used effectively in support of learning, five critical things need to be in place:

- First, governments need to have integrated national ICT strategies that incorporate explicit attention to the use ICT in education and learning. Put simply, if the potential of Web-based learning is to be realized, then it is essential to have broadband access and electricity available everywhere that learning takes place.
- Second, these strategies must place teacher training at their heart. Teachers need to be trained both in how to use ICTs for their own professional development, and also in how to use them effectively in their teaching. Whilst much learning takes place beyond school boundaries, schools are likely to remain important places for learning, at least in the medium-term future, and teachers will therefore continue to be crucially important in guiding such e-learning.
- Third, attention should be paid to the inclusivity of learning. Unless specific focus is placed on the needs of people with disabilities, the elderly, and the marginalized, there is a very real danger that Web-based learning will actually lead to yet further differentiation and disadvantage for the least advantaged in any society.
- Fourth, despite the shift to the privatization of education in many global systems, the enormous potential of Open Educational Resources needs to be realized through policies and practices that specifically advocate its utilization.
- Finally, much more attention needs to be paid to the effective use of mobile devices in learning. It will not be long before most people primarily access the Web through a small tablet or mobile hand-held device. This will transform learning, and educators must be prepared for the transformation that is likely to occur as a result. Computer laboratories where people go to learn will very soon become a thing of the past.

These five elements can serve as a checklist for those involved in the development of Web-based learning initiatives. They are the critical points of leverage that can enable education to be transformed through the use of the Web, and they provide the map guiding this educational exploration.

This chapter begins by examining some of the parameters for such an exploration, focusing on the ways through which the Web can enhance access to information and facilitate communication. It pays particular attention to the role of the Internet in distance education. This section examines some of the applications that are relevant for education, and concludes with comments on the development of both local and international content.

## Context: Educational Content and Communication in Development Practice

Over the last 20 years, new ICTs, and especially the Web, have not only transformed the ways in which we access and produce information, but they have also had a significant influence on when, where and how we communicate. In the context of education, until recently, most attention has been placed primarily on *content* provision and dissemination, in other words on information. In many ways, this merely replicates traditional models of educational provision, albeit through different modalities, and does not fundamentally change the delivery of learning resources. Greater attention on the *communication* dimension of education could have far reaching implications for our understanding of what learning is really all about, and how it can best be achieved by those living in poor and marginalized communities.[1]

One of the challenges in examining the interface between the Web and education is the diversity and complexity of education itself. Formal education is usually considered to include primary, secondary and tertiary, or higher education, each of which has traditionally been delivered in very different ways; secondary schools have had classrooms, whereas in universities, most formal teaching is in lecture theatres or small tutorial rooms. Yet the Web can transform our experiences in space, and remove the need altogether for traditional learning locations.

Moreover, learning takes place throughout our lives; such experiences have often been subsumed within the notions of either informal or non-formal education. There is also vocational education, designed to give learners the skills necessary for particular forms of employment, and pre-school education intended to equip young children with the experiences necessary for starting more formal schooling in the first grade. Special needs education caters to those whose requirements cannot be met through traditional educational systems, and commonly refers to education for those who have learning difficulties or disabilities. The Web can support learning in all such contexts, but each has specific implications for how exactly it can best be used to advantage. For those with disabilities, it is critically important, for example, that Web-based solutions are fully accessible and that devices used to access online learning resources are compatible with their specific requirements. All too often this is not the case, and Web-based education disadvantages this population even further.

This broad analysis highlights a central distinction between *education* and *learning*. Education is essentially a system for inculcating a required curriculum, whereas learning is what individuals actually do. More often than not, curricula in formal education systems are defined primarily by social and political elites, and seek to inculcate the behavioral and skills-based norms expected for anyone to participate effectively in their given political and social context. An education system that delivers for the majority of people may well fail to encourage some people to learn and will ultimately put them at a disadvantage. Ideally, learning should go beyond merely the ability to memorize and regurgitate information, and should instead involve the acquisition of knowledge, which is information mediated by experience. This is where some form of assistance or support, usually provided by teachers, is critically important, since teachers are able to support learning by mapping out pathways through the curriculum and helping individuals to understand the information or content that makes up that curriculum. Enabling teachers to have a good grasp of how best to use ICTs to support learning – something very different from simply giving them the skills to use 'Office' suites of software – is so critically important.

Hence, education is fundamentally concerned with both *content*, the information that is deemed to be worthy of acquisition, and *communication*, not only between teachers and learners, but also among learners themselves. One of the most exciting aspects of the Web lies not so much in how it facilitates the gathering of information, but rather the way through which it provides new modalities for configuring the communicative experiences

[1] For a useful introduction to the use of ICTs for education in developing countries, see Selinger, M. (2009) ICT in education: catalyst for development, in: Unwin, T. (ed.) ICT4D: Information and Communication Technology for Development, Cambridge: Cambridge University Press, 206-248.

of learning peers, as well as the interactions that they have with teachers. Hence, Web-based teaching and learning have often been used at the vanguard of attempts to shift from traditional didactic modes of teaching to constructivist models of learning.[2] ICTs, more than ever before, enable people to learn individually rather than collectively and in doing so, they facilitate the shift towards student-centered learning that certain models advocate. Recognizing the importance of educating the teachers themselves in knowing how to uses such technologies effectively, UNESCO has recently published an important set of guidelines that emphasize not only the value of technology in education, but also the need for teachers to be well-trained in its usage[3]:

> "To live, learn, and work successfully in an increasingly complex, information-rich and knowledge-based society, students and teachers must utilize technology effectively. Within a sound educational setting, technology can enable students to become:
>
> Capable information technology users
>
> Information seekers, analyzers, and evaluators
>
> Problem solvers and decision makers
>
> Creative and effective users of productivity tools
>
> Communicators, collaborators, publishers, and producers
>
> Informed, responsible, and contributing citizens
>
> Through the ongoing and effective use of technology in the schooling process, students have the opportunity to acquire important technology capabilities. The key individual in helping students develop those capabilities is the classroom teacher."

One of the most dramatic changes that new digital technologies, and especially the Internet, have brought about has been the separation of learning from its old spatial constraints. No longer does teaching have to be in a classroom or a lecture hall; learners can access content from the Web, and can communicate with teachers anywhere in the world. Tutors in India, for example, are now providing support for schoolchildren in the UK.[4] Classrooms no longer have to be designed with desks arrayed in perfect symmetry beneath the dais of the teacher, but instead learning can take place wherever students can access their digital devices.[5] Degree courses have for long been made available by distance learning, but the Web has transformed the opportunities for enhanced learning at a distance, both in terms of the quality of the learning experience, and also the number of options available for students to acquire such degrees.

This edited volume concentrates specifically on the ways in which the Web can support 'development', and so it is crucial to consider the complex interactions that exist between education and development. First, though, it is essential to observe that there are many conceptualizations of 'development', and ICTs are used in various ways to support and challenge fundamentally different notions of what is understood by that term. Web-based training courses provided by companies to enhance the skills of their workforces so that they generate increased corporate profits are very different from the use of the Web by anarchists who are determined to overthrow the

[2] Papert, S. (1980) Mindstorms: Children, Computers and Powerful Ideas, New York: Basic Books. Although for a critical perspective, see Kirschner, P.A., Sweller, J. and Clark, R.E. (2006) Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential and inquiry-based teaching, Educational Psychologist, 41(2), 75-86.

[3] UNESCO (2008) ICT Competency Standards for Teachers, Paris: UNESCO.

[4] http://www.voanews.com/english/news/asia/Indian-Tutors-Teach-British-Kids-Online-120222089.html, accessed 14 July 2011.

[5] Baggaley, J. (2007) Distance education technologies: an Asian perspective, Distance Education, 28(2), 125-31

very foundations of the capitalist system that enable such profits to accrue in the first place. The hegemonic notion of 'development' encapsulated in the Millennium Development Goals (MDGS)[6] and numerous international agendas, is one whereby poverty really can be eliminated by *economic growth*.[7] However, such growth always tends to lead to increased inequalities, unless there are effective mechanisms in place to ensure that the benefits of growth are distributed fairly.[8]

If poverty is defined instead in terms of *social* agendas, that places emphasis on equality of access to resources, taking into consideration such criteria as disability, gender, age and ethnicity, a very different set of arguments come into play in terms of how Web-based education can be used to support development. Likewise, for those using the Web as a means through which to try to overthrow *political* regimes, be they unsuccessful in their efforts as in Burma and Iran, or successful as in Tunisia and Egypt, another contrasting set of priorities will be emphasized. Here, agendas around governance, transparency and political representation come to the forefront.[9]

Moreover, it is possible to conceive of development in *ideological* terms; individual human development in many Indian religions, for example, rests fundamentally on the concept of nirvana, through which a person achieves transcendental knowledge that enables them to understand the true nature of reality, and a peaceful state of mind through the expulsion of greed, hatred and delusion. Such wisdom is fundamentally different from that being extolled by development 'experts', seeking to benefit from their advocacy of economic growth agendas.

The fact that there are diverse notions of development raises challenges for any consideration of the role of Web-based education and learning intended to contribute to development. First, the intended educational outcomes are fundamentally different whether one adopts a stance to development based on economic growth, or one that focuses instead on social, political or ideological goals. The emergence of the concept of 21st century skills, for example, represents a powerful coalition of interests between commercial ICT companies and those organizations that emphasize the growth agenda. This is typified by the following vision statement from the US-based Partnership for 21st Century Skills[10]:

> The Partnership for 21st Century Skills is a national organization that advocates for 21st century readiness for every student. As the United States continues to compete in a global economy that demands innovation, P21 and its members provide tools and resources to help the U.S. education system keep up by fusing the three Rs and four Cs (critical thinking and problem solving, communication, collaboration, and creativity and innovation). While leading districts and schools are already doing this, P21 advocates for local, state and federal policies that support this approach for every school.

See The Partnership for 21st Century Skills.[11]

[6] http://www.un.org/millenniumgoals/, accessed 14 July 2011.
[7] See for example, Sachs, J. (2005) The End of Poverty: How we Can Make it Happen in Our Lifetime, London: Penguin; for a contrasting view, see Easterley, W. (2006) The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done so Much Ill and so Little Good, New York: Penguin.
[8] See Unwin, T. (2007) No end to poverty, Journal of Development Studies, 43(5), 929-53.
[9] These are, for example, well captured in Sen's important notions of freedoms: Sen, A. (1999) Development as Freedom, Oxford: Oxford University Press.
[10] See for example Bellanca, J. and Brandt, R. (2010) 21st Century Skills: Rethinking How Students Learn, Bloomington: Solution Tree Press.
[11] http://www.p21.org/, accessed 14 July 2011.

The skills deemed to be necessary to economic growth are those that will sustain the competitiveness of any country that adopts them, and at their heart are the ICT skills that facilitate information acquisition, communication, collaboration, and innovation. Indeed, this is often what the term 'capacity development' is used to refer to. It is scarcely surprising that global corporations such as Google, Microsoft, Cisco and Intel are so eager to encourage and enhance their adoption. By focusing primarily on economic growth, this approach plays down the importance of other attributes such as empathy, altruism and understanding that are of much greater importance if other approaches to 'development' are considered.

At the heart of such arguments is a crucial distinction between communal and individual responsibilities and interests, both in learning and in development. The dominant constructivist, 21st century model of ICT Web-enhanced learning is fundamentally one driven by an individualized notion of learning and success. Knowledge has tended to become simply a commodity to be purchased, rather than a transformatory and empowering force for communal good. Accordingly, there has been a dramatic increase in the attention paid to education as a private, rather than a public good, typified in the UK by the considerable increase in university tuition fees from around £3,000 a year to, in many instance, £9,000 a year from 2012. This is justified by the UK government on the grounds that it is a sound investment for individuals, since university graduates have greater lifetime earning. However, little emphasis is placed on the damage to communal interests and the public good that this will cause. This distinction between individual and communal interests is of great importance at the interface between education and technology, as is clear in debates over proprietary and open/free educational content.

This coalition of interests in the use of ICTs for education has been a highly significant point in advocating for access to ICTs to be considered as a human right. Education has long been seen as a human right, with UNESCO, for example, claiming that:[12]

> Education is a fundamental human right and essential for the exercise of all other human rights. It promotes individual freedom and empowerment and yields important development benefits. Yet millions of children and adults remain deprived of educational opportunities, many as a result of poverty. Normative instruments of the United Nations and UNESCO lay down international legal obligations for the right to education. These instruments promote and develop the right of every person to enjoy access to education of good quality, without discrimination or exclusion…. Education is a powerful tool by which economically and socially marginalized adults and children can lift themselves out of poverty and participate fully as citizens.

If one takes this perspective, and if ICTs are seen to be critical for the acquisition of knowledge in the modern world, then access to ICTs might also be seen as a human right. As the 2011 report of the UN's Special Rapporteur[13] on the promotion and protection of the right to freedom of opinion and expression commented with respect to this:

> The Internet is an important educational tool, as it provides access to a vast and expanding source of knowledge, supplements or transforms traditional forms of schooling, and makes, through "open access" initiatives, previously unaffordable scholarly research available to people in developing States. Additionally, the educational benefits attained from Internet usage directly contribute to the human capital of States.

[12] http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/right-to-education/, accessed 14 July 2011.

[13] Report of the special rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank la Rue, UN, A/HRC/17/27, May 2011.

Consequently, the Special Rapporteur went on to argue that efforts by governments to block access to websites, or to criminalize individual freedom of legitimate expression in websites, were restrictions of human rights to education and freedom of expression. Such arguments are, nevertheless, highly problematic, given the range and diversity of political and social regimes around the world. It is, though, possible to recognize such diversity, and maintain a focus on the important aspects of Web-based applications that enable teachers and learners to contribute to 'development' however this is defined. For our purposes, the emphasis is primarily on the most marginalized of populations around the world; in advanced societies, there is a sense that the market will take care of the majority of individuals, but alternative and communal interventions are necessary for those whom the market is leaving behind.

## Applications: the Web of the Possible

The single most important point to be made about the Web, education and development is that the Internet has led to much greater global inequality in terms of access to education, information and communication. Those with access to the Web have possibilities that were unimaginable 20 years ago; yet, the lives and learning experiences of those without access remain very much the same as they were in the last century. A striking recent publication by the ITU highlights this situation graphically.[14] In 2000, there were approximately 24 users of the Internet per 100 people in developed countries, and virtually zero in the least developed countries; by 2010 there were 71.6 users per 100 people in developed countries, but still only 3.0 users per 100 in the least developed countries. The differences are far larger now than they were a decade ago; the inequalities are becoming greater between those with the last and those with the most.

It must also be remembered that 28.4% of the world population, even in developed countries, do not use the Internet. Without the infrastructure for connectivity, and the electricity to power devices, the Web cannot be used directly by poor and marginalized learners. While 'developing' countries in general are indeed seeing an increase in most ICT indicators, the least developed countries, and the least developed parts of all countries, are being relatively further disadvantaged as the technological leaders pull ahead with the latest intervention. There must therefore be integrated national, and indeed international, strategies in place for the use of ICTs in education to ensure that the poorest and most marginalized can indeed benefit from Web-based learning. Building on the above arguments, this section focuses on three key elements of such strategies: the need for effective teacher training so that the Web can support those without connectivity, the creation of appropriate content, and the transformatory power of Web-based communication.

### Using the Web in Support of Unconnected Learners

Much of the rhetoric about constructivist learning, about 21st century skills, and about the empowering benefits of Web-based learning, are not applicable directly to most of the world's poorest learners – whether they are in so-called developed or developing countries. The challenge, therefore, is to find ways of using the Web to benefit such learners indirectly, and this is one of the key reasons why teacher education remains so important. Across Africa, considerable emphasis has been placed on getting computers and the Internet into schools and universities, so that students can benefit from access to the Web.

[14] ITU (2011) The Role of ICT in Advancing Growth in Least Developed Countries, Geneva: ITU.

However, much less attention has been paid to ways in which ICTs can be utilized effectively to support teacher training.[15] This is why recent initiatives such as UNESCO's teacher training programme in Africa,[16] or the UK Open University's Teacher Education in Sub-Saharan Africa (TESSA) programme,[17] are so important. TESSA has been working since 2005 to design and build a bank of multilingual and flexible Open Educational Resources that are freely available for teachers anywhere in Africa to use. However, although the TESSA Web-forum has some 4,156 users, there are only 57 topics discussed in its English language forum, 8 in its French forum, and none in its Arabic and Kiswahili forums.[18] Moreover, its facility for teachers to share resources only has some 26 resources contained within it.[19] Thus it remains primarily a vehicle for the dissemination of Web-based content that can be used in African universities and education colleges and more should be done across age and educational levels.

Using the Web to help train teachers more effectively and enable them to have the skills and resources needed to support learning by poor people is one important way that education can be enhanced for all. However, it is not necessary for everyone to have access to the Web for learners to benefit from its potential. In many places, teachers with periodic access to the Internet use the opportunity to download learning resources or information from the Web, and then make use of this in their classrooms. In some situations, where electricity and hardware are available, these learning resources can be used directly in the classroom or even by learners in their own time. Where this is not the case, teachers can at least share their understandings of the material with their students and pupils. Moreover, well-educated teachers can translate foreign language materials into local languages, or adapt foreign content to local contexts, thereby making the information more accessible to their pupils. Such simple, low cost and user-friendly solutions remain the most effective ways in which the Web can be used to reach the unconnected. It should be emphasized that 93% of those living in least developed countries do not have access to the Internet. Much more needs to be done explicitly to support them if the Web is to become the effective tool for development that many believe it to be. Despite this cautionary note, the next two sections address the plethora of ways that applications may be used by the more fortunate to gain access to fresh content and new modes of communication.

## Educational Content

At one level, most information on the Web is of some educational use. There is so much multi-media material, be it in the form of books, journal articles, videos, images, blogs, newspapers, or other kinds of learning nuggets, that it is extremely difficult to know what to use, either as a learner or a teacher. Three critical factors are necessary for this plethora of information to become valuable: first, learners have to be able to identify the material of high quality; second, they have to be able to relate this content to their own learning needs; and third, they must have the financial wherewithal to pay for it.

In a world over-crowded with information, the greatest skill any learner can develop is the ability to identify the most relevant and reliable information swiftly. To an extent, search engines have provided one vehicle for winnowing the wheat from the chaff, but the algorithms used, and the increasing personalization of search results

[15] Unwin, T. (2005) Towards a framework for the use of ICT in teacher training in Africa, Open Learning: The Journal of Open and Distance Education, 20(2), 113-129.
[16] http://portal.unesco.org/education/en/ev.php-URL_ID=42605&URL_DO=DO_TOPIC&URL_SECTION=201.html, accessed 14 July 2011.
[17] http://www.tessafrica.net/, accessed 14 July 2011.
[18] http://www.tessafrica.net/index.php?option=com_fireboard&func=showcat&catid=1&Itemid=255, accessed 14 July 2011.
[19] http://www.tessafrica.net/index.php?option=com_share&task=publicbasketlist&Itemid=446, accessed 14 July 2011.

can introduce serious challenges when seeking the most pertinent content. Refined bibliographical databases provide a more sophisticated response to this challenge, with service providers now charging universities substantial sums for access to online journals and books. Unfortunately, the poorest universities are therefore further marginalized in terms of such access. However, organizations such as INASP[20] provide substantial support to those institutions with limited access to journals, and free or low-cost solutions in selected subject areas are also made available by international organizations. For example, the FAO provide access to journals in its areas of remit through AGORA[21], the WHO through HINARI[22] and UNEP through OARE[23]. Increasingly, educational institutions are now requiring academics to make their publications available through university repositories, and many also choose to make pre-publication drafts of papers available on their own blogs or websites.

At the school level, the challenges are equally substantial, since there are so many providers of educational content that it can be overwhelming for teachers to judge what is of best quality or relevant to their needs. Moreover, even when they find content, it is usually in one of the main global languages, such as English or Mandarin. Invariably, teachers in poor countries do not have the time to devote to hours of expensive and slow online searching; all too often, they also hold other jobs to supplement the meager salaries that they gain from their teaching profession. This is in part why textbooks still dominate the educational market in schools in poor countries. While there are some internationally renowned free educational resources, such as those provided by the BBC,[24] or through initiatives such as Curriki,[25] one of the most valuable things that Ministries of Education or civil society organizations in poor countries could do would be simply to provide key links to high quality, educationally relevant free content on the Web.[26] The challenge, of course, is that companies make profits out of publishing text books – even when these are funded by bilateral donors as part of their support for education in poor countries.

One of the fundamental challenges for education on the Web is the cost of producing and accessing high quality content.[27] In traditional models of educational publishing, authors were paid for producing books, although they did not usually receive financial reimbursement for writing papers in academic journals. However, with the Web, anyone with access can upload content for free. This is a good model from an access perspective, as long as content producers have an income from elsewhere, but people who want to make their living by providing educational content need to find ways to generate an income from it. As yet, there remains huge debate about the optimal business models to facilitate the production of high quality content that can be accessed by school pupils, university students or lifelong learners for free. Someone at some stage has to pay, be it universities, Ministries of Education, advertisers, or the learners themselves. Increasingly at the university level, institutions are making their content freely available, in part a generous donation to international education and in part a marketing strategy. Among the first and most successful to do so were the Massachusetts Institute of Technology through its Open Courseware Initiative,[28] and the UK's Open University's Open Learn initiative[29]. Many other universities make audio copies of lectures available through initiatives such as Apple's iTunes U.[30]

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[20] http://www.inasp.info/, accessed 14 July 2011.
[21] http://www.aginternetwork.org/en/, accessed 14 July 2011.
[22] http://www.who.int/hinari/en/, accessed 14 July 2011.
[23] http://www.oaresciences.org/en/, accessed 14 July 2011.
[24] http://www.bbc.co.uk/schools/, accessed 14 July 2011.
[25] http://www.curriki.org/, accessed 14 July 2011.
[26] An early attempt to do this in 2004 was at http://www.gg.rhul.ac.uk/ict4d/Learners.html, accessed 14 July 2010.
[27] See for example, the work of the Institute for the Future of the Book (http://www.futureofthebook.org/, accessed 14 July 2011).
[28] http://ocw.mit.edu/index.htm, accessed 14 July 2011.
[29] http://openlearn.open.ac.uk/, accessed 14 July 2011.
[30] http://www.apple.com/education/itunes-u/, accessed 14 July 2011.

However, content is probably the least valuable thing that a university has. What matters most is the intellectual capacity of its researchers, their ability to inspire new generations of learners, and the ways in which they debate and engage with students.

Under the theme of content production and provision, the Open Educational Resource (OER) movement nevertheless has so much to contribute[31]. OERs can enhance the quality of content through collaborative production and reduce the traditionally high costs of such content. It may also be used in contexts where teachers have little content knowledge; it can compensate for poor existing infrastructures, and make content available where none existed previously. However, the practical reality is that in many poor countries such initiatives have failed to flourish. There are many reasons for this, not least that OERs are often introduced by external organizations and staff and therefore they are not integrated within existing structures and financing arrangements for local universities. In addition, they may also run counter to the traditional didactic modes of teaching, and they undermine traditional sources of income for staff. If people are going to develop content for others to use, they must understand the value that they can gain in doing so, and they need to be compensated appropriately. Without external funding from international agencies or foundations, it has proven almost impossible to make such initiatives sustainable.

Learning or Content Management Systems (LMSs, and CMSs) are another important area to be considered in terms of applications for content delivery, especially where this is used in distance learning scenarios.[32] Even in the more affluent countries of the world, such systems of organizing content for students are not universal, and many schools manage perfectly well without them. However, at most universities in the developed world, such LMSs are now widespread, providing easy access for students to course content in the form of lecture notes, videos, audio files, and links to resources, as well as means of networking and communicating with their tutors online. Broadly speaking, such systems are of two types: proprietary and Open Source. Among the most popular of the former are systems such as Blackboard and Fronter, whereas the latter include Moodle and Chisimba.[33] In many of the poorer countries of the world, such systems remain poorly developed, and much more training is required among academic staff before they will be used effectively.[34] Moreover, the infrastructure required to support them is considerable, and until rapid connectivity solutions over university intranets, let alone the Internet, is achieved, they will remain limited in practical value.

Finally, one should also consider applications that are used for the production of content. Most educational content, whether it is stand-alone or incorporated within LMSs, tends to consist of simple Web-based resources in the form of text, images, video, audio, and games. Preparing content other than text and images often goes beyond the skills of many teachers, especially in poor countries. Hence, much teacher-disseminated content tends to be in the form of uploaded text documents or slide shows, using proprietary software such as Microsoft

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[31] See for example UNESCO's OER initiative (http://oerwiki.iiep.unesco.org), the work of the UNESCO/COL Chair in Open Educational Resources at Athabasca University (https://unescochair.athabascau.ca/), the WSIS OER Platform (http://www.wsis-community.org/pg/groups/14358/open-educational-resources-oer/), and the OER Africa initiative (http://www.oerafrica.org/), all accessed, 14 July 2011.

[32] See for example, Eaves, M., Maclean, H., Heppell, S., Pickering, S., Popat, K and Blanc, A (2007) Virtually There: Learning Platforms, Scunthorpe: Yorkshire and Humber Grid for Learning Foundation / Chelmsford: Cleveratom, and Ipsos MORI and JISC (2008) Great Expectations of ICT: how Higher Education Institutions are Measuring Up, London: Ipsos MORI.

[33] http://www.blackboard.com, http://com.fronter.info, http://moodle.com/ and http://www.chisimba.com/, accessed 14 July 2011.

[34] Unwin, T. with Beate Kleessen, David Hollow, James Williams, Leonard Mware Oloo, John Alwala, Inocente Mutimucuio, Feliciana Eduardo and Xavier Muianga (2010) Digital Learning Management Systems in Africa: rhetoric and reality, Open Learning: The Journal of Open and Distance Education, 25(1), 5-23.

Office, or Open Source alternatives such as Open Office. Developing sophisticated websites almost always requires professional design and delivery. The recent development of easy to use blogging software, such as WordPress is beginning to change this, enabling teachers with access to the Internet to upload a considerable range of learning resources. This trend is likely to move further with the evolution of the Cloud, and the increased competition among providers such as Google and Microsoft to host content services, such as educational resources. Additional solutions for content development include educational wikis.[35] Although these have not yet been used extensively, they provide interesting opportunities, not only for teachers to collaborate in shared content production, but also for peer learning and collaborative student project delivery.

## Education and Communication

It would be too narrow minded to say that most Web-based educational content is merely traditional forms of content made more widely available through the Web, but there is a large element of truth in such an assertion. In contrast, the Internet and Web-based applications can have a much greater transformatory influence through the ways in which they enable new modes of communication. As yet, though, rather less emphasis has been placed on communication than has been placed on content.

At the simplest level, the Internet has transformed the ways through which teachers and learners communicate. Web-based learning resources can be accessed by students almost anywhere in the world, and the use of Voice over Internet Protocol (VoIP), initially in audio and now much more frequently with video, can enable teachers to interact synchronously with classrooms many hundreds of miles from where they are situated. This has had a significant impact on the delivery of distance education. If such video connectivity could become more reliable, it is not impossible to imagine a small group of teachers giving lessons to many classrooms across the world. Integrating such video communication with existing LMSs can be a way of providing a completely rounded and synchronously interactive multimedia experience for learners 'at a distance'. This creates enormous opportunities for entirely new kinds of school and university configurations, both in terms of timetabling and in the use of space. It also opens up important opportunities for the delivery of global capacity development programmes, as with GIZ's Global Campus 21.[36] Organizations such as Academic Earth are providing free online videos of lectures across a range of fields already,[37] and it is easy to conceive of a future where students can pick up lectures from a variety of different online sources, and compile these together to suit their particular needs. Limiting points at this time are the importance of the formal credentials that are associated with particular degrees, and once again the need for the people who prepare and deliver the lectures to be paid!

This in turn raises the matter of assessment. It is, for example, possible to imagine a system where an award-granting body simply sets exams, be it at school or university level, and then anyone can sit that exam online to show that they have acquired knowledge in a particular field. Online assessment is a thriving business,[38] and software will soon be sufficiently sophisticated to be able to mark student essays, perhaps even more effectively and reliably than human markers.[39] At a less sophisticated level, Web-based systems and LMSs already provide a simple means through which teachers can provide formative and summative feedback on student work, and this is also likely to increase in the future, as education becomes more virtual in practice.

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[35] http://educationalwikis.wikispaces.com/, accessed 14 July 2011.

[36] http://gc21.inwent.org/ibt/GC21/area=gc21/main/en/site/gc21/public/index.sxhtml, accessed 10 December 2012.

[37] http://academicearth.org, accessed 14 July 2011.

[38] See for example http://www.articulate.com, and http://www.murraydata.co.uk, accessed 14 July 2011.

[39] See for example Valenti, S., Neri, F., Cucchiarellu, A. (2003) An overview of current research on automated essay grading, Journal of Information Technology Education, 2, 319-30.

A further important form of Web-based communication is social networking, or in the school context, educational networking.[40] While many educational institutions use popular social networking environments such as Facebook, others have turned to alternative, easily tailored solutions such as Ning, or the Open Source Elgg, which was partly designed with schools and universities in mind.[41] These applications offer interesting opportunities for groups of learners to collaborate in flexible ways, with or without teachers being involved. However, they are in their infancy, particularly with respect to learners who are poor or in marginalized contexts.

## Globalizing and Localizing Education

The Web is both centralizing and decentralizing, globalizing and localizing; it is a means of control, and an opportunity for anarchy. For many, it has been seen as a vehicle through which high-quality, uniform educational content can be disseminated internationally, thereby enabling those who cannot afford to go to school to gain a free education. At the heart of many such visions are concepts such as learning nuggets that can be combined in different formats to provide whatever curriculum content might be needed in a particular circumstance.[42] Such ideas are attractive, not least to content providers who would like their content to be sold widely around the world. However, there are real dangers in such universalism, not least the tendency for imperial powers to convey their particular view of the world through the educational materials that they subsidize and export overseas. In some subject areas, such as mathematics, it is even argued that the same learning resources can be used anywhere in the world; after all, 2 + 2 = 4. However, even this is not quite as simple as it may seem. Images and contexts matter and what may be entertaining and educational in one country might be confusing or even offensive in another.

While the Web offers enormous potential for sharing centrally produced learning resources freely, as well as a distribution channel for the sale of relevant educational content to those who can afford it, there are two important issues that must be considered carefully. First, in most instances such resources can be made much more effective if they are localized and tailored to the needs of users, not only in terms of language, but also in the composition and visual imagery of the resources. One of the challenges is that such localization can be expensive and technically demanding. Despite the rhetoric of the importance of websites being made available in many different languages, it is remarkable how few global education initiatives actually conform to this ideal. A second issue is the extent to which Web-based content produced locally in poor contexts can then be used globally elsewhere. A challenge in this case is that developing high-quality educational content requires considerable skill and can be very expensive. As a result, there are usually resourcing difficulties in developing content in poor countries. Moreover, many students level tend to prefer glitzy well-produced 'externally-sourced' content to poor quality, home-produced materials.

These issues touch on the debate about business models and neo-colonial agendas that may be associated with the dissemination of educational concepts and content from the richer to the poorer countries of the world. The developing world constitutes an important market for educational content providers, especially when the international donor community is willing to provide large sums of money for the production and dissemination of text books and materials in support of the Education for All agenda, and particularly the goal of Universal Primary Education as formulated in the MDGs. There is undoubtedly some capacity in poor countries to de-

[40] http://www.educationalnetworking.com/, accessed 14 July 2011.
[41] http://www.ning.com/ and http://elgg.com/, accessed 14 July 2011.
[42] I recall several conversations in the early 2000s with Hugh Jagger on the subject of learning nuggets, and am grateful to him for his enthusiasm, even though conceptually I have difficulty with the validity of such a notion (http://www.hughjagger.com/).

velop high quality, locally relevant learning resources, but these are insufficiently supported, and it is difficult for them to generate sufficient income when there is so much educational content freely available on the Web already.

In spite of these challenges, there is substantial value in Web-based solutions to educational establishments, not only in the production of content, but also in sharing learning experiences, be this through school twinning programmes[43] or the development of joint curriculum resources by universities in different parts of the world. Using the communication technologies mentioned above, the Web has opened up many exciting opportunities for learners across the world to draw on the experiences of others in developing shared understandings. In the final analysis, learner to learner communication may become one of the most valuable educational assets in building a wider sense of peace and global understanding.

## A Web Awaiting Exploration

Despite the vast amounts of information on the Web, its full potential has not yet been unlocked in terms of being a truly effective vehicle for education around the world. Even in the richest countries of the world, with computers in every school and interactive whiteboards in every classroom, the Web remains primarily a resource for gathering information; its potential for developing innovative forms of communication and shared knowledge creation is surprisingly underutilized.

Among the poorest people, and in the most marginalized communities, the Web is even less accessible, even though the information could help to empower them. This is not so much because of a lack of connectivity, electric power and infrastructure, but because the educational community has not yet grasped the full potential of the Web. As mobile devices become ubiquitous, and mobile Internet opens up the remaining 25% of the world that does not yet have connectivity, it is crucial that this opportunity is grasped. Otherwise, like most technologies before it, the Web will continue to serve the interests of the richer and more powerful, to the detriment of the poor and marginalized. Many mobile learning initiatives have failed to take root[44], and it is remarkable how few university students yet use the full potential of their mobile devices to contribute to their learning. However, with the rapid development of mobile broadband solutions, with the creation of even better handheld devices in the future, and with the realization that such technologies can indeed transform education, then learners will increasingly demand access to appropriate and sophisticated learning resources that they can access through their mobiles to use the Web in innovative ways, especially for those who remain outside traditional educational systems.

[43] See for example http://www.britishcouncil.org/etwinning.htm, accessed 14 July 2011.
[44] See for example, MoLeNET (http://www.molenet.org.uk/), accessed 24 September 2011, which supported 104 projects between 2007 and 2010 in the UK.

# CHAPTER 9

## Commerce and Trade

*Torbjörn Fredriksson*

The advance of new information and communication technologies (ICTs) has had a transformational impact on the ways in which enterprises organize and conduct their commercial activities, both within and across national boundaries. While this has been the case for a long time in developed countries and for large enterprises throughout the world, it is only in recent years that the power of ICTs has been felt also among micro- and small enterprises in developing countries. Thanks to the rapid spread of mobile telephony and related applications, there are now greater possibilities than ever before for enterprises that matter to the poor to exploit ICT opportunities in their commercial activities. This chapter provides a brief overview of some recent developments and draws out key policy implications.[1] It argues that, in order for policy interventions to harness the emerging opportunities, they need to become more demand-driven, better understand the needs of different enterprises, exploit the diversity of ICTs and leverage the capabilities and expertise of various stakeholders.

### What ICTs Can Do for Different Types of Enterprises

Sustained and equitable growth is essential for making substantial progress in creating wealth and reducing poverty. Enterprises play a crucial role in this context. At the same time, it is well established that the enhanced use of ICTs by enterprises can help reduce transaction costs and improve productivity and growth.[2] ICTs have played an important role in advancing productivity for developing countries across sectors, when measured at the national level.

However, benefits from ICT use are not an outcome of the technology itself, but rather of what the technology enables managers and workers to do. The positive impact of having access to affordable ICTs expands when it effectively meets the needs of the users. Virtually all enterprises need information to decide what, when and how much to produce. They also need to decide when, and to which market, to sell. Costs related to obtaining, selecting and using such information can constitute a significant barrier to growth.[3] Although all enterprises have a need for effective communication and for accessing information of various kinds, the extent to which an enterprise could benefit from using ICTs for other purposes (such as making on-line transactions or storing and processing information) varies greatly.

Consequently, benefits are not equally distributed across the private sector. Different ICTs – such as mobile phones, computers and the Internet – vary in accessibility, functionality and user requirements. The potential for any enterprise to gain from enhanced access to certain technologies or applications depends on its needs for information, storage and communication, which in turn are affected by the company's size, industrial sector, growth-orientation, location and workforce skills.

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[1] This chapter draws significantly on the work of UNCTAD in exploring the links between ICTs, enterprises and poverty alleviation (see UNCTAD 2010).

[2] See, for example, OECD 2004, Eurostat 2008, Indjikian and Siegel 2005.

[3] See, for example, Pingali et al. 2005.

For *subsistence-based enterprises* (i.e. those which provide the most direct livelihood support for the poor) accessing client markets (especially distant markets) presents a particular challenge, requiring interaction with market intermediaries. For most such enterprises, markets are restricted to the immediate community or district centers. Enterprises serving local markets often rely on information delivered informally through local networks of communication, where trust and risk reduction are major factors that govern their dependence on networks. Lack of timeliness of information is a serious, but common, failure of the information delivery system used and constitutes a significant aspect of the vulnerability of subsistence-based enterprises to changes in the surrounding environment.[4] The quantity and ranges of information obtained through traditional channels are also an issue, with barriers including literacy and fluency in non-native languages. Weaknesses in informal information sourcing should similarly be recognized.

*Growth-oriented enterprises*, by contrast, frequently seek to extend their market reach. Their sectoral value chains often reach beyond the district locality to main centers of population and sometimes across national boundaries. A higher degree of integration of enterprises into market systems requires more formalization of information systems.[5] Particular characteristics of the transition towards greater formalization include 1) growing demand for an increased volume and complexity of information, as the value of information is better recognized; 2) reduced information needs gaps, as internal capacity to meet information requirements rises;[6] and 3) greater emphasis on external communication. This transition may be accompanied by a move from a manual paper-based information system to the use of ICTs for internal processing of information (with PC applications), and from face-to-face contact or telephony (pre-existing landlines/payphones) to ICTs for external communication (using mobile phones or e-mail/Internet).

By integrating into global value chains (GVCs)[7], enterprises in developing countries can potentially access relatively secure and high volume markets for a broad range of goods and services. However, in order to do so effectively, they need the capacity to handle large-scale production for exports and to conform to strict product, process and environmental quality standards. This in turn often requires an even higher degree of formalization of information systems (including use of ICTs).[8] Therefore, those who lack the capacity and opportunity to comply with international standards tend to be marginalized and excluded from GVCs.[9]

## ICT Use in the Evolving ICT Landscape

The ICT landscape continues to evolve at a rapid pace, opening opportunities to leverage new technologies for commerce and trade and for doing business in different ways. From the perspective of micro- and small enterprises, the most exciting development during the past decade has been the swift diffusion of mobile telephony. Data from the International Telecommunication Union (ITU) suggest that the total number of mobile subscriptions reached some 5.4 billion in 2010.[10] Average global penetration at the end of 2010 was estimated to be 79 subscriptions per 100 inhabitants.

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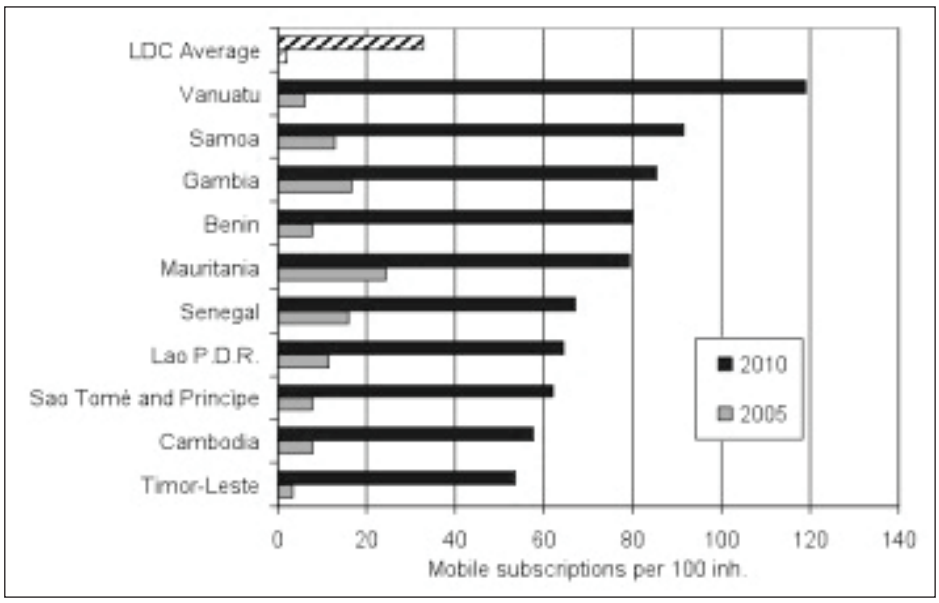
[4] See Duncombe and Heeks 2002.
[5] See Gelb et al. 2009, Duncombe and Molla 2009, Murphy 2002.
[6] Defined as the gaps measured between the information that the enterprise needs in order to produce and trade, and the information they have or are able to acquire (See, for example, Duncombe and Heeks, 2002).
[7] Altenburg (2007) provides a useful discussion on pro-poor GVCs.
[8] See Parikh et al. 2007.
[9] See Kaplinsky and Morris 2001, McCormick 1999.
[10] See ITU World Telecommunication/ICT Indicators database.

Figure 1: Mobile penetration in selected LDCs, 2005 and 2010




(Number of subscriptions per 100 inhabitants)
*Source: ITU's World Telecommunication/ICT Indicators database.*

What is particularly remarkable is the progress achieved in the least developed countries (LDCs).[11] In these countries, average mobile penetration rose from 2 subscriptions per 100 inhabitants in 2005 to 33 subscriptions in 2010 (Figure 1). In some of them, the growth rate has been truly impressive. In Vanuatu, for example, penetration surged from 6 to 119, and in the Gambia from 16 to 85 per 100 inhabitants.

Nevertheless, lack of service availability remains a constraint to mobile uptake in some places. Although the share of world population that is within range of a mobile network base station continues to increase according to the ITU, and stood at 88% in 2010, there is still much work to be done. In many LDCs, more than 30% of the population still lack access to a mobile signal on average, with an even higher share in rural regions.[12]

On the back of the roll-out of mobile networks, many new applications that are relevant to small enterprises have emerged in recent years. Mobile phones are increasingly used by enterprises in developing countries not only for standard calls, but also for non-voice uses, such as text and picture messaging, Internet access and mobile money. Mobile money is one of the most exciting examples, a phenomenon that has taken off only in the past two years. According to data from the GSM Association, more than 100 such deployments had been implemented as of April 2011, spanning all developing regions.[13] In fact, Africa was leading the trend with 51 mobile money systems, followed by 33 in Asia and Oceania, and 14 in Latin America and the Caribbean. As many as 37 deployments had been launched in LDCs. There are now more than 40 million users among providers for which subscription data are available.

[11] LDCs have been identified by the United Nations as "least developed" in terms of their low gross national income, weak human assets and a high degree of economic vulnerability. See http://www.un.org/special-rep/ohrlls/ldc/list.htm for further information.
[12] See UNCTAD 2011.
[13] See http://www.wirelessintelligence.com/mobile-money.

Another case is mobile micro-insurance. For example, the Kilimo Salama scheme (Swahili for "safe farming"), which was introduced in March 2010, grants weather-indexed insurance to small-scale farmers in the Kenyan Rift Valley. Without the mobile technology, the transaction costs associated with such insurance products were simply too high to make them viable. In a panel debate at the WSIS Forum 2011 on mobile money applications, some industry experts predicted that it will soon be possible to measure the amount of rainfall by analyzing the impact of precipitation on the radio waves. This would make it possible to use weather-indexed insurance schemes even in places where there are no weather stations.

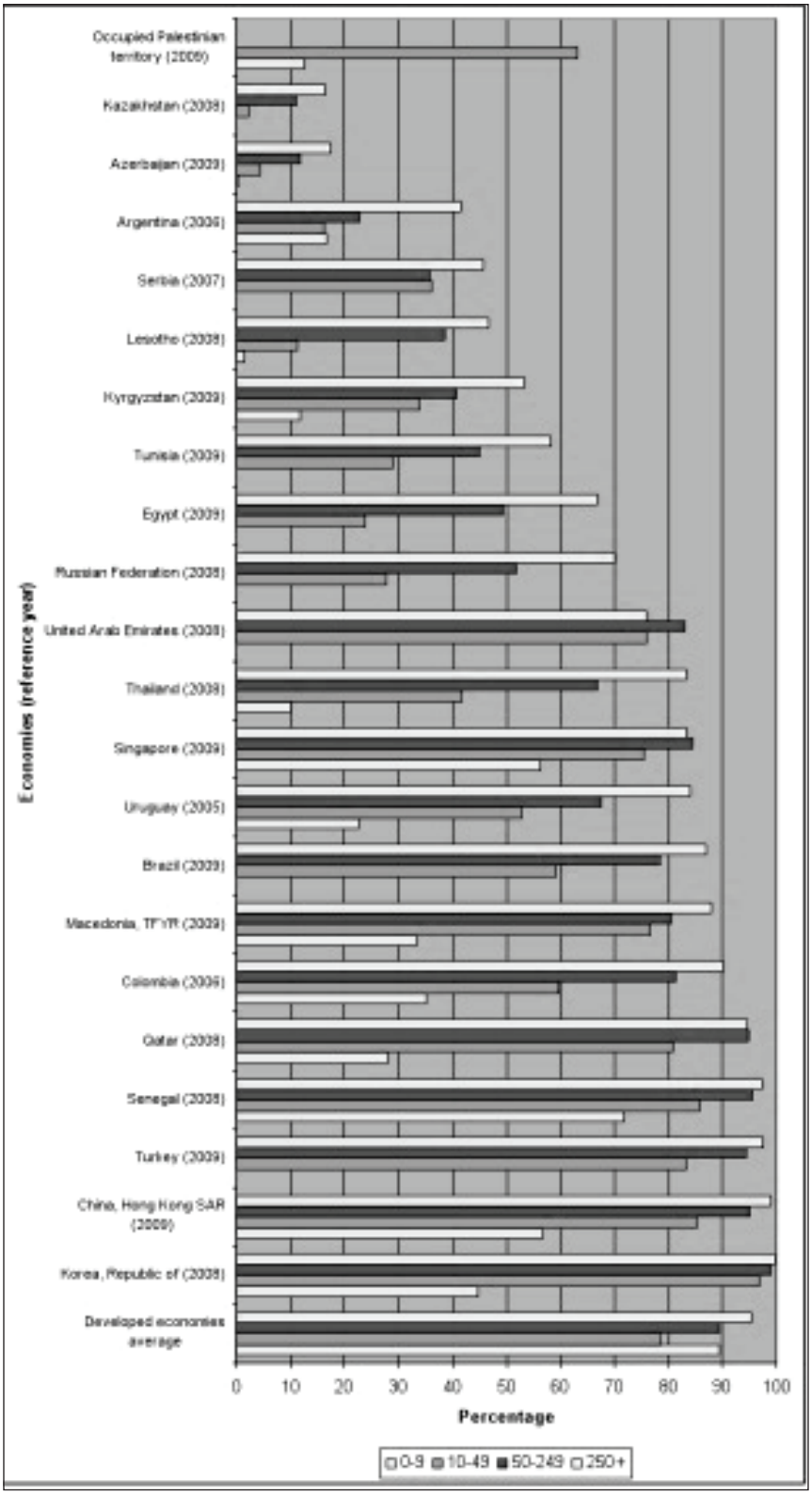
The mobile phone has some evident advantages. It is relatively cheap and more accessible than other ICTs – with the exception of radio. Moreover, it is easy to use and requires limited literacy skills, thereby becoming available to larger groups of potential users in low-income countries. Furthermore, mobile phones are fairly easy to recharge. In addition, improved access to mobile phones has enabled new combined uses of ICTs with different features and advantages. For example, some community radio stations in Africa that are connected to the Internet run so-called radio browsing programmes, which provide indirect access for rural enterprises and others to the Internet and broadcast to communities. They help raise awareness of what is available online, allowing users to find new solutions to their diverse needs. So, better access to mobile phones also expands the possibilities for enterprises and people in remote areas to benefit from other ICT tools.

As stressed in previous chapters, the Internet is generally far less accessible in developing countries than mobile telephony, especially in rural areas. At the end of 2010, there were an estimated 2 billion Internet users, which corresponds to almost 30% of the world's population. There is still a significant divide between developed and developing economies and between developing economies and the LDCs. According to the ITU, almost 75% of the population in developed countries is using the Internet. In developing countries, the corresponding share is only 21% and in LDCs it is a mere 4%. In the case of fixed broadband, the gulf is even wider. A person in a developed economy was in 2010 on average 300 times more likely to have access to fixed broadband than one living in an LDC. Mobile solutions are likely to be the preferred route to extending broadband in many low-income countries with limited fixed line infrastructure. Although mobile broadband penetration in low-income countries is still far below the world average, the gap is smaller than in the case of fixed broadband. The ITU estimates that there were about 872 million active mobile broadband subscriptions in 2010. Whereas global mobile broadband penetration was about 65% higher than fixed broadband penetration, in Africa it was 1,400% higher.[14]

High-speed connections are essential to make full use of today's multimedia rich Internet and to enable powerful business applications. We know from studies in developed countries that broadband is essential to enable enterprises to make full use of Internet-based services and applications.[15] As can be seen from Figure 2, fixed broadband use by enterprises is close to ubiquitous in developed economies. In developing countries for which data are available, the pattern is diverse. While more than three-quarters of medium-sized and large enterprises in Brazil, Colombia, Qatar, Turkey and the UAE have broadband Internet access, the share is much lower in other economies, especially in the case of smaller enterprises.

[14] See UNCTAD 2011.
[15] See UNCTAD (2009) for a review of various studies.

Figure 2. Enterprises using the Internet via fixed broadband, selected economies, latest year (%)

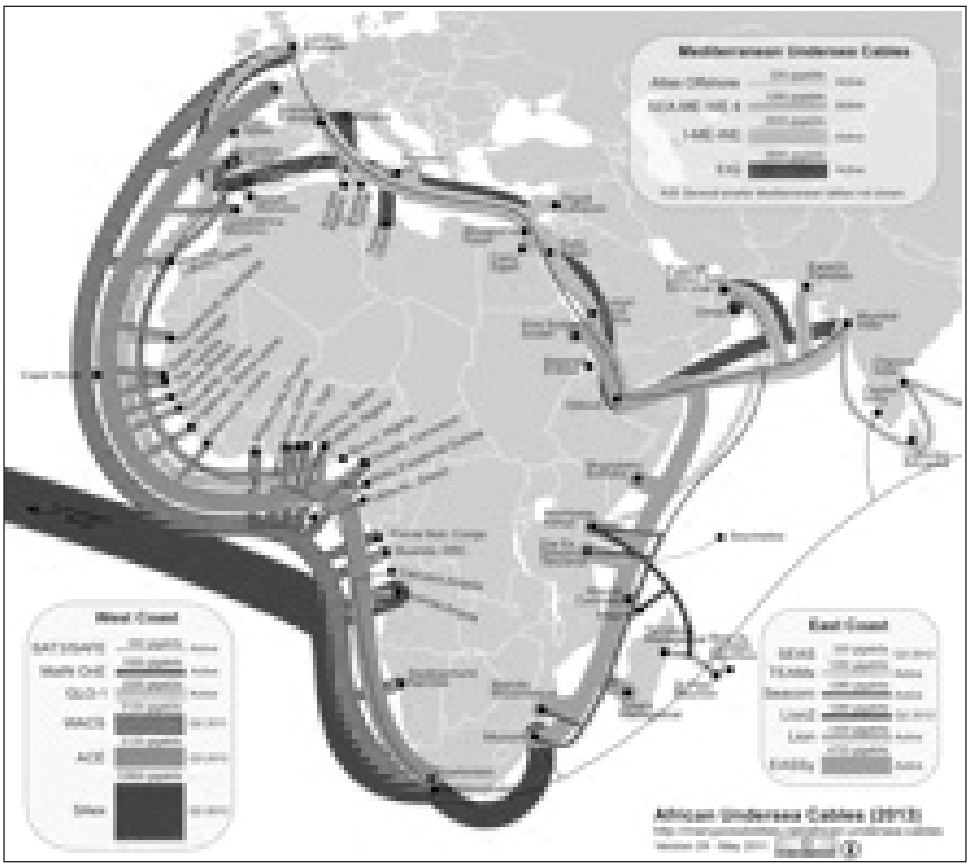



*Source: Source: UNCTAD Information Economy Database.*

The Internet offers huge potential benefits for enterprises by enhancing access to information, enabling transparent and efficient commerce between customers and suppliers and improving interaction with government. But to exploit such possibilities, enterprises need affordable Internet connectivity as well as the skills to use it. There is a clear difference in the level of Internet use between medium-sized and large enterprises, on the one hand, and of small and (especially) micro-enterprises on the other. In the case of Jordan, for example, UNCTAD data show that virtually all enterprises with more than 250 employees use the Internet, but just 6% of micro-enterprises. Use of the Internet by small businesses in developing countries for more advanced applications (such as e-commerce) is still rare, but it is likely to increase as the deployment of fixed and mobile broadband makes faster Internet access available. Provision of Internet access alone may not bring significant benefits to micro-enterprises, unless other support and tailored information are also made available.

International bandwidth is another important aspect of connectivity for commerce and trade. If such bandwidth is constrained, broadband experience will be poor, limiting the types of applications users can access. Rapid growth in capacity is helping to drive down prices, but the impact is constrained due to skyrocketing demand for bandwidth intensive video applications. One region that has long had constrained international bandwidth is sub-Saharan Africa, where there was only one major inter-regional undersea cable until 2009. Since then, five new systems have been launched and another two are scheduled to go operational over the next few years (Figure 3). These new systems have already helped to bring prices down in some countries and will raise the total capacity delivered by fiber-optic cable in the region from 3 Tbit/s to 21 Tbit/s.[16] This increase in capacity will help to integrate the region into the global information economy.

Figure 3. African Undersea Cables, updated 4 May 2011



*Source: Steve Song, http://manypossibilities.net/african-undersea-cables/*

[16] In East Africa, mobile data prices have fallen sharply since the introduction of new fiber-optic submarine cables. See http://whiteafrican.com/2010/10/28/snapshot-mobile-data-costs-in-east-africa/.

Improved broadband connectivity is generating new ways of doing business. One advantage of having broadband access is the possibility to use Voice over Internet Protocol (VoIP). This is of particular relevance for micro-enterprises and SMEs in developing countries, given its lower cost structure compared to traditional telephone services.[17] However, several countries reportedly either ban VoIP services (as in Ethiopia, Kuwait and Oman) or have restrictions that make it almost impossible for such services to be provided by competitive providers (as in Armenia, Bangladesh, Egypt, Philippines, Saudi Arabia, Thailand and the United Arab Emirates).[18] Broadband also facilitates the use of social media and many of its applications, which present economic and marketing opportunities for enterprises. Social media may furthermore offer a cost-effective way for informal enterprises and SMEs to establish a Web presence. As mobile versions of social networking do not require much bandwidth, they can be especially attractive options for users in countries with slow Internet connections.[19]

## Impacts of ICT Use by Enterprises

Evidence from both developed and developing countries has shown that effective use of ICTs affects productivity in both large and small enterprises. For example, a firm-level World Bank study covering 56 developing countries found that "ICT is playing an important role in allowing businesses to grow faster and become more productive – this alone suggests that creating an appropriate environment to exploit ICT is important".[20] Developing-country enterprises using ICT had better performance compared with enterprises that did not use ICT, with notable improvements in enterprise growth, profitability, investment and productivity. Other studies have shown that ICT use has a positive effect on labour productivity also in low-income countries. In an examination of 13 countries in Africa, ICT use was found to be positively correlated with productivity in all types of enterprise, and mobile phone use was identified as the significant correlating factor.[21] Indeed, a review of 14 different studies concluded that mobile phones were helping small enterprises to become more productive, particularly in relation to marketing, sales and customer relations.[22]

Judging from the available evidence, the main observed benefits of ICT use in enterprises of relevance to the poor are twofold: 1) a reduction in information search and transactions costs for those involved in enterprise; and 2) improved communications within supply chains, leading to benefits for individual enterprises and overall improvements in market efficiency.[23]

Positive effects have been observed across industries. One of the most often cited studies in this area is that by Robert Jensen of the fishermen in Kerala, India.[24] Fishing is an industry of direct relevance to the poor. Various information market failures can affect fishermen. While at sea, they have limited bargaining power in the market. A lack of knowledge of market prices makes it difficult for them to identify in which market location they would get the best price. Due to the cost of transportation and perishability of their catch, they can only visit one market per day, often ending up selling in their local market. The study by Jensen, as well as other research, provides convincing evidence that increased use of mobile phones has helped to address information asymmetries between fishermen, traders and consumers.[25] Interestingly, benefits in the communities studied have extended

[17] Other compelling reasons to use VoIP include the possibility to chat, do videoconferencing and send files.
[18] See UNCTAD (2011).
[19] Ibid.
[20] See World Bank (2006, page 72).
[21] See Esselaar et al. (2007).
[22] See Donner and Escobari (2009).
[23] UNCTAD (2010) provides a recent review of the evidence.
[24] See Jensen (2007).
[25] Other relevant studies include Abraham (2007), Boadi and Shaik (2006) and Boadi et al. (2007).

beyond the individual fishermen who were using the phones, partly as a result of greatly improved functioning of the fish markets more broadly. Better market coordination has resulted in increased profits for the fishermen (with or without phones), lower fish prices for poor consumers, as well as a reduction in the wastage of fish.

There are similarly many examples from ICT use in agriculture. Mobile phones are increasingly used by farmers to obtain relevant information and coordinate activities with other participants in the value chain. Positive effects by way of reduced transaction costs and better market prices have been observed, for example, in the cases of grain markets in Niger, dairy farmers in Bhutan (box 1) and onion trading in Ghana. In some instances, even those who do not themselves use the phone have benefited from better functioning of markets and from information passed on from phone owners.

*Box 1: The impact of mobile phones on dairy farming in Bhutan*

In only a few years, Bhutan has moved from no mobile phones to more than 50 subscriptions per 100 inhabitants. The rough terrain and high mountains have not deterred mobile connectivity, on the contrary. A tower on one mountain can provide a signal to all surrounding regions. As of early 2010, there were two operators: B-Mobile (State-owned) and Tashi Cell. The villagers of Orong are subscribers of B-Mobile.

Almost all farmers can afford a cheap mobile. Recharging the phones with new airtime can be a problem in remote areas where there are no shops. In such cases, farmers often call their relatives asking for a recharge, often using "missed calls" to ask the other party to call back.

Dairy farmers in the Orong geog in eastern Bhutan first did not predict that it could also enhance their incomes, but bought phones to stay in contact with family and friends. However, it soon became clear that mobile phones could support their dairy farming livelihoods in several ways:

- Access to market information. Farmers can now find out the prices that apply in different markets and nearby districts. This has given them more choice and improved their bargaining power.
- Avoid intermediaries. Better price information has allowed farmers to deal with customers directly, especially those who procure larger quantities (e.g. boarding schools and hotels). Farmers supply these organizations directly without intermediaries. Their income has increased as a result.
- Increased direct sales and less waiting. In the past, farmers living 1-2 hours walking distance from the main highway could wait for hours (sometimes a day) for travelers to come and buy their produce. Today, public transport agencies (mainly bus services) call them to inform how far the bus or van has reached. This has reduced farmers' waiting time.
- Collective pricing/organization. Farmers stay in touch with each other via their mobiles. It has enabled better organization of the farmers and better decisions on the price to charge. Enhanced organization has given farmers the choice of selling to the MPU or to other clients.

*Source: UNCTAD (2010).*

One of the potential advantages of introducing ICTs is to enable micro- and small enterprises to become less dependent on middle-men. Intermediaries often hold information on buyers, sellers, products and prices. They can reduce the informational costs and increase the communication speed for buyers and sellers. Their broader spread of contacts allows trade to become less localized. They can make trade less risky, because of their informational resources and reputation. But intermediaries can also have a negative impact on micro-entrepreneurs. They are typically in a powerful bargaining position, as they have more information than micro-producers and customers. As a result, they can offer prices paid to producers down below market values, reducing the income for micro-entrepreneurs.

Whereas there are many instances of disintermediation, greater ICT use does not automatically result in such an outcome. Indeed, the introduction of ICTs may even reinforce the market position and power of existing trading intermediaries. A study of women micro-enterprises in the weaving industry in Nigeria found that despite the introduction of mobile phones, the market structure remained largely unchanged. Commerce remained localized and intermediated. Indeed, mobiles helped to consolidate the role of existing intermediaries (because of their access to capital and other resources) and also led to the creation of new forms of intermediaries.[26] A study of the African blackwood carving sector in Tanzania, in which information exchange along the value chain was intermediated through complex networks of traders, similarly found that trading intermediaries were likely to reinforce their position and benefit through use of mobile phones rather than be cut out of the value chain.[27]

## Opportunities in the ICT Producing Sector

The changing ICT landscape has had a major impact not only on the use of such technologies by enterprises, it is also giving rise to new activities in the ICT producing sector and in activities enabled by ICTs. Opportunities are emerging also for micro- and small enterprises.

A growing ICT sector can contribute to aggregate increases in productivity, GDP and trade. The OECD reported increases in aggregate labour productivity (value added per person employed) attributable to a strong ICT sector in some developed countries between 1990 and 2002.[28] In developing countries, greater productivity gains have been observed from an expansion of the ICT sector than gains simply accrued through ICT use, while the opposite tends to apply for developed countries.[29] In a developing-country context, the expansion of the ICT sector is typically associated with a shift towards higher value-added activities with increasing returns, displacing activities in traditional economic sectors.

A dynamic ICT sector contributes to making the private sector as a whole more productive and competitive. It can also create new jobs, spur innovation and – not least important – support sustained use of ICTs throughout the economy. Recent developments show that, in low-income countries as well, a thriving ICT sector can significantly boost economic growth. The case of Kenya is interesting in this context. Its ICT sector grew 20% a year on average since 2000 and was responsible for as much as 24% of that country's GDP growth during the past decade.[30] Another example is Cameroon, where the ICT sector between 2000 and 2008 grew annually at rates between 15% and 46%.[31] In India, the growth of the ICT sector has been remarkable, with its share of the country's GDP climbing from 3.4% in 2000/01 to 5.9% in 2007/08.[32]

The part of the ICT sector with arguably the greatest direct involvement of poor people, which is spreading rapidly in many low-income countries, is related to ICT micro-enterprises (UNCTAD 2010). Throughout the developing world, there is a proliferation of shops and market stalls selling used and new mobile phones; kiosks that offer mobile phone applications and content; and activities such as installation, setup, and various repair

[26] See Jagun et al (2008).
[27] See Molony (2007).
[28] For example, the contribution of ICT manufacturing industries for Finland was 0.2 percentage points during 1990-1995 and 0.8 percentage points during 1990-1995. The relative figures for the Republic of Korea were 0.8 and 1.0 percentage points. The contribution of ICT services industries to aggregate labour productivity growth was typically less than for ICT manufacturing in the same periods. See OECD (2004).
[29] See UNCTAD 2007.
[30] See World Bank 2010.
[31] See Nzépa, Tankeu and Esse, 2011.
[32] See Malik and Mundhe 2011.

services. Selling airtime or mobile-money services on the streets or in shops engages millions of people in low-income countries. Much of this activity is in the informal sector and, while the activities are not well measured, anecdotally, they provide benefits to proprietors and customers and occupy niches that larger formal businesses are not interested in.

There are relatively low barriers to entry for some of the activities conducted in this field, making it possible for people with limited formal skills to participate. The simplest mobile card selling or vending jobs can typically be conducted by people with few formal skills and capabilities. In Gambia, for example, disabled street beggars were offered the opportunity to work part-time for Gamcel, a mobile network operator.[33] As authorized dealers, rising in economic stature and earning above-average wages, they felt empowered to participate in society. The simple activity of selling mobile subscriptions in this case helped to reduce poverty and to improve the living conditions of the people involved. ICT micro-enterprises in the informal sector often complement enterprises in the formal sector by selling goods and services that are adapted to low-income consumers. However, ICT micro-enterprises are frequently exposed to volatility and risk, and returns on investment are often low, forcing entrepreneurs to draw on other sources of income as well.

When considering ICT micro-enterprises as a new source of livelihood, the sustainability of different business models should be kept in mind. By the time a particular technology, intervention, or business model has proved successful in one context, its relevance elsewhere may have become obsolete. The "village phone" service developed by Grameen Phone in Bangladesh (and replicated in other countries) illustrates this point. While it initially allowed rural women to establish micro-enterprises reselling capacity on mobile phones, the business model became less sustainable as more and more people had their own phones. Because of the importance of networks and close interaction with other informal and formal enterprises, the opportunities for ICT micro-enterprises to develop are greater in urban settings. In rural areas, the scope for creating livelihoods around such activities appears to be more limited.[34]

Other parts of the ICT sector also hold opportunities, but not necessarily for all developing countries. For example, ICT manufacturing is characterized by high concentration of global production and exports, significant economies of scale, and high barriers to market entry for new countries and companies. Among developing countries, it is mainly Asia that has successfully managed to develop an internationally competitive ICT industry. In 2009, seven of the world's top ten exporters of ICT goods were in Asia, with China – by far the leading exporter – accounting for $356 billion of such exports.[35]

In combination with the lowering of trade barriers, advances in communication technology have expanded the opportunities for the splitting up and reorganization of value chains. This has had a profound impact on the ways in which enterprises manage their production, as well as innovation activities. It has also allowed multinational companies to deploy new information systems to enhance their cross-border coordination of both internal *and* external relationships. In particular, better connectivity has made some previously non-tradable services tradable. Cheaper and faster transmission has enabled the instantaneous exchange of digitized information and voice communication between people connected anywhere on the globe. In the business sphere, knowledge can be codified, standardized and digitized, in turn making it possible for the production of services to be "fragmented" into smaller components that can be located elsewhere to take advantage of cost, quality, economies of scale or other factors.

[33] This case was first brought to the world's attention by Ahonen (2009) and Mobile Monday.
[34] See Foster and Heeks (2010) and UNCTAD (2010).
[35] See: "In wake of financial crisis, Asia´s share of global ICT exports surges to record high" at http://www.unctad.org/Templates/webflyer.asp?docid=14417&intItemID=1528&lang=1.

Such increased tradability has not only affected relatively simple tasks such as data entry or call centre services. It has also facilitated a trend towards open innovation systems,[36] the need for which is accentuated by intense global competition. While in the so-called closed innovation paradigm, research, development and commercial exploitation of a new technology were performed mainly by large companies within their boundaries; companies now increasingly rely on outside innovation for new products and processes and have become more active in licensing and selling results of their own innovation to third parties.[37] Information systems play a critical role for the coordination of open innovation systems.

Companies that fully understand and implement ICT-enabled strategies can become capable of participating in geographically complex international networks made possible by, among other factors, new combinations of activities, whose respective centres of excellence may have been sited in distant locations. ICTs can be seen as the string that bundles together three trends in innovation in the globalizing economy: the emergence of R&D networks that connect geographically dispersed and specialized pools of expertise, the diversification of innovation activity at the level of the firm, and the emergence of inter-firm technological alliances.[38]

To date, developing Asia has been the most active in seizing opportunities from increased fragmentation – in both manufacturing and services. In the case of exports of IT and ICT-enabled services (broadly defined), India and the Philippines have been the most successful developing countries in terms of market shares. In 2009, these two countries accounted for an estimated 50% of the global market for business process offshoring.[39] At the same time, many additional countries are emerging as significant destinations for offshoring. The main such locations in 2009 included China, Thailand and Sri Lanka in Asia; Argentina, Brazil, Costa Rica and Mexico in South and Latin America, and Egypt, Mauritius, Morocco and South Africa in the Middle East and Africa.

## Some Implications for Policy

The expansion of the "information economy" has led to a restructuring of GVCs, with large shifts in the composition of world trade, both sectorally and geographically. In particular, improved tradability of services has led to the fragmentation of a range of business activities that were previously undertaken in-house. The trend towards open innovation and outsourcing of a diverse set of business functions has helped some developing countries to make inroads into global production and knowledge systems. Whereas some developing countries, especially in Asia, have been the first to capitalize on these opportunities, many others are eyeing future growth prospects in this field. Moreover, the changing ICT landscape in the past few years – especially linked to the spread of mobile telephony – has created opportunities for leveraging ICTs also among less affluent segments of the population. Such disruptive innovations as mobile money system are beginning to act as lubricants in the economy of some low-income countries, helping to facilitate a better and more efficient allocation of available capital. Recent introductions of cloud computing and smart electrical grids are further illustrations of how new technology is being applied in novel ways and in new areas.

Although evidence of positive effects on commerce and trade from the evolving ICT landscape is growing, enhanced ICT access does not guarantee benefits to all. As with other goods and services, increased technology ownership is likely to be associated with higher levels of income as well as other resources and capabilities required for their effective use. There is always a risk that ICT adoption increases disparities between more established and better resourced enterprises, on the one hand, and those that are less well-endowed on the other.

[36] See Chesbrough 2003.
[37] See OECD 2008.
[38] See UNCTAD 2007.
[39] These data are from UNCTAD 2010.

This makes it important to take a holistic approach to leveraging ICTs for seizing new opportunities as well as addressing potential pitfalls.

A general lesson is that policies should reflect fully the diversity of ICTs as well as of enterprises. ICTs vary in terms of their accessibility to different enterprises, their functionality, and their user requirements. Many people who run micro-enterprises in low-income economies cannot read or write, and they may have only restricted access to electricity. Therefore, programs should make innovative use of voice-based telecommunications interfaces and of proxies such as info-mediaries. As noted above, the need for information and other inputs also varies depending on the size, industry, and market-orientation of enterprises. As a result, so does the extent to which different enterprises may benefit from improved access to specific technologies. Consequently, to be effective and reach intended beneficiaries, policy interventions need to become more demand-driven and context-specific.[40] In practice this requires careful analysis of the needs and capabilities of the intended beneficiaries of ICT-related projects.

While this point is far from new, insufficient attention has hitherto been paid to it by policymakers and practitioners. Many strategies and policy initiatives for ICTs and ICT4D that have been developed by governments and their development partners in the past 15 years have emphasized the delivery of services to communities rather than responding to communities' own needs. This has sometimes led to a centralized, top-down model of development which has been insufficiently responsive to the needs of small-scale enterprises and to the precise priorities of target beneficiaries (Box 2).[41] Policy on ICT4D and enterprise should move away from top-down supply-led approaches to those that reflect the real requirements of enterprises, the barriers and drivers to the adoption of ICTs, and the broader context of affordability, capability and content surrounding them.

An illustration of the problem of insufficient assessment of needs is the case of the Cameroon Chamber of Commerce, Industry, Mines and Crafts, where a multimedia centre with Internet facilities that was created for its members who are women entrepreneurs in the textile sector went largely unused. One reason for this was that the centre was designed without understanding the specific situation of its target users, resulting in the centre being located in an area that was difficult to get to by public transport and had opening hours (8 a.m.–4 p.m.) that were inconvenient for women entrepreneurs. Furthermore, although most of its target users were unfamiliar with the Internet, there was no training organized for them to learn how to use the centre. Finally, its existence was not well promoted.

**Box 2: The problem of insufficient needs analysis**[42]

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[40] Similar arguments are made by Chaudhuri (2011).
[41] See, for example, O'Farrell et al. (1999), Heeks (2009) and Souter (2010).
[42] See Busken and Webb (2009).

Rooting policy approaches in the real experiences of relevant enterprises will foster the flexibility in programme design and implementation that is needed to respond both to various local circumstances and to continuous change in technology and markets. It places greater demands on national governments and development partners to be well informed before launching new policy interventions and to work in partnership with stakeholders that can contribute valuable knowledge and experience in relevant areas. There is a potential tension between the desire to achieve "scalability" in project design and to ensure that projects are well tailored to each context. Ideally, projects should be both scalable and customized – but this is hard to achieve in practice.

Governments and their development partners should ensure the further expansion of mobile coverage to those areas that are not yet covered by a mobile signal. In countries where monopoly or duopoly are holding back further investment in mobile networks, there may be a need to take steps to inject greater competition in the market. In several LDCs, mobile penetration is still below 10 percent. Lack of competition tends to result in higher prices and less widespread coverage, in turn inhibiting demand. In the medium term, enhancing access to broadband technologies is of course also important.

It is also relevant to explore ways to make mobile as well as other ICT services more affordable. High costs significantly hamper take-up and usage, especially among those with little income. The lowest mobile user charges have been observed in South Asia, where Indian operators, for example, charge some of the most competitive "prepaid" tariffs. Operator revenues are generated using low tariffs, but a high volume of users. While operators in India in 2009 reported about US$4 in average revenue per user, it was about US$12 in Benin and US$25 in Angola.[43] Unsurprisingly, Indian subscribers spend much more time talking on their mobiles. Where markets are competitive, mobile network operators can seek to facilitate usage at low-income levels through an array of mechanisms.

Improved mobile access at increasingly affordable rates—partly the result of cheaper imports of technology—and new service models are facilitating access for people without large or predictable incomes. This allows for greater involvement of enterprises in developing countries in ICT-related innovation processes.[44] Such involvement is likely to enable the adaptation of ICT systems (which were first developed outside these communities) to the specific situation prevailing in low-income economies. It has already given rise to innovations such as the development of "simpler" versions of mobile phones and computers, the use of dual SIM cards, new ways of communicating with a phone without having to pay for the call ("missed call"), and the use of airtime as currency.

Business development services should make better use of mobile phones in supporting enterprise growth. In Bangladesh, a helpline set up to offer information and advisory services to small farmers with mobile phones now receives 100,000 calls every month.[45] In Africa, there are relatively few examples of such services to date,[46] and the rapid growth of mobile access makes it sensible to take a fresh look both at how business support services of this kind can be delivered and to consider the specific requirements for assistance. In doing so, they should consult both subsistence-based and growth-oriented enterprises about their needs and their communications preferences to ensure that services are tailored most effectively to meet demand.

[43] See UNCTAD (2010).
[44] See Heeks (2009).
[45] Information by Katalyst, cited in UNCTAD (2010).
[46] See Donner (2009).

The development community is well-advised to revisit the scope for ICT in enterprises to bring benefits to the poor. Interventions need to be rooted in today's realities—including taking the needs and circumstances of micro- and small enterprises and the actual communications environment available to them into account—and in the realistic assessment of future prospects. One way to take up this challenge is to ensure that ICT and enterprise policies are better reflected in national development and poverty reduction strategies. So far, the potential of ICT and enterprise has been insufficiently explored. For example, very few of the UN Development Assistance Frameworks in Africa include ICT-related projects. Similarly, a review of private sector development strategies formulated by the main donor agencies found that the potential for leveraging ICTs is often little exploited.[47]

Meanwhile, governments and development agencies alone cannot successfully make ICT work for commerce and trade among enterprises in developing countries. The private sector is crucial as the primary source of infrastructure investment and service innovation. Indeed, citizens and enterprises have shown themselves to be innovative in appropriating technologies and services to meet their needs. Governments and donor agencies need to learn from this example and tailor their interventions that help the private sector and civil society to seize opportunities created by recent technology developments. Successful projects aimed at enhancing the productive use of ICT by enterprises have often seen the involvement of multiple stakeholders acting in partnerships.

It should further be acknowledged that the evidence base for ICT4D remains weaker than in most other development areas. The deployment of extensive ICT networks and implementation of ICT4D programmes in developing countries are too recent, and data availability is too limited, for extensive impact analysis to have emerged. In addition, the pace of change in technology and markets means that impacts, too, are changing fast and that research findings may be transitional in nature. The bulk of ICT4D analysis still derives primarily from micro-level studies. While these provide valuable insights into developments in particular contexts, care is needed when extrapolating findings.[48]

Development agencies can help improve the evidence base by commissioning targeted research to help address remaining knowledge gaps. They can also develop guidelines for use by governments and other actors in different countries. Critical issues in any programme of research and analysis along these lines include: better measurement of ICT use by enterprises, assessments of the need among different enterprises for ICTs, systematic impact assessments of ICT use, and analyses of the best ways of using ICTs in the provisions of government support services to relevant kinds of enterprise.

From the perspective of leveraging ICTs for economic development, the scope has never been larger. Governments have an essential role to play in this context, to ensure that the outcome of more widespread use of ICTs is positive from a development perspective. Benefits are not automatic, and there are also important risks to address. Despite progress in infrastructure and connectivity, there are many bottlenecks that prevent entrepreneurs and small firms from using ICTs efficiently. Its use is often limited by low levels of ICT literacy, slow connection speed, a lack of local content and high costs of use. Productive use of ICTs also requires laws and regulations to address a set of issues, such as the legal validity of electronic documents, e-signatures, privacy, intellectual property rights, cybercrime, building trust and protecting consumers.

[47] See UNCTAD (2011).
[48] See Souter (2010).

Meanwhile, the readiness in the development community to leverage the new possibilities is currently far below its peak. A number of bilateral donors that invested significantly in ICT4D before and during WSIS have dropped explicit ICT4D programmes from their portfolios, even if they continue to support the mainstreaming of ICTs in other development sectors.[49] For example, the United Kingdom's Department for International Development used to have a strong unit supporting ICT4D, but it has been eliminated.[50] Similarly, the Swiss Agency for Development and Cooperation has been phasing out most of its support to international mainstreaming efforts of ICTs in development processes since 2008. Greater awareness of positive examples will hopefully contribute to reversing this trend. There are signs that the tide may be shifting again, helped in part by the "Arab Spring", which showed the power of making ICTs such as mobile phones and social media widely available.

The "ICT revolution" resembles previous technological upheavals that have had profound consequences for economic development.[51] The steam engine, railways, the internal combustion engine and the industrial application of electricity spelt the end of entire sectors of activity, generated new industries and services, and most importantly, allowed enterprises to work differently and more efficiently. Because the ICT revolution is relevant not just to the high-tech, information-intensive sectors, but also to the whole organization of economic life, its effects are spilling over more quickly into most sectors of the economy. Developing countries may stand a better chance of sharing in its benefits than in previous technological revolutions.

[49] See Souter (2010).
[50] See Greenberg (2008).
[51] See UNCTAD (2001).

# CHAPTER 10

## Finance

*Richard Duncombe*

### Introduction

This chapter provides an overview of current understanding of the application of mobile phones for the delivery of financial services in developing countries. Evidence from studies of mobile-money, mobile-payments and emerging account-based service deployments is considered in relation to a range of differing country experiences. Key impediments to the successful application of mobile technologies for the delivery of financial services are highlighted, as well as current initiatives that are being undertaken to overcome them. Finally, some recommendations are made with regard to promising future areas of work.

Internet banking has grown rapidly in the industrialized countries, but less so in the developing world due to constraints of infrastructure, access, affordability and user acceptance. Mobile phone networks, on the other hand, are close to providing a universal access infrastructure for data as well as voice transmission, offering a platform for a wide range of new mobile financial (m-finance) services that have the potential to reach the mass of populations located in both urban and rural areas of low income countries.[1] M-finance is an umbrella term that incorporates a range of emerging services, including person-to-person (P2P) mobile transfers (m-transfers) and mobile payments (m-payments). Mobile banking (m-banking) can incorporate m-payments and m-transfers, but it is more concerned with delivering a broader range of banking services, such as account-based savings, credit or other transaction products offered by banks. M-payments and m-banking are subsets of the broader domains of e-payments and e-banking which incorporate other ICTs including web-based applications that integrate user interfaces and networks with back office systems and data centres which can be located anywhere around the globe.

[1] International Telecommunication Union (2009) data shows in the case of the poorest continent – Africa – mobile penetration for individual countries has increased from an average of 2% of total population in the year 2000 to an average of 25% in 2007. This impressive growth masks extreme variations between countries, but overall, mobile cellular networks have now extended coverage to over 60% of the total African population creating network access potential for previously un-served communities in some of the poorest countries. Many sub-Saharan African countries with a GDP per capita less than US$500 (in 2007) are fast approaching near universal mobile network coverage. For example, Ghana stands at 68%, Rwanda at 80%, Sierra Leone at 70% and Uganda at 80% coverage of the total population.

## Current Understanding and Evidence

Much of the optimism surrounding the potential for m-finance in developing countries is founded on early success stories. One of the most notable examples is M-PESA[2] (meaning mobile-money), operated by Safaricom in Kenya, which is built on domestic m-transfers. Other examples are SMART Money and Globe GCash in the Philippines which offer a broader range of services (debit/credit payments through merchants, utility payments, domestic and international cash transfers). However, they have a smaller and more affluent user base than M-PESA.[3] It has been suggested that m-finance applications have the potential to be 'transformational' for the poor and disadvantaged if they are able to bring about greater financial inclusion[4] for the section of the population that is currently unbanked (Porteous, 2007).[5] They are considered as 'additive' if they merely provide an alternative banking channel for existing financial service customers. M-PESA (and to a lesser extent SMART and Globe) have signalled a shift towards greater financial inclusion, but at this stage, the services reflect expanded use of P2P m-transfers, rather than the provision of access to a broader range of financial services via mobile phones. Against this background, two key questions arise. First, to what extent can the success of M-PESA, Globe GCash, and SMART Money be replicated in other country contexts? Second, how, and to what degree, can market penetration for m-payments be expanded to address a broader set of financial service needs of the unbanked? Although some evidence of greater financial inclusion is starting to emerge, this remains an open question.

### M-transfers: evidence from M-PESA

Though there is great potential, so far M-PESA in Kenya provides the only persuasive example of successful scaling of an m-finance service that reaches a large proportion of the unbanked population. M-PESA has attracted a customer base of approximately 11.9 million users (54% of Kenya's adult population and 73% of Safaricom's subscriber base) and has licensed approximately 17,000 service delivery agents countrywide (Safaricom, 2010). Adoption of M-PESA is the main reason cited for increased usage of (non-bank) financial institutions in Kenya which has increased from 7.5% of the surveyed population in 2006 to 17.9% in 2009. At the same time, the proportion of the population who were either using informal financial services or who were excluded completely from such services decreased markedly (Finscope, 2009).

Successive studies of M-PESA (Hughes & Lonie, 2007; Camner, Sjoblom & Pulver, 2009; Mas & Morawczynski, 2009; Jack & Suri, 2009) have identified specific reasons for its successful market development, with particular attention on M-PESA's ability to reach and acquire customers in the unbanked category. First, M-PESA was created as an initiative to address the needs of the less-well-off and was funded in part by the UK DfID Financial Deepening Challenge Fund. Therefore the system needed to incorporate low transaction costs and a novel account mechanism from its inception. Second, the initial functionality of M-PESA was restricted to a

[2] M-PESA was established in 2007 as a donor-driven financial services development project. A detailed description of the early inception phase of M-PESA is provided by Hughes & Lonie (2007).

[3] By 2007 the remittance service (SMART Padala) offered by SMART Money had approximately 1.5 million users remitting US$28.9 million from abroad and $US113.7 domestically. Globe GCash is similar, standing at 1.4 million users by the end of 2007 (Alampay & Bala, 2009).

[4] Financial inclusion can be simply understood as the degree to which economic actors (individuals, households or enterprises) can access and make use of formal financial services. It has also been defined as enhancing poor people's freedoms by offering services that are useful for managing their lives and livelihoods, and that richer people already take for granted (Nio-Zarazua & Copestake, 2009).

[5] 'Unbanked' refers to the section of the population of a developing country that does not access formal banking services which includes mainstream banks and MFIs (micro-finance institutions) which are normally classified as semi-formal institutions.

single money transfer service through a simplified text-based user interface using entry-level mobile phones; by centering on this basic platform, the service was attractive to the mass market of phone users. Third, a rapid expansion of a network of existing agents to facilitate cash-in and cash-out services took place alongside the service roll-out. These agents were licensed to act on behalf of an entity – Safaricom – an institution that is largely trusted across Kenyan society and is perceived to be financially independent. M-PESA also benefited from very strong demand for the transfer of domestic cash remittances and the need to 'send money home'. In all regards, M-PESA has enjoyed the first (and even the sole) mover advantage and still benefits from a near-monopoly market position in Kenya.

Analysis of M-PESA points towards a variety of factors that determine the adoption and usage of technology in the developing country context. These factors include supply-side issues (geographical availability, low cost, ease of access and the characteristics of the service offered) and demand-side issues (actual consumption or ability to consume the service) and finally, a critical factor on the national front: flexibility in the application of domestic regulations that govern non-bank financial institutions. The complexity and the interplay of these determining factors are highly country-context specific, a view which is supported by the diverse experiences of m-finance evolution in other countries (Honohan & King, 2009).

## M-transfers: other country evidence

For Vodacom's M-PESA service in Tanzania, rollout has been much slower than in Kenya, reaching only 280,000 users and attracting 1,000 retail agents in the first 14 months of operation. Several reasons have been pointed out for the slower pace of adoption, including emphasis on the great differences in the financial services landscape existing in these countries (Camner, Sjoblom & Pulver, 2009). This wide variation has required radical re-thinking of the design of the product, pricing, marketing, registration, and the organization and incentivizing of the agent network. In contrast, greater early success has been achieved in Uganda, where MTN's mobile money service was established in March 2009. In the first year it attracted 890,000 users (16% of the MTN subscriber base in Uganda) and transferred more than USH590 billion (US$245 million) through 1,500 agents established throughout the country.[6] However, continued expansion on the basis of domestic remittance may be more problematic in Uganda. Some research suggests that the scope of countrywide demand for remittances is limited, reporting that only 28 percent of Ugandan households gain income from personal monetary transfers, with the Western and Eastern regions showing the highest incidence. The Northern region is the lowest, with as much as 64 percent of households reporting no instances of remitting money either formally or informally (FinScope, 2007).[7] This evidence suggests that the majority of households do not receive remittances and would find no benefit from current m-finance applications. The supply side also differs – with later entrants to the market (e.g., Zain's ZAP and UTL's m-Sente)[8] providing more competition and differentiation of services; while consumers may ultimately benefit from choice in providers, this makes scaling for individual providers more

[6] More recent figures indicate a doubling to 2 million registered users with a through put of USH1 trillion (US$479 million) (Ndiwalana et al, 2010).

[7] UNHS (2006) reported a lower figure, with 41.4 percent of all households in Uganda having received at least one remittance from a domestic source in the year preceding the survey. The mean monthly value of the amount received domestically was within the range reported by Ndiwalana et al (2010) totalling USH18500 (US$8.22) whilst from abroad it was USH70500 (US$31.33) but with significant variations between the amounts remitted to urban and rural areas (on the basis of a 2009 exchange rate of USH2250=US$1).

[8] In each case, mobile operators are partnering with commercial banks and other financial service institutions and merchants (MTN with Stanbic Bank; Zain with Standard Chartered Bank, and UTL with DFCU). Partnering banks play a dual role – they mirror the value of outstanding e-money issued by a mobile operator in a pooled account, and they contribute the management of liquidity (GSMA, 2010). Partnership arrangements form part of the commercial strategy of each provider, but they are also critical in order to be able to comply with Uganda's financial service regulations.

challenging. The availability of agents and their ability to provide support services is a key constraint in Uganda where the number of agents established by MTN (for example) is one tenth of those established by M-PESA in Kenya (Heyer and Mas, 2009). South Africa offers another example – as a country with a far more developed financial sector, m-banking services (that were bank-led) have had a much lower impact in attracting new banking customers from the unbanked population that were mobile phone users.[9]

Overall, the evidence for m-transfers suggests that each country-context will present a different combination of factors and therefore the extent and pattern of replication may be difficult, if not impossible, to model and predict. Despite this uncertainty, the mobile sector has continued to invest heavily in the roll out of fairly generic applications in recent years. Data from the end of 2010 shows that there have been 147 m-finance deployments in developing markets, 60 of which have already launched (predominantly for m-transfer and m-payments) with a geographic reach covering 42 developing countries. MTN has a rolling plan to introduce MMT across 21 sub-Saharan Africa countries, potentially reaching in excess of 80 million existing subscribers,[10] while other service providers, such as Zain, Vodafone, Warid and Orange have already launched similar products that will eventually create a competitive market for the delivery of mobile financial services in most African countries.[11] Outside of Africa, and excluding the Philippines, only a small number of deployments have gained traction in the market. These include Tameer Bank/Telenor's Easypaise in Pakistan, M-Paisa in Afganistan, Wing Money in Cambodia and some others in South and South East Asia and the use of point-of-sale devices in well-established financial outreach strategies in Latin America.[12]

## M-payments and account-based services

Thus far, market expansion has been fuelled by demand for m-transfers, but over the longer term other forms of transaction may play a greater role in sustaining service provision. These are predominantly: a) airtime purchases which can be facilitated via mobile money at a cheaper cost than by conventional means, and, b) a plethora of other types of payments which include those for transport (trains, buses, taxis, etc), hospital/medical bills, school fees, utilities, and micro-finance institution (MFI) loan re-payments, – in fact this category would include any form of payment to a participating provider or merchant that is normally made by cash means. An example would be the 'True-Money' product in Thailand,[13] which is an 'e-wallet' that can be loaded with cash by use of a scratch card (or cash card), from a bank account or via a credit card through a network of 8,000 agents throughout Thailand. The main objective of the service is to provide means for customers to pay for a

[9] The South African study compared data for 2005 and 2007 and showed how structural changes in the banking sector – including the introduction of new low cost 'Mzansi' bank accounts and other banking initiatives aimed at the previously unbanked – pushed the expanded access significantly, with the greatest potential for m-finance provision thought to be amongst the 4.8 million unbanked adults in South Africa who were mobile phone owners. However, the contribution of m-banking to this increase in financial inclusion was comparatively low (450,000 m-banking customers or 3 percent of the banked population by 2007). The socio-economic make up of these new customers suggested that take up during this period was confined to 'those who were wealthier than the national average and certainly in comparison to the unbanked in general' (Porteous, 2007:23).

[10] Mobile Money Transfer (MMT) is a mobile payments service that is being offered by MTN (Uganda) in partnership with Stanbic Bank. The service is due to be launched in five West, Central and East African countries (including Cameroon, Ghana, Cote d'Ivoire and Nigeria and Uganda) and has been piloting in five others (Van der Merwe, 2009).

[11] See: Mobile Money for the Unbanked deployments tracker - http://www.gsmworld.com/our-work/mobile_planet/mobile_money_for_the_unbanked/mmu_deployments_tracker.htm

[12] Make reference to McKay & Pickens (2010) for analysis of existing schemes that have been scaled and references to more details on individual schemes.

[13] See the following link from Thai Telecom that describes the requirements for payments facilitated by True-Money. http://www.thaitelephone.com/EN/Help/Payment/truemoney.php

wide range of pre-paid services that the company offers – including mobile airtime, landline, cable television, Internet and other value added services (GSMA, 2010). The early market success of True-Money reflects the higher state of development of the financial services sector in Thailand in terms of banking infrastructure, branches, ATMs, formal sector participation, financial literacy, and other factors. In contrast, m-payments in Africa are incipient at this stage. One survey in Uganda reveals adoption by a very small minority of more affluent urban users to pay for cable television, school fees and some other goods and services (Ndiwalana et al, 2010). The clearly stated benefits are the speed of payments (avoidance of queuing) and cheaper cost (compared with other payment methods offered). However, the potential scope for m-payments is higher than for transfers in Uganda, as well as in most other low income countries. Demand is particularly strong from proprietors of non-agricultural micro-enterprises, with 63 percent reporting daily payment transactions and 13 percent weekly. This is greater than for domestic remittance in Uganda, with only 16 percent reporting daily transfers, 10 percent weekly and 16 percent monthly (Finscope, 2007).

The second area of incipient demand for m-finance is account-based services for savings, borrowing and associated transactions, which creates potential for m-transfer and m-payment services to develop into a formal banking channel, thus contributing directly to greater financial inclusion. The unbanked tend to have greater needs for micro-savings in comparison with micro-credit, and evidence suggests that mobile money accounts are already being used as a short-term savings vehicle in the same way that airtime can be accumulated and used to make payments which are then re-converted to cash by recipients (Duncombe, 2009). This type of informal user-innovation has stimulated providers to recognise the latent demand for micro-savings and to plan their service designs accordingly. For example, ZAIN's ZAP service moves beyond money transfer as the primary service offered and promotes multiple services that encourage retention of e-money as either short or longer term savings, thus providing options for users to retain their balances rather than instantly convert them back into cash. The service (as with True-Money in Thailand) also performs as an 'e-wallet' and can be linked to the accounts of partnering banks and other financial institutions such as MFIs, facilitating access to m-banking and other over-the-counter services. Thus far the services have been appealing predominantly for more affluent individuals and corporate customers. In terms of account based services as an extended offering, M-PESA has been supplemented by M-KESHO (Kesho meaning future or tomorrow) which, in partnership with Equity Bank, offers deposits, interest paying savings and payment products that are linked to the M-PESA mobile user interface, aimed at the estimated 3 million M-PESA users that currently do not access formal banking services.[14]

Researchers who have studied m-finance deployments in detail suggest the "none have scaled at (or near) the level experienced by M-PESA in Kenya. This has prompted us to take stock of where we are in the evolution of mobile money and to sharpen our focus accordingly" (Mas & Radcliffe, 2010:4). It has also been observed that getting customers to use services regularly and sustain their involvement with such services is much more difficult than getting them to sign up or register for a service initially. One survey of the most advanced branchless banking services by the Consultative Group to Assist the Poor (CGAP) concludes that… "we should be careful not to overstate the impact. Most users of the seven branchless banking services (GCash, M-PESA, Smart Money, WIZZIT, and the agent-based banking services of Banco Bradesco, Banco do Brasil and Caixa Economica in Brazil) are neither unbanked nor poor. Branchless banking appeals to the better-off and already banked as well as the poor and excluded. For example, according to research conducted by MIT, 70 percent of

[14] The proportion of M-PESA customers making use of non-cash transfer options (e.g., to withdraw cash from an M-PESA linked account or to pay bills) is relatively low (between 2 and 5%) but the proportion of customers using their M-PESA cash balance as a saving mechanism or to store money before travelling is high (26% and 17% respectively). This 'unintended' usage of the M-PESA system suggested unfulfilled demand for a secure savings mechanism which stimulated the introduction of M-KESHO. Three months after the launch of M-KESHO, 455,000 customers have opened accounts (although only 176,000 have been activated) which was a faster uptake than M-PESA achieved (Mas & Radcliffe, 2010).

M-PESA users have an account with another formal financial institution, and the average user reports annual expenditures 67 percent higher than those of non-users. Half of WIZZIT's users fall into the upper half of the South Africa's socio-economic strata, as measured by the Living Standard Measure (LSM) classification used by FinMark Trust. The majority of GCash and Smart Money clients are not poor. Only in Brazil, where branchless banking agents are the preferred method of making utility and other recurring payments, do low-income consumers make up the majority of users."[15] Interestingly, the Brazilian examples, that tend to have greater social utility, are neither wholly market-driven nor driven by the business models of mobile service providers.

## Impediments to Progress

Given the plethora of early deployments a key impediment to progress in m-finance is achieving scale and traction in individual markets. There are three factors that govern speed-to-scale. The first is the need to stimulate 'network effects', a process by which the benefits to the individual user grow as the network grows. Thus, a network with few active users will find it difficult to attract new customers, while one with a growing user base will gain momentum through this effect, also known as Metcalfe's Law. Second is the need to attract both customers and distribution agents in tandem. It will be difficult to attract agents in a particular district where demand from customers is low. On the other hand, new customers cannot be attracted to a service without a local presence of agents (a chicken and egg conundrum). Third, new customers will most often be attracted and retained through building empathy with the system. Evidence suggests that in developing country environments, empathy (or trust) for first time users are driven largely by word-of-mouth recommendation[16] from existing to new customers (Mas and Radcliffe, 2010). A key requirement, therefore, for any m-finance offering is to inculcate a perceived need for the service: first, amongst customers – many of whom may be using formal banking services for the first time, and second, through incentivizing agents (in the case of m-transfers) or merchants (in the case of m-payments) to provide the service to customers. This requires a very high investment of money, time and human resources on the part of the service providers (mobile phone companies in partnership with banks) in marketing, promoting and supporting the services that have been offered.

A second key impediment is lack of interoperability between networks. In Kenya, M-PESA has a dominant (near monopoly) market position. However, in other emerging (particularly African) markets there is intense competition between multiple service providers. Choice in the market has brought advantages of product innovation leading to differentiated services, competitive pricing, and rapid service penetration, but also disadvantages, primarily those arising from the lack of interoperability between competing service providers. For example, for m-transfers, a user of a particular mobile-money service is unable to connect with and send money to a user of a different service over the same network. It also means that service agents and merchant networks are unable to collaborate in order to simplify the user experience. Thus, it is common for users to be confronted with a confusing array of outlets (often concentrated in the same or adjoining premises) rather than a single point of service that can manage transactions between competing service providers (GMSA, 2009). Lack of interoperability is also an impediment for commercial transactions and payments – particularly those that may suit micro-entrepreneurs – who will increasingly demand a low cost means to facilitate electronic payment – akin to PayPal in the developed countries – for the goods and services they offer.

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[15] Make reference to CGAP (Consultative Group to Assist the Poor) 'Customer adoption'. http://www.cgap.org/p/site/c/template.rc/1.11.134440/

[16] For example, the determinants of both switching and new take-up of formal banking services in Uganda have been researched by Hudson (2003) who identified recommendation of family and friends to be the key factor, mentioned by 58 percent of a sample of 979 financial service users, whilst another study conducted by Mukwana & Sebageni (2003) found that existing clients exercised choice on the basis of subjective criteria such as staff attitudes or the physical appearance of the premises, and to a lesser extent on objective criteria pertaining to interest rates offered, loan terms, etc.

Another impediment to wider spread adoption of m-finance is that of access for the financially excluded. A key determining factor for financial sector participation is formal sector employment (implying higher and more regular levels of income and consumption). This is reflected in usage of M-PESA where one survey found that the average Kenyan user reports household assets equal to US$13,350, or 21 percent higher than that of non-clients (Jack & Suri, 2009). Other factors that correlate to adoption of the new technology include gender, age and poverty level proxy indicators such as ownership of assets. In Uganda, mobile phone ownership is found to be the most significant of all the assets measured, thus a study concludes that… "those with a mobile phone are more likely to have a formal sector bank account by a factor of three" (Johnson & Nino-Zarazua, 2007:6). A key factor for the excluded group is incomplete education which results in a large proportion of the population in developing countries lacking the necessary literacy skills to interact effectively with text-based user interfaces. Taking the example of Uganda, lack of literacy skills has been mentioned as a reason for lack of use of text-based services where only 10 percent of the poorest use SMS compared with 82 percent of the richest (Scott et al, 2008). Lack of trust is also linked to low levels of financial literacy amongst the unbanked – a further constraint on assimilating the required skills to interact effectively with mobile phones and m-finance applications. A further linked aspect is pricing and affordability. One survey of 16 branchless banking initiatives that have been scaled reported only a 19 percent average reduction in prices in relation to comparable products offered by banks, with greater reductions – up to 50 percent cheaper – for medium term saving and bill payment products (McKay & Pickens, 2010). Costs also need to be considered in relation to affordability. In Uganda, for example, MTN charges a flat rate fee of 800USH (US$0.35) for a single money transfer to another mobile money account or another bank account, with a minimum transfer of 5000 USH (US$2.2).[17] While this fee seems relatively low, there is still a large affordability gap which is highlighted when the cost of 100 minutes of mobile use is considered as a percentage of GNI (Gross National Income) per capita. In Uganda (an example of a low income country) this figure stood at 96 percent in 2007. By contrast, 100 minutes of mobile use in South Africa (a middle income country) constituted only 7 percent as a percentage of GNI. Further costs that impact the poor include the individual or even shared ownership of a handset and, for those in rural areas, the transport costs for travelling long distances to agents or pay points.

A further set of impediments are those that relate to the perception of potential users; this entails a complex set of factors that have yet to be researched in detail for current deployments. Early adoption studies of m-banking in South Africa suggest that uptake was influenced by a wide range of non-price factors (given that affordability was less of a constraint in that market) and that identifying the degree of risk aversion and the level of trust exhibited by potential users was key (Benamati & Serva, 2007; Brown et al, 2003). This includes trust in technological systems – in the less conspicuous software designs, network architectures and operational models that lie behind the hardware interface of the mobile handset. More critically, this also involves trust in the organisations that are offering the services. For agent-based services, this operates across two different levels – the agent/intermediary and the financial service provider. This behavioural issue has been illustrated in the workings of M-PESA where a multitude of problems in cementing trust between individual users and M-PESA agents were identified (Morawczynski & Miscione, 2008). However, these problems were largely overcome by the high levels of overall trust in the management and integrity of the system as a whole – a direct result of the respected position of Safaricom in Kenyan society – and in particular the trust invested in the owner of the company who is a Kenyan national of high standing.

Trust in systems is also threatened by the perceived or real threats to security, data privacy, theft and fraud. These may be threats to the individual user including loss or theft of the phone or SIM card and possible theft of identity, the defrauding of the customer by unscrupulous agents by demanding incorrect fees or the stealing

[17] For a full list of charges for MTN mobile money refer to: http://www.mtnbanking.co.za/SBIC/Frontdoor_MTN_02_01/0,2547,12865163_12866081_0,00.html

of money by various false transaction means. There may also be threats to the integrity of the system as a whole which may include money laundering for criminal or terrorist financing, or organised criminal activity designed to exploit loopholes in the operators' systems. Davidson & Leishman (2011) suggest a range of measures to effectively protect different types of fraud and abuse which include: a) the necessary investment by operators in training and supporting their agent networks so they are motivated to adhere to know-your-customer (KYC) rules and procedures; b) education of customers, for example, in relation to protecting PIN numbers and obtaining a record of transaction; c) designing technologies and processes that are less open, and better able to monitor fraudulent behaviour.

## Current Work by Organizational Actors to Ameliorate Impediments

Much of the current work in the area of m-finance is directed at pump-priming new deployments for mobile-money (principally for m-transfers and m-payments) as well as addressing the challenges posed by scaling new and existing deployments. The primary global actor that coordinates and drives sector development is the GSMA (Global Standards on Mobile Applications) which, through its Mobile Money for the Unbanked (MMU) Programme, has directly funded initiatives, coordinated dialogue between operators and financial regulators, and disseminated research and best practice guidelines.[18] Although directed at the unbanked, the programme tends to support work that is strongly market and business oriented. The content of the latest Mobile Money for the Unbanked Report reflects a dual concern of scaling and more conducive regulation (GSMA, 2010). Key research programmes involve best practices in incentivizing and managing networks of mobile money agents, and building a better understanding of the broad range of financial regulatory issues that are of direct interest to mobile phone operators, particularly those which have no prior experience in delivering financial services. Future work points towards understanding bank partnership models, technology solutions and methods by which to drive customer usage of m-finance products.

Other influential global actors include CGAP (Consultative Group to Assist the Poor), which took a strong interest in mobile banking and supported much of the early research. As part of the World Bank, CGAP is a policy and research center that has strong links to other development agencies and private foundations. It provides market intelligence, promotes standards, develops innovative solutions and offers advisory services to governments, microfinance providers, donors, and investors. CGAP provides a broader and somewhat more critical perspective on m-finance than MMU, given its central concern for delivering financial services to the poor. Two additional organizational actors include the Financial Access Initiative (FAI), a research center based at New York University (Wagner) focused on substantially expanding access to quality financial services for low-income individuals. This is an influential center that has built its reputation by providing rigorous research on the impacts of financial access on underprivileged populations and on developing innovative approaches to improve that access. Finally, the Institute for Money, Technology and Financial Inclusion (IMTFI) based at the University of California - Irvine has employed ethnographic methods to identify design principles for creating financial services for low income clients (IMTFI, 2010).

[18] Founded in 2009, with a $5 million fund provided by the GSMA and the Bill and Melinda Gates Foundation, the Mobile Money for the Unbanked (MMU) programme encourages mobile network operators to create new services for the previously unbanked in developing countries by making investments in mobile money and other mobile-finance initiatives. After 15 month of operation the MMU had committed funds to deployments by 19 operators in Latin America, Africa, and Asia. The MMU also supports research and dissemination of lessons learned from such deployments and produces an annual report.

Initiatives at the global level are driven by well-funded donor and philanthropic organizations that have given m-finance a considerable amount of high profile momentum. The key actors at the national level are the major mobile phone service delivery organizations (e.g., MTN, Orange, Vodafone, Zain, Warid), each of which have sought strategic collaboration with major national or trans-national banking and finance institutions. These partnerships provide the main thrust for both investment and strategy. In this respect, it is important to realize that m-finance is fundamentally a market-driven phenomenon. As profit seeking enterprises, mobile phone service providers are guided by the need to attract and retain customers, and to regularly meet or increase key performance indicators such as average revenue per user (ARPU) and market share. Services such as M-PESA and MMT are value-added services (VASs) for telephony providers, and as such, they are important marketing tools that help sustain core businesses and drive revenues through mass consumption based on extracting small transaction fees from low income clients.[19] This raises the question of whether willingness to pay for m-finance services is a result of price insensitivity given the attraction of security and convenience or a reflection of the exploitation of market power and the extraction of economic rents by the service providers (Ivatury & Pickens, 2006).

Another set of critical actors are those that determine policy and market regulation of m-finance. These issues are complex and vary considerably for each jurisdiction. There is still a lack of understanding and clarity from financial regulators concerning the impact of new m-finance services. Key issues include bank licensing and ability of banks to outsource to mobile operators, the licensing of agents to open accounts and handle cash, "know your customer" regulations (that prevent money laundering) for low balance accounts, consumer protection, security and many other areas of regulatory policy and market intervention.[20] Regulation also impacts the user experience directly through the rules governing account opening procedures, user identification, ease of use (user interface), transaction processes at retail agents and customer care – these are all critical factors that influence user perceptions of the banking process and enhance or diminish trust in the individuals and institutions involved.

Government policy also plays a wider role controlling the rate at which mobile devices and call rates are taxed, thereby influencing market prices. In many low income countries, high taxation environments keep overall charges of mobile phone services high, which have had a regressive impact on lower income prospective users.[21] Government also plays a leading role in the broader policy arena, which drives decisions over capital investment in new technologies and infrastructure, not only for new mobile phone technologies, such as 3rd generation networks and broadband, but also complementary investments in the electrical and transport infrastructure that are required to attain the potential benefits offered by further expansion of financial services to their citizens.

[19] Safaricom's annual financial statement (2010) showed M-PESA accounted for 9% of company revenues in the last financial year, with revenues growing by 158% over the previous year. For more analysis see: http://technology.cgap.org/2010/06/07/proof-mobile-money-can-make-money-m-pesa-earns-serious-shillings-for-safaricom/

[20] See: CGAP (2008a) and CGAP (2008b).

[21] For example, Uganda has a 12% excise duty on mobile phone services, in addition to a standard VAT rate of 18%, which together with other less developed countries in sub-Saharan Africa (e.g., Zambia, Tanzania and Kenya) puts it in the top ten of markets with the highest taxes on mobile telephony. Refer to: http://www.apc.org/en/node/9093/

## Important Gaps in Knowledge

Thus far, our understanding of m-finance has been driven by market (or marketing) models which tend to take a service provider/industry perspective.[22] There is little understanding of m-finance initiatives from a user perspective. One ethnographic study of M-PESA has cast some light on users classified as poor, with some significant changes in financial and social behaviour observed – including more frequent remittances of smaller denomination, a reduction in journeys to visit relatives, and changes in saving habits (Morawczynski & Pickens, 2009). Low income users chose to access M-PESA because it was affordable, convenient and more secure than pre-existing money transfer options such as the post office or bus drivers. Senders were predominantly male and young, and recipients predominantly female. Usage was dominated by recurrent transfers to relatives for the purposes of income support, while larger lump sums were transferred less frequently for purchase of farm inputs or payment of school fees. There was also evidence of M-PESA accounts being used as a temporary store for small amounts of savings.[23]

In addition to a need for standard user practice analysis, there is lack of understanding of user-driven innovation in the area of m-finance. With a heavy emphasis on industry marketing of m-finance, consumers are often viewed as passive recipients of services and the focus is on raising their awareness of and educating them in the use of services. This tends to ignore the complex processes of user appropriation of technologies which involve both adaptation and modification, with innovative practices arising from the poor communities themselves (Bar & Riis, 2000). Beeping (calling another user or network participant and hanging up before they answer – prompting a return call) and the widespread use of the phone as a store of value (accumulating call credit or a balance in a mobile money transfer account) are examples of this (Donner, 2007). This type of user innovation has stimulated service providers, together with donors and community-based organizations (CBOs), to take an active interest in developing applications that exploit the changes in financial practices that the poor themselves are inventing.

One researcher has argued that financial transactions facilitated via mobile phones are likely to strongly reflect existing social and cultural patterns of financial behaviour (Donner, 2007). For example, M-PESA has been appropriated in accordance with patterns of domestic remittance – thus amplifying and improving existing transactional relationships rather than creating new ones. Another researcher drawing upon economic anthropology takes this view a step further, suggesting that an understanding of existing financial behaviour can be translated into design principles that can enhance m-finance products for the poor (Maurer, 2010; Chipchase, 2009). This research suggests that a broader range of m-finance services (covering credit/debit accounts, savings and insurance) can achieve a high degree of success if they are carefully designed to map onto pre-existing, socio-culturally entrenched, financial practices and norms.

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[22] Such modelling identifies those who currently access and use services, and those who can potentially access but have not yet used them (which we can define as the unbanked population). The latter group includes those who are voluntarily excluded (i.e., those who choose not to use formal services) and those involuntarily excluded (those who are ineligible or discriminated against for some reason). There will also be a remaining group defined as too poor or marginalised and beyond the reach of foreseeable market solutions and this group may be substantial in low-income countries. Market modelling has gained considerably credence due to incorporation as a key analytical tool in National FinScope surveys – large-scale repeat financial access surveys which have been conducted in seven sub-Saharan African countries during the past five years. At present repeat studies incorporating time series data are available for two countries – South Africa and Kenya.

[23] A random survey reported that one third of all domestic remittances in Kenya are now transferred via M-PESA, they are smaller than the average remittance, but they amount to only 1.5% of average monthly household expenditure. Enhanced security and ease of use were reported as the key perceived reasons for accessing the service amongst users, whilst lack of convenient access to an agent, and no reason or need to access, was mentioned by non-users. The cost of access and use were stated by less than 10 percent of users and non-users as being a significant constraining factor (Jack & Suri, 2009).

This highlights a final gap in knowledge of m-finance and demonstrates the need for a better understanding of the interface between m-finance provision and the financial needs of the unbanked. Poor households have a broad range of financial needs to meet (including those for daily, longer-term, lifecycle, emergency and investment reasons) and these needs generate a range of financial service requirements. This financial environment is dominated by small transactions which involve high levels of insecurity; the insecurity in turn fosters strategies of diversification and risk spreading. The way in which the poor manage risk is usually fungible,[24] embodying a complex set of interactions and responses across a broad portfolio of financial service settings. Increased penetration of m-finance into rural communities via private networks of agents will bring significant change to this financial landscape and the assessment of the broader potential for m-finance needs to take full account of this complexity.

## Recommendations and Promising Areas of Future Work

First, our approach to m-finance should move away from a prescriptive 'one-size-fits-all' approach. Rather we must recognise the considerable differences in the socio-economic environment within which m-finance initiatives are being introduced. Due to the wide variety of socio-economic, demographic, geographic political and financial landscapes, it is difficult, if not impossible, to identify common factors across countries, and there are dangers in transferring conclusions, often based on the use of incompatible data, from one country to the next. The diversity of factors is important for understanding why m-finance technologies may achieve differing degrees of up-take and use in various countries or between groups and regions in the same country. For example, we know that early adoption of m-payments was built on latent demand for secure cash remittances from urban to rural areas. We also know that the degree and pattern of urban migration has been identified as key factor in determining demand for domestic remittance (Ratan, 2008). Thus, countries such as Kenya, with mid-range urbanization ratios, as well as the required family and cultural ties, will exhibit greater domestic remittance statistics and greater propensity for m-transfers.

Second, there is a need to understand the potential of m-finance applications that move beyond m-transfers to encompass m-payments and account-based services, thus addressing the potential for greater financial inclusion directly. However, this line of inquiry tends to fit with a re-conception of micro-financial services as moving towards a more market-orientated 'financial systems' approach that is directed at low income households rather than those who are poor; it almost certainly excludes those who are chronically poor (Hulme & Arun, 2008). Thus, rather than seeing generic applications as a panacea to the financial service needs of the poor, the accessing of specific services via a mobile phone should be viewed as a potentially valuable element, of a more complex and extensive portfolio of financial service provision and use. As suggested previously, the specific financial needs of the poor should drive consideration of applications that could be tailored to those needs. An initial requirement, for example, is to define the extent and pattern of mobile phone ownership and use amongst the poor more accurately – this type of data is largely unavailable or unknown for most countries.

Third, if our focus is to be on the poor and disadvantaged, then we should consider applications that are clearly appropriate to their needs, particularly where existing platforms can extend the reach of services to the poor/unbanked in innovative ways. Areas of potential demand for m-finance may include the provision of micro-insurance and the facilitation social cash transfers. Micro-insurance can be used to protect against susceptibility to weather extremes, price variability and health risks. The ability of m-payment systems to reduce transaction

[24] Fungibility is the interchangeability of things that are identical or uniform. The term is frequently applied to money because any given amount can be used interchangeably with any other amount. The use of financial resources is highly fungible as the household budget shifts between consumption and investment in response to changing needs and opportunities and for the poor the distinction between business and personal assets is often not clear.

costs could also be an important factor for enhancing their reach and sustainability. For example, in Kenya, Oi and Safaricom are exploring bulk payment functionality to allow governments to make social transfer payments to vulnerable households. For social cash transfers, there are already examples of mobile payment systems that assist in the delivery of cash payments in Lesotho (Vincent and Freeland, 2008) and Kenya (Brewin, 2008) and just as for financial remittances, the potential is considered to be large for national systems that can be scaled (Devereux & Vincent, 2010).

Finally, there is a need to investigate the consequences of m-finance for non-users. There is reason to believe that they may be negatively affected, although there is no empirical evidence to support this as yet. Those who are already disadvantaged (the chronically poor and illiterate) may become further marginalized due to having to use more expensive and less reliable options and being cut off from the development of emerging financial systems. The benefits of mobile phones for this group may lie outside of formal provision. Evidence suggests that mobile is more likely to be used as a tool to communicate and coordinate cash transactions, rather than to deliver funds electronically. Access for those who cannot use textual interfaces can be also assisted by innovation in user-centered design that promotes alternative voice or graphically activated user interfaces (Lalji & Good, 2008). Alternatively, Chipchase (2009) suggests that solutions should be far more opportunity and learning focused rather than technical fixes. Thus, rather than asking 'how to design an interface for illiterate consumer?', we need to reframe the question as 'what skills need to be learned to be able to completely carry out a series of simple mobile money related tasks?'. In this respect, there is need to understand what forms of assisted or 'mediated' access are the most effective – kiosk operators, agents, community-based groups or other dedicated providers, or informally through family and friends.

# CHAPTER 11

## Gender

*Nancy Hafkin*

### Origins of the Concern for Gender Issues in the Internet and Information Society in Developing Countries

Gender was not even mentioned when the term "digital divide" came into use in the United States in the mid-1990s. The NTIA's report *Falling Through the Net* (1995) identified gaps based on race, ethnicity, and geographical location between information haves and have-nots, but made no reference to differences between the sexes. While the initial discourse on inequalities in access and usage of the Internet was confined to internal divides within the US, it spread rapidly to an analysis of inequalities between countries that showed a wide gap between developed and developing countries — the global digital divide.

In contrast to the US, gender did figure prominently in the late nineties discussions of internal digital divides in India and across Africa that recognized inequalities between men and women in access to and use of the Internet.[1] By the first part of the first decade of the twenty-first century, the idea of the Internet as a major tool for women's empowerment and promoting gender equality became axiomatic with the imprimatur of the United Nations, the World Summit on the Information Society (WSIS) and the World Bank, among others. The two issues — ICTs and women's empowerment — in turn, have come to be regarded as essential components of sustainable economic and social development. As the WSIS Declaration of Principles stated:

**Our challenge** is to harness the potential of information and communication technology to promote the development goals of the Millennium Declaration, namely the eradication of extreme poverty and hunger; achievement of universal primary education; promotion of gender equality and empowerment of women . . . We affirm that development of ICTs provides enormous opportunities for women, who should be an integral part of, and key actors, in the Information Society. We are committed to ensuring that the Information Society enables women's empowerment and their full participation on the basis on equality in all spheres of society and in all decision-making processes. To this end, we should mainstream a gender equality perspective and use ICTs as a tool to that end. (ITU, 2003, 1).

Virtually all analysts now identify gender as one of the major components of internal developing country divides in a list that includes education, skills, income, language, ethnicity, age and geographical location. The majority of women in developing countries cross several of the other divides, leaving many women on the negative side of multiple divides and making the gender digital divide that much harder to circumvent.

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[1] Gender concerns appear to have emerged first in India in the late 90s in the MS Swaminathan Research Center's rural knowledge centre projects, which were early telecentre experiences. In Africa gender awareness was stimulated by the Association for Progressive Communication and the International Development Research Center and articulated in the volume *Gender and the Information Revolution in Africa* (IDRC, 2000).

## Do poor women need information technology? Can illiterate women use technology?

The often-heard response to this question is that marginalized women have so many needs that should be satisfied before thinking about the Internet. Shouldn't basic needs such as clean water, decent health, food security and income be dealt with first? My answer is that women should have an equal right with men to the empowerment that comes with accessing the Internet. Access to the Internet can bring significant opportunities, growth, employment and social relationships. Having information is terribly important in meeting basic needs. According to the Self-Employed Women's Association (SEWA), the Indian labor union that organizes poor, often illiterate, women in the informal economy, the critical reason for embracing ICTs is that '*Yeh technology ka zamaana hai'* (this is the era of technology), and women have historically been sidelined from technological advancements or recipients of hand-me-down technologies. They should not be left behind this time as well. Women need to be able to use the tools of the mainstream and control them in their own ways and towards their own ends, towards the satisfaction of their basic needs. (Gurumurthy et al., 2008, 125-126).

The enthusiasm for the potential of the Internet to empower women assumed women would benefit equally with men from increased deployment of the Internet to developing countries. There was virtually no attention paid to the reality that the Internet, along with other technologies, might not be gender neutral.[2]

## Rising Waters Do Not Lift All Boats

Research shows that rates of women's use of the Internet do not necessarily go in tandem with an increase in national rates of Internet penetration because a wide range of socioeconomic and political factors affect and frame the gender divide. Countries with a high degree of information technology development vary greatly in the extent of women's participation. France, Germany, Luxembourg, the Netherlands, Norway, and the UK have rates of female Internet use equivalent to those of countries with much lower Internet penetration such as Brazil, Mexico, Tunisia, and Zimbabwe. Italy's digital gender gap is similar to that of Kyrgyzstan, which has 10 percent of Italy's Internet penetration rate. Greece and Portugal, with relatively high rates of Internet use, are close to the bottom on the percentage of female Internet users, but Mongolia and the Philippines, with relatively low levels of Internet penetration, are near the top.[3]

Such evidence disputes the arguments that you don't have to take care of gender and information technology because it will take care of itself as information technology penetrates the society. The digital divide is not self-repairing. Gender analysis is needed to identify the issues and specific efforts to be undertaken that take into account the socio-cultural context to ensure that women enjoy the benefits of the Internet.

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[2] That technology is not gender neutral has become an axiom of studies on the social aspects of technology following the writings of Judith Wajcman, particularly in *Feminism confronts technology* (Penn State Press, 1991). See also Nancy Hafkin, 2002, Are ICTs Gender Neutral? A gender analysis of six case studies of multi-donor ICT projects. Lead paper for United Nations INSTRAW discussion list on gender and the digital divide.

[3] See Charts 6.7 and 6.8 on the relationship between Internet penetration and the proportion of female Internet users in Heidi Ertl, Heather Dryburgh, Nancy Hafkin, and Sophia Huyer, 2005, *Women in the Information Society: From the Digital Divide to Digital Opportunities*. Montreal: International Communication Network ORBICOM. http://www.orbicom.uqam.ca/in_focus/publications/details/2005_chap6_en.pdf.

## The Need for Gender Analysis

The Bhoomi e-governance project in India is an example of the need for gender analysis and women-specific actions to ensure that women benefit equitably with men from the Internet. The Bhoomi project computerized some 20 million landowner records in the state of Karnataka so that any farmer could obtain a copy of the ownership document required to secure bank loans for a charge of 15 rupees. However, Bhoomi had adverse effects on poor women landowners as it enabled land sharks to identify and target them and its records did not cover tenant farmers, the majority of whom were women. No outreach was undertaken to make women aware of the project. Few women landowners learned of the system, and some who did learn of it found that officials at the kiosk were unable to help them obtain their certificates because of the nature of their tenancy.[4]

References to gender have to be explicit in policy as well as in projects. Very few ICT policies refer to gender, even though they generally recognize rural-urban disparities. Without explicit references to gender issues in ICT policies, little happens for women as a result.

## Challenges to Women Accessing and Using the Internet

Gerster and Zimmerman (2003) define three kinds of barriers to access the Internet:

- Availability — physical presence of ICTs and the opportunity to use them
- Affordability — costs of acquiring or otherwise accessing the media
- Capabilities — skills of various kinds

With issues in each of the three categories, marginalized women in developing countries have many barriers to leap before they can access the Internet.

### *Availability*

The most basic issue in the availability of the Internet to women is having the physical presence of the Internet and other ICTs where they live or nearby. ICT infrastructure itself is a gender issue: it is concentrated in urban areas, and women form the majority of those who live in rural areas in much of Asia, sub-Saharan Africa, and parts of the Caribbean. Infrastructure is never simply rolled out evenly across countries. All over the global South, providing access in rural areas is particularly challenging. In virtually all developing countries, telecommunications infrastructure, as well as electricity, is weaker in rural areas and connectivity is frequently available only within capital and secondary cities, while the majority of women live outside these regions. Simply by being the majority of the population in rural areas, women have fewer opportunities than men to access new technologies.

### *Opportunities for use*

For reasons both of limited infrastructure and affordability, home access to the Internet is rare in the rural areas, as well as in poor urban areas, of developing countries, especially Africa. Fixed broadband remains very expensive and computers are found in more than 10% of households in only six African countries (four of which are

[4] See Rahul De, 2006, The Impact of Indian E-Government Initiatives: Issues of Poverty and Vulnerability Reduction, *Regional Development Dialogue*, 27, 2, 88-100, http://www.iimb.ernet.in/~rahulde/RDD_RDe_2006_text.pdf and Jennifer Brown, K. Ananth Pur and Renee Gioverelli, 2002, Women's access and rights to land in Karnataka. RDI Reports on Foreign Aid and Development 114, Rural Development Institute, Seattle.

island states and in special situations). In the majority of African countries, one percent or less of all households own a computer. The chances of a marginalized woman living in a household with an Internet-connected computer are close to zero in the 19 Least Developed Countries where the monthly cost of a broadband connection costs more than 100% of monthly Gross National Income per capita. In the absence of home access and the unlikelihood that poor people would have jobs that enable Internet access or be able to afford, or even share, web-enabled smartphones,[5] the possibility of Internet access usually falls to public access telecenters or cybercafés.

Cybercafés present particular difficulties for women. The main users of cybercafés in developing countries are young, male, relatively educated, and relatively well to do (see e.g. Mwesige, 2004); they charge fees that may seem minimal to Western users, but are unaffordable to most marginalized women. Often cybercafés become *de facto* men-only spaces, effectively inhibiting women's access, especially when young men playing video games or viewing pornography dominate them. Aware of this reputation, parents are frequently reluctant to let their daughters go to cybercafés. The cafes may be located in places that women are not comfortable visiting, or even fear harassment as a result of finding themselves in "men's space."

Women's multiple roles and heavy domestic responsibilities severely limit their leisure time that might be used to visit cybercafés. The mobility of women (both in the sense of access to transport and ability to leave the home) is also more limited than that of men. It is particularly problematic for women to use facilities in the evenings and return home alone in the dark.[6] The same locational factors hold true for telecenters. While the atmosphere inside the telecenter may not be as male-dominated as many cybercafés, the location of the center may keep women away. For example, the Mahiti Mitra telecenters in the large Kutch district of Gujarat state in India are located mainly in central bazaars, where men tend to sit all day and where women are not comfortable venturing. Even when women come to these centers, they are uncomfortable in asking questions freely in front of men.

Many of these issues in the public access venues involve gender relations, more specifically patriarchal cultures and attitudes that limit women's freedom, their mobility and their actions. This aspect of the barriers to the Internet outlined by Gerster and Zimmerman is the only one that is unique to women. Women share the other barriers with other marginalized groups.

The collision with patriarchy takes places not only in public places, but also in the home. Even when there is a computer in the home, there is no guarantee that the women of the home will have access to it. In a study from India, when there was a computer in the home, boys said it was theirs; girls said it belonged to the head of the household. Financial means permitting, parents often exhibit willingness to spend money on education or on a home computer for boys, but not for girls.

Given the rarity of computers in the home in developing countries, the telephone, in particular the mobile phone, which has become nearly ubiquitous even among the poor in developing countries, can serve as a proxy for the Internet on gender issues: Using narrow band mobile cellular telephony as a proxy for the Internet seems particularly valid because there has been little progress on the penetration of fixed Internet in recent years, particularly in Africa, while mobile broadband has potential of becoming Africa's main broadband Internet access method in the future.

Women informants in the Research ICT Africa study reported that their partners controlled and/or limited their telephone use. Women household members said that they rarely made use of the mobile phone because the household head maintained possession of the tool (Gillwald et al., 2010). Surveys of household ownership

[5] The penetration level of 3G cellular networks in Africa, for example, in 2009 was only one percent. (ITU, 2009).

[6] For more on the topic of women's difficulty in using public access Internet facilities, see Rathgeber 2002, Creech et al, 2006; Etta and Parvyn-Wamahiu, 2003; Hafkin & Jorge, 2003; Hafkin & Taggart, 2001; and Huyer et al., 2005.

of mobile phones are insufficient to determine whether women own or have access to them. Because mobile phones can be carried around, husbands may have more complete control over mobiles than over landline phones. If they take the mobile phone to work, for example, women have no means of taking advantage of it **(Lee, 2009, 4).** Men complete calls on behalf of women in their household for fear that they will overuse of their airtime. In Ethiopia it was reported that male household heads frequently locked the landline phone when they went out (Gillwald, 2008).

There is increasing evidence of men not only expressing displeasure and control over women's use of ICTs, but also resorting to using physical violence. Domestic violence often results when men become jealous or suspicious when their wives or girlfriends use or own mobile phones, when women monitor men's call logs, or when they answer their mobiles. In many cases, men monitored the cell phone and Internet use of their partners. Women from Zambia and Ethiopia told similar stories:

Zambia:

> 'My husband didn't trust me, he suspected I had other men so I sold my mobile.'
>
> 'My husband demands that I answer the phone in his presence, but he doesn't do the same.' Women reported being battered because they answered their husband's cell phones (Wakunuma, 2007, 6).

Ethiopia:

> 'A man puts pressure on his woman who has a mobile phone because he is afraid that she will cheat on him. If she is carrying around a mobile, there will be men asking for her number. Hence, I prefer if she [his girl friend] doesn't have a mobile phone.' (Woldekidan, 2008, 19).

### *Attitudes towards technology*

Conventional wisdom says that numbers of women suffer from technophobia. This may not be so much the case, but rather the absorption of societal views that technology is more for men. Cultural attitudes often discriminate against women's access to technology and technology education. Often girls' are discouraged from technical and scientific subjects by male teachers, and women themselves sometimes subscribe to the attitude that technology is something for men, with respect to both use and utility. Many sources attest to the feeling of discomfort with computers and other ICTs that women in developing countries experience. Women are often scared away from cybercafés, telecenters and mobile phones by the technicalities of using them. In Asia, Latin America and Africa the attitude is widespread that technology is a man's domain.

### *Affordability*

Access to information technology, particularly in the developing world, is costly – whether to buying computers, mobile phones, television or even radio (especially when the cost of purchasing batteries is considered) or paying fees for public access Internet. As women are the majority of the world's poor, they are less likely than men to be able to pay for access. Women's earnings in general are less than those of men, while many women in developing countries earn no cash income at all. In developed and developing countries alike, much of women's work is unpaid. There is also differential access to money within the household. As girls generally have less access to money than boys, young women are more reluctant to spend it on cybercafé Internet access. Not only do women have less disposable income than men in general, they have more family responsibilities and are more likely than men to spend their earnings on food, clothing and other basic needs.

Recent statistics from the ITU show just how expensive Internet access is in developing countries. While prices are falling rapidly in high-income countries, with users paying the equivalent of one percent or less of average monthly GNI per capita for an entry-level broadband connection, the opposite holds true for low-income countries:

In some 19 countries, a broadband connection costs more than 100% of monthly GNI per capita. And in a handful of developing countries the monthly price of a fast Internet connection is still more than ten times monthly average income (ITU, 2011, 1).

It is not surprising that Internet user levels remain extremely low in these countries.

Africa continues to stand out as the most expensive place for fixed broadband Internet, with the average cost across the region (including North and South Africa) three times the monthly average per capita income. Only one out of ten people in Africa uses the Internet. (ITU, 2011). Given the lower levels of women's income, under current price levels marginalized women are unlikely to be one of the ten who has Internet access.

### *Capabilities*[7]

Capabilities include skills of all kinds, in particular language, education and literacy, digital literacy, and information literacy. Women may suffer deficits in all these skills.

### *Language*

The issue of language is a vital aspect of becoming Internet able. The preponderance of English language on the Internet has fallen rapidly since 2000, but the Web is still dominated by major world languages that many women in developing countries do not speak or read. Girls and women are much more likely to become Internet users if they know a major international language, but far fewer women than men do. While breakthroughs have been made through UNICODE in using non-Latin scripts, (now even for domain names), there is much less material related to economic and social development on the Internet in local languages such as Tamil or Amharic than in international languages. Much of the local language material that does exist tends to be cultural and historical, without direct socio-economic value.

### *Education and literacy*

The fact that the Millennium Development Goal related to gender equality is based on improving women and girl's education underlines the important message that girls and women have lower rates of education overall than men. The majority of the world's illiterates are women. The following figures show how strikingly high these figures are.

While most use of the Internet requires literacy, a number of projects have developed web sites that target illiterate women, but they are costly to produce and maintain, and little evaluation has been done of the numbers of women they reach. Cell phones are touted for their appeal to the non-literate, but SMS requires literacy in a language supported on cell phones.

[7] Gerster's category of capabilities refers mainly to skills and should not be confused with Amartya Sen's definition of capabilities (Sen, 1999), which is much wider: "the substantive freedoms he or she enjoys to lead the kind of life he or she has reason to value."

Table 1: Examples of countries with high rates of women's illiteracy % of women unable to write a letter (in any language)

| Country | % Women's Illiteracy rate |
|---|---|
| Senegal | 73.0 |
| Benin | 65.1 |
| Ethiopia | 63.3 |
| Burkina Faso | 56.9 |
| Mozambique | 48.8 |

*Source: UNESCO, 2009.*

### *Digital literacy*

Far fewer women than men have digital literacy (often referred to as e-literacy). Computer literacy is becoming widespread throughout the world in formal education, and there have been a number of projects in all developing areas that aim at teaching girls and women computer skills. Women, especially poor women, are far less likely than men to be computer literate. Even if women are literate and have access to a computer, they still cannot access information technology without a minimal set of computer skills. This is illustrated by the case of the Bamshela telecenter project in South Africa, where the female users made use of it primarily as a phone shop because they lacked the skills to use its computers and fax machines.

Digital literacy correlates very strongly with age, and with massive populations of young people in developing countries, one can assume that computer literacy will reach the same level as print literacy in the near future, with growing numbers of girls becoming literate. At higher levels, computer literacy is a basic requirement for science and technology education, where there is major concern globally about the small number of girls in science and technology subjects and fields. The numbers for computer sciences are especially concerning. Paradoxically, the new technologies also offer many opportunities for women and girls to gain the education and technical skills required to participate equally in the information economy. And girls in developing countries, particularly those from poor backgrounds, may be sufficiently motivated by the desire for economic success to overcome the disinterest that many women in the West find in computer studies.

People's abilities to learn to use computers may depend on confidence in their abilities. In women, this is often undermined—by the attitudes of teachers or male students towards women in computer classes. In a demonstration project to bring computer skills to men and women smallholder farmers in Peru, the men farmers mocked women when they sat down at the computers, saying that computers were not for women. On the other hand, when women do get the opportunity to learn computer skills, they tend to experience a greater boost in their overall self-esteem and confidence than men.

Yet there is much evidence that computer training need not be restricted to literate women alone. There are many cases, especially from India, where non-literate rural women have come to realize that the Internet and computers are an all-pervading aspect of life, even where they live, and who have learned to use computers, despite lack of formal education and lack of knowledge of an international language:

> Pushpa Parmar, a weaver from Rawanpura village, gives computer training to rural women. Illiteracy has never been a barrier, she says. She has created a Gujarati-English computer manual for women*: 'I thought of words and symbols that women would understand and remember easily. They are so eager to learn that I don't have to repeat my lessons.'* (Kaul, 2003, 1).

### *Information literacy*

Information literacy is often confused with digital literacy. Learning how to use a computer well is insufficient to make a person information literate. To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and effectively use the needed information. An emphasis on information literacy goes directly to the purpose of ICTs as a *tool* and not as an end in themselves. The skills of information literacy are enormously valuable resources and assets in the increasingly global knowledge society. While the literature on information literacy efforts in developing countries is growing and information literacy appears in the ICT policies of a number of developing countries, there is little evidence of specific efforts that have either targeted or included girls and women, despite the enormous importance of this area.

### *Addressing gender inequality*

The many digital divides are based on existing divides and may increase them. Even meeting all the challenges listed under the above three categories is insufficient to ensure women's full access to the benefits of the information revolution without addressing the overriding issue of gender inequality.

Despite the enthusiasm for a link between the Internet and women's empowerment, it is doubtful that simply addressing the ICT portion of the existing gender divide will help take care of the larger divide. Gender inequalities often are unaffected and sometimes may even be perpetuated by ICT use. Information technology is a socially embedded tool, which in and of itself cannot bring gender equality. The general lack of equality between men and women is reflected in technology access and use. The whole question of Internet access is tied to social and cultural disparities between men and women that keep women from accessing and using Internet at the same rate as men.

Therefore, efforts to increase the Internet access and usage of underserved women in developing countries need to go hand in hand with efforts to increase gender equality. The chances of women – especially poor women in developing countries – having access to Internet would be greatly increased by actions that reduce inequalities between men and women – such as the education of girls.

## How can ICTs Serve Women and Development?

### What do we mean by development for women?

Amartya Sen's capability approach stresses the centrality of women to development. Sen conceives of development as "a process of expanding the real freedoms that people enjoy" and emphasizes the need for the "expansion of capability of persons to lead the kinds of lives they value." This view of development places people and their human development at the center of the development process. Sen stresses the importance of greater freedom to enhance the ability of people to help themselves and to influence the world. He argues that human development should be viewed first and foremost as a process of expanding people's capabilities. What matters to Sen is what people are capable of being, or doing, with the goods to which they have access.[8]

### What can women gain from the Internet?

Following Sen's approach, what marginalized women can gain most from the Internet is an end to their isolation – especially isolation from the resources and the information they need. In India, an illiterate elderly woman

[8] For more on Sen's approach to development see Sen, 1999 and Dreze and Sen, 2001.

from a minority group in western India escaped isolation when she came to use the Internet-based e-governance system to solve her problems dealing with government bureaucracy, where formerly she had been treated badly by the hierarchal attitudes of officials:

> ". . . there were many constraints imposed on me. But through my self help group, I learned about the Setu and the Mahiti Mitra [Internet-based information hub in the Setu self-governance program in Gujarat]. . . . Now because of me, all the other women in my family come to the centre on their own."(Gurumurthy, 2008, 94).

Another woman in India who used the Internet in a telecenter in Uttar Pradesh said:

> ". . . the most significant change in me has been that I previously used to feel some kind of fear to get out of the house alone, and I used to feel diffidence after coming to the center. But now there is not a bit of that previous fear in me." User of Sitakund ICT Centre, quoted in (Slater and Tacchi, 2004, 10).

Women can also reap specific benefits from the Internet in just about any area they deal in – and in the same areas and for the same reasons that men use the Internet. Women farmers can learn how to grow and market their crops better, and women artisans can use e-commerce to sell their products beyond local markets. They can find medical and health information for themselves and their families, and they can seek out information on topics that would be taboo for discussions with friends and family.[9] They can use social media to find others with similar interests and problems of all kinds, keep in touch with friends and relatives in distant places, communicate with their government as citizens, and make informed choices on nearly everything that touches their lives. They could acquire education that they wouldn't otherwise have access to. The Internet could mitigate the poverty of women and their families, it could provide information on income-generating possibilities, end women's isolation, improve women's civic participation, increase the reach and speed of their communication and, as a result, help to advance gender equality. The Internet could also provide entertainment to lighten the dreariness of their lives. The list is nearly endless. And why are we asking this about women? Would we ask why men would want the Internet?

Another benefit for women from using the Internet is psychological — the gain they experience in their self-esteem. Numerous sources have documented women's gain in confidence from using computers and accessing the Net.

- In six case studies of multi-donor ICT projects, women participants emerged from each project with enhanced self-esteem as a result of successfully using the technologies (Hafkin, 2002).
- In a self-evaluation of users at the Sitakund ICT center in India, none of the men mentioned any increase in self-confidence, while every woman user identified this as an outcome. (Slater and Tacchi, 2004).
- Women in ICT projects in Afghanistan said that they experienced increased self-esteem and a sense of empowerment (World Bank, 2005).
- Rural women kiosk operators in Tamilnadu, India came to be regarded as persons of status in their community and enlarged their worldview considerably (Srinivasan, 2010).
- In Bolivia, indigenous Aymara women found that the use of computers considerably strengthened their self-esteem and sense of self-worth (Rodriguez, 2001).
- Young Muslim women in Mumbai who secured computer education not only experienced a higher boost in self-confidence; they were also more likely than men to secure computer-related jobs (Umrani, 2007).

[9] This is particularly the case for young women in conservative societies where sexuality is not openly discussed– see e.g. Gadio, 2011.

## Content, Supply and Demand

Women's livelihood options are linked to the resources they have for knowledge. At present, for most women in developing countries, this knowledge is highly local and limited. Availability of the Internet in a form and with content they can access and use would be enormously beneficial in increasing their livelihood options and improving their lives and those of their families. The net result would be both economic and social development.

Content is an often neglected topic, but one of major importance in discussing constraints to women's use of the Internet. Information becomes knowledge when the local context is added, linking information to the user's environment and particular situation. Very few web sites provide the information that poor rural women in developing countries want and need, in a language and format that they can access. Most information and services that are currently delivered through the Internet are largely irrelevant to the daily lives of poor women in developing countries, who need and want localized, contextual, and accessible social, economic and political information relevant to their daily lives.

Users themselves can often develop content best. Paolo Freire (1994) and others have shown that literacy instruction is most effective when it involves content that speaks to the needs and social conditions of the learners. Women have indigenous knowledge that would be useful to share with others. As more poor women become users of the Internet, they will themselves become producers of content. This is particularly the case with the young of the world, who are growing up in the environment of Web 2.0 that by definition sees the user as the producer of content.

Adopting Sen's definition of development as freedom and self-development leads to a wide view of what content marginalized women in developing countries may want. Web 2.0 takes the definition of content from subject matter to communication and relationships, both of which are essential to Sen's definition of development. Women need the freedom to access and create the content that most enriches their lives. It is not necessarily women-specific.

## Best Practices

A number of Internet-based projects have emerged that feature content created specifically for women. Among these are the following:

- **TARAhaat Information and Marketing Services Ltd** (tarahaat.com) delivers a broad spectrum of services and products for the rural and semi-urban citizens of India through a network of franchised community and business centers owned by individual entrepreneurs. Its applications focus on education, communication and e-governance.
- **E-Seva (esevaonline.com)** has almost 9,000 telecenters that provide information services and computer training for rural India. Many of the center managers are women.
- **Women's Information Resource Electronic Service** (WIRES, www.ceewauwires.org.) provides women entrepreneurs in small-scale business in Uganda with information on markets, prices, credit, and trade services repackaged in simple, ready-to-use formats, preferably in local languages.
- **Feminist International Radio Endeavor** (FIRE, http://www.fire.or.cr/ and http://www.radiofeminista.net/indexeng.htm) based in Costa Rica, is women's Internet radio that supports community media with content on women's rights.
- **Nutzij Center for Mayan Women Communicators (**http://www.interconnection.org/cmcm/). Through video production and using the Internet, the Nutzij ("my word", in Maya) project run by a collective of

young Mayan women in Guatemala helps women develop skills to preserve their community's cultural heritage on video and market the content to the world via the Internet.

One of the ironies of discussing Internet content for women is the comparison between the amount of content available that poor women in developing countries could use and the amount of content on the Internet that exploits women. According to the United Nations:

The trend towards an increasing gender digital divide is alarming, as is the tremendous difference between the volume of Internet content that denies women's rights in contrast to content that promotes them. These trends are particularly alarming when considering the array of internationally agreed development goals promoting gender equality. (United Nations, 2011, 94).

## What media do marginalized women in developing countries use?

The majority of the world's women do not use the Internet; many do not even know about it. Women Internet users in developing countries are almost entirely elite urban women, who have access either at home, at work or at school. A gendered picture of the current situation of Internet access and use in Africa shows very little access to and use of the Internet by either men or women, as compared to other areas of the world. And within Africa fewer women than men have any knowledge of it. Access varies greatly according to income, education, employment status, age and place of residence. There is no question that access to Internet is in short supply, for both men and women, in rural areas of developing countries as compared to urban areas. However, there are no significant gender differences *when factors other than gender are held constant*.[10] However, since women in general have lower income, less education, and are less likely to be employed, access to Internet is clearly not equal between men and women. When other factors are not kept constant (e.g. age. education, income) being female reduces the probability of knowing about the Internet and using it.

A recent study of Internet use based on a sample survey representative of the Kenyan population as a whole produced some interesting results. Women were found to use the Internet for news and information at less than half the rate of men (17% of men, 8% of women). Of this representative group of Kenyans, fully 45% of women didn't know what the Internet was. While 12% of those surveyed had accessed the Internet on mobile phones,[11] it was found that this group was predominantly young (76%), male (70%), well educated and well to do (82% were middle- or high-income) (Bowen, 2010).

## What information and communication media/networks do poor women in developing countries use?

Table 2 shows that radio is by far the most common information media used by women in some rural parts of South Africa, with television following at less than half that rate. Women used postal services almost as much as they did mobiles phones (either owned, shared or rented), with home phones coming in fifth, used by slightly less than one out of five women. At the very bottom of the list were computers — whether Internet-connected or not — at only three percent. Numerous other studies from other regions confirmed the same pattern of women's media usage.

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[10] In urban areas low-cost access to the Internet is often unavailable in low income areas. Dorothea Kleine's analysis of geographical location of cybercafés and telecenters in Chile found that they were concentrated in higher income areas. (Kleine, 2011). [Dorothea Kleine, 2011. Technologies of Choice? Chilean national ICT policies seen through the eyes of microentrepreneurs in rural communities, http://tascha.uw.edu/wp-content/uploads/2011/04/Kleine_Washington_April-12_2011-final_np.pdf ].

[11] Kenya is a relatively low-income developing country that has a surprisingly high rate of smart phone usage among mobile phone users.

Table 2: Available information and communication networks as used by rural women in South Africa (Kwa-Zulu Natal province)

| Media used by women | % of women using this media |
|---|---|
| Radio | 87 |
| Television | 37 |
| Mobile telephone (narrow band) | 26 |
| Post | 23 |
| Landline telephone | 19 |
| Computer (both Internet connected and unconnected) | 3 |

*Source: Gumede et al., 2009, 118.*

## Places of Use

This discussion will center on telecenters as they are the preferred mode of Internet public access by women and the most common method of Internet access for marginalized women in developing countries.

## Telecenters

Public access telecenters, with numerous for and not-for-profit variations, came into being in the developing world in the last half of the 1990s. In India, which has been the global center of the movement to establish telecenters directed at poor, rural areas, the largest initiative is the Rural Knowledge Centre Movement coordinated by the MS Swaminathan Research Foundation (MSSRF). Based on a private sector business model, village knowledge centers (VKCs) operate shops that tackle a number of the issues that constrain women from accessing electronic information, including language, script and literacy. The shops use Tamil language and script in the computers, with semi-literate women trained as data operators entering locally relevant content. Illiterate villagers hear weather reports, market prices, and other information downloaded from the Internet as audio files and played over public address loudspeakers. The large number of women operating the centers in turn attracts women users. The centers started self-help groups to provide women information on health and medical issues, small business, and how to access government programs and pensions. Some centers provide evening counseling sessions for women and microfinance loans and training to start cottage industries. Female agricultural laborers who are paid partly in grain get information on grain market prices at the centers.

Indian President A P J Abdul Kalam[12] envisaged a network of computerized knowledge centers in every village where half of the operators would be women. The leadership for the village knowledge centers was taken up by the Swaminathan Foundation, with a plan to establish some 600,000 village knowledge centers in India to bridge "the urban-rural digital divide and ensure knowledge connectivity in areas relevant to the day-to-day life and livelihood of rural families." In 2007, the foundation took on a number of local and international partners (including UNESCO, the Swiss Agency for Development and Cooperation, IDRC, and Microsoft) and became the *Grameen Gyan Abhiyan* (Rural Knowledge Movement). Inclusion, with particular emphasis on women, was a first principle of the VKCs. Women were consulted and involved in the planning and set up of all the local centers:

[12] Kalam, known as the "People's President" was in power from 2002-2007.

The key to success has been the integration of gender analysis and awareness at the earliest stages of project design, and making them [women] a part of ongoing training, evaluation and monitoring. The knowledge centers track the number of men and women visitors to the centers on an ongoing basis, providing a changing picture of how rural women are using ICTs. MSSRF is also always keen to ensure that at least half of the volunteers must be women. The experience of handling and maintaining computer equipment and answering men's questions gives women new confidence and status in the community and helps ensure that technology is not thought of as a 'man's domain.' (APC, 2008, 1-2).

The knowledge centers use the Internet as a tool to provide villagers with information and skills so that they will be able to help themselves. There is great emphasis on locally specific information, with the VKC staff spending a goodly proportion of their working time providing value added from the Internet through the creation of local databases, translating information into local languages, and developing multimedia resources for villagers without literacy skills. The information provided has always been demand driven and is relevant to the day-to-day life and work of rural women and men. One area stressed in content has been women's health and advice on growing local crops and protecting them from diseases. Swaminathan's principles are that knowledge provided should be demand driven, immediately relevant, in the local language, and gender sensitive. (Nanda & Arunachalam, 2010).

The rural knowledge movement has been replicated in 12 African countries as a South-South cooperation initiative by the Government of India-financed Pan-Africa e-Network, the Information and Communication Technology Agency in Sri Lanka, the Telecentre Network in Bangladesh and the Mission Swaabhimaan in Nepal, among other places. There is little evidence, however, of gender concerns at the level of the MSSRF in the new movement sites. Unfortunately, since 2008 the energy around village knowledge centers has dissipated in India as well.

### *Women and telecenters: the general experience*

The Swaminathan telecenters mark the acme of gender mainstreaming in the use of ICT by poor, disempowered women. However, the general telecenter experience has not always been so positive for women. A study of women and telecenters in Africa found that women tended to be much less numerous than men as users of the centers. When women were users, they appeared to gain only marginal benefits, an outcome attributed to the lack of attention to gender differences and women's information needs in the design of the centers (Johnson, 2003). There are exceptions to this pattern of men being more numerous among telecenter users, taking into account variables such as class, location, education and employment status all figuring in. A recent study of telecenters in Jamaica showed that 57% of users were women. Even while being less numerous, however, men frequented the centers more often, for reasons of lack of time and money on the part of the women users (Nadamoto, 2006).

Women-run and –managed telecenters have been successful in several places. In Chile, women frequent public telecenters (*Biblioredes*), using the facilities and taking computer training courses more than men because they are free and many of the center operators are women, with whom they feel comfortable asking questions about computer use. In Senegal, the Guédiawaye community telecenter is owned and run collectively by its 1,200 members, 80% of whom are women. All staff members come from the community. It carries out a variety of activities, ranging from computer training to handicrafts. In South Africa, women run 90% of the telecenters located in rural areas. The Kalomo Bwacha Women's ICT Club in rural Zambia runs a telecenter that combines ICT services with social concern for women.

While women-run and managed have shown benefits for women, it is not a necessary requisite for a gender-friendly telecenter. Rather, gender awareness and balance are the key elements.

## ICTD: The shift from Telecenters to Mobiles

At the time of their introduction in the developing world in the 1990s, telecenters were seen as the panacea for access to ICTs for the poor, including women. They were directed towards inclusivity, remote and low-income areas, where they generally tried to be especially welcoming to women. While village-based telecenters in India have brought e-literacy and access to large numbers of poor, largely rural women and attracted many women users in parts of Latin America as in Chile where they have been accompanied by substantial government support, the reality is that enthusiasm and funding for telecenters has died out in most of Africa as well as in many parts of Asia and Latin America. In general the problems have been scalability, lack of economic viability and the absence of concern for community information needs.

In the first decade of the twenty-first century attention and excitement in the world of information and communication technology for development has largely shifted to mobile phones because of the astonishing rapidity of their global spread, their relatively low-cost (especially when compared to that of establishing and maintaining telecenters) and their ability to bridge illiteracy and locational barriers. There has been substantial discussion of the relative value among ICTs of Internet to mobile telephony among women.[13] Given women's low income and education levels, the choice of mobile phones appears to be the obvious one, despite the fact that standard mobile phones hold less potential for information empowerment than the Internet.

### *Importance of mobile telephony*

The extraordinary popularity of mobile phones as the ICT device of choice in developing countries is seen most starkly in Africa, which has achieved the greatest growth in mobile adoption of any region in the world, far outstripping the Internet in growth. At the same time that Africa has the lowest percentage of Internet users overall (at 5%, with huge variations by region), it has the world's highest ratio of cellular to fixed lines, with 52 % cellular penetration rates and 534 million subscribers at the end of 2010, representing a growth rate of 470 % over 5 years. By 2009, 80 % of Kenya was covered by mobile networks, and mobile broadband was becoming more available throughout the region.

Trends are such that more and more poor women and men will come to adopt smartphones in the coming years, leading to increased potential for empowerment and surmounting the limitations of "dumb" mobile phones for acquiring knowledge and wider exposure possibilities for social and business purposes when compared to the Internet. In view of the apparent inevitability of this trend, we shall examine various aspects of poor women and mobile cellular telephony in developing countries.

### *Why women like mobiles more than the Internet*

Mobile phones are particularly useful for women's empowerment for many reasons.

- They can be used even when working in the fields or when away from home.
- Initial capital costs are less than those of computers.[14]
- The learning curve is less steep than that of computers.

[13] This came before the advent of web-enabled smartphones.
[14] Though while the initial capital cost of a computer is much higher than that of a mobile phone, the operating costs are much less.

Women appear to find mobiles more relevant for:

- Easy social contact with family and friends
- Small-scale business purposes (e.g. collecting outstanding debts, following up on orders)
- Easy and fast communication at all times
- Emergency communication
- Increased security at night
- Reduced travel costs

## Willingness to pay high costs for communication

Given the benefits, recent research shows that even poor women may spend an extraordinary percentage of their incomes on mobiles. A recent survey showed that the poorest 75% of the population in Kenya, Rwanda and Uganda spend from 64 to 69% of their disposable income on mobile communication and indicates that low-income women would pay a substantial portion of their income to acquire one, if they do not already have one.[15]

## Economic and Social Development Benefits of Mobile Telephony for Women

### *Economic benefits*

A recent South African study showed that mobile phones increased employment for women in wage employment, in particular those not burdened with childcare. Men in the same community showed no positive employment effect associated with mobile phone service. In addition, household income increased "in a pro-poor way" — resulting in better health and nutrition and more education for children — when cellular infrastructure was provided, along with substantial decreases in extreme poverty.

In a number of countries access to mobile phones has changed the way women farmers work, giving them better access to market rates and a wider audience to whom to sell. Poor women farmers in cooperative women's farming groups in Lesotho use mobiles to obtain information on market prices in order to better to market their produce and identify a wider audience of buyers. Although illiterate, the women farmers handle the technology to make cash transfers and find new economic opportunities, with savings in time and travel costs. One drawback, however, was that the phones have to be sent to town for recharging because there is no electricity where the women live.

Just as for men, the mobile is an enormous asset for women in establishing a business. Women can set up economic enterprises without an office or even an established market space and can be reached even when they are away from their home or workplace. In Mozambique, women market sellers of *xicadju* (fermented cashew juice) in Manhiça province use mobile phones to tell inform suppliers in Gaza Province when they need more stock, ending the need for long and sometimes fruitless journeys. A Mozambican woman stressed the laborsaving aspect of mobiles for her work, saying: "For me, the cellular telephone is my feet, my work." (Macueve et al., 2009, 26).

[15] For further discussion of this, see Gillwald & Stork, 2010 and GSMA, 2010.

Mobile phones function as ways around social conventions, allowing women entrepreneurs to improve their businesses. In religious Muslim areas, where women may be forbidden to speak directly with men, mobile phones may enable female business owners restricted by religious norms to expand their businesses without male assistance and without violating social norms:

The local interpretation of the religious requirement of purdah places constraints on the 'acceptable space' for a woman; for example, it is necessary for some Muslim women who wish to engage in certain business transactions to have the services of a third party. Access to a mobile phone now makes it possible for these women to have direct links with their business partners without compromising their purdah status (Comfort and Dada, 2009, 49).

Using mobile phones for cash transfers provides a great spur to women's micro and small-scale enterprise development, particularly in Africa. M-PESA (M for mobile, *pesa* is Swahili for money) is a mobile-phone based money transfer service that was developed for Vodafone under the initial sponsorship of the UK Department for International Development (DFID), which targeted women as participants. (Datta et al., 2009). M-PESA users don't need bank accounts; they buy digital funds at an agent and send that cash by SMS to any other mobile phone users in Kenya . The phone becomes an electronic wallet, holding up to 500 Euros. For women, m-payments are a safe and inexpensive way to receive send and remittances. M-PESA has grown with astounding rapidity, acquiring 15 million subscribers by mid-2011 with millions of daily transactions in Kenya alone. The service also operates in Afghanistan, Fiji, Tanzania and South Africa, with Vodafone planning to extend it shortly to India and Egypt.

In addition to facilitating greater freedom and mobility, mobile phones also provide greater privacy, security and protection from abuse and violence. In India, a study showed a positive correlation between cell phone ownership and greater female autonomy and decreased tolerance for domestic abuse, specifically husband's control and wife beating.

### *Health*

Mobile phones also provide health benefits for women. In Indonesia, midwives with mobile phones were more likely to turn to medical care providers for help and information and likely to stay in contact with their clients. The Grameen Foundation runs a program called MoTECH in Ghana that supplies women with pre-natal health information via SMS and encourages them to seek antenatal care from local facilities. In India, ZMQ Software Systems provides women with pre-natal health information via SMS. "The goal of our program is to use technology to empower women," according to Subhi Quaraishi, the CEO of SMQ. The messages, all in Hindi, contain information on vaccinations, exercise, diet, medication, and how to deal with emergencies that arrive during pregnancy. UNICEF and other health organizations working on maternal health also use mobile technology to deliver services to women.

Accessible, appropriate and timely content on health, for example, tends to draw women to the Internet when they might otherwise not have come. In the Mahiti Mitra telecenters in Gujarat, India, large numbers of women participants take part in mobile teleconferences on health adapted from Internet downloads and translated into local languages.

### *Security*

The overwhelming majority of women want mobile phones for increased security. In a recent study of poor women in developing countries, 93% of those interviewed said that having a mobile phone would make them feel safer and more connected (GSMA, 2010). Several studies have shown that access to the Internet has increased women's awareness of domestic violence and remedies for it.

### *They will come to mobile broadband*

It is a reasonable projection that just as non-Internet connected phones have spread like wildfire through developing countries, with significant numbers of women using them, current mobile phone users in developing will come (albeit more slowly than in developed countries) to mobile broadband. With the advent of personal computers and the Internet, pundits spoke about developing countries being able to leapfrog generations of technology. With mobile telephony, for most underserved persons in developing countries, the acquisition of mobile broadband telephony is not likely to come through leapfrogging but rather as a sequential step from the current "dumb phones" that nearly 100% of poor women mobile phone users in developing countries presently utilize. As awareness of the Internet grows, the poor will try to take advantage of the opportunities it offers, with smartphones become the most accessible means of access, particular as the costs of acquisition and use drop.

## Current Work to Ameliorate Impediments

Since about 2007, funding from United Nations, bilateral and foundations sources for Information Technology for Development (ICTD) and digital inclusion has been drying up. DFID has closed its Information and Communication for Development Group, and IDRC has dropped its program on ICTD from its 2012-2016 program, choosing instead to mainstream it in other areas.[16] USAID too is embedding ICT into sector-specific initiatives. Another major bilateral player in ICTD, the Swiss Agency for Development and Cooperation, closed its ICT4D Division in 2008, moving some of its projects to a newly created Knowledge and Learning Processes Division. While the United Nations Department of Economic and Social Affairs, its regional commissions, the ITU, UNESCO, UNCTAD and UNDP have done significant work on gender issues and information technology, the Global Alliance for ICT for Development (GAID) has been reluctant to commit itself to gender and ICT efforts and has few, if any, funds for project activities. India has moved into the formerly western country bilateral ICTD space with south-south cooperation, notably through its Pan-African e-network project, launched in 12 countries in 2010, but without any mention of gender in its program prospectus. This private sector space was occupied in the last decade by the computer giants, such as Microsoft, which has abandoned its Digital Inclusion Initiative, and Hewlett-Packard that no longer operates its e-inclusion program. Cisco also abandoned the Gender Initiative of its LDC Initiative in 2006. In the absence of these traditional sources, the mobile telephone private sector has taken up the pursuit of digital inclusion, with special attention to women. Now the GSMA (the industry association of global mobile operators) has become the most active participant in gender and ICT inclusion.

## GSMA- mobile corporate interests enter ICTD

Mobile cellular operators have undertaken high-profile efforts to encourage "Bottom of the Pyramid" (BoP) women to adopt mobile telephony. The efforts in this direction by the GSMA Development Fund, in conjunction with the Cherie Blair Foundation for Women and with the specific encouragement of US Secretary of State Hillary Clinton on behalf of the United States Agency for International Development, have taken on hyperbolic tones. The Blair Foundation concentrates its efforts on strengthening the capacity of women entrepreneurs "in countries where they lack equal opportunities." In 2010 GSMA and the Blair Foundation together sponsored a major study entitled *Women & Mobile: a Global Opportunity: A Study on the mobile phone gender gap in low and middle-income countries*.

Cloaked in the language of Millennium Development Goals, the study makes the economic case for the connection between mobile telephones and women's empowerment for BoP Women. Their data cites a gender gap

[16] Critics often regard mainstreaming as the 'kiss of death,' arguing that mainstreaming of gender for example, has led to lip service at all levels, but without the funding, personnel or activities that accompanied a program approach.

of 300 million fewer users of mobiles than men.[17] The report presents the idea of women owning mobiles as a panacea that would increase women's independence, facilitate women-owned businesses and increase the revenue of telecommunications companies. Unfortunately, it does not present much data to back up the revenue claim, nor does it discuss any of the constraints to mobile ownership that BoP women face.

The GSMA's agenda is to convince global mobile operators that BoP women are the last, huge untapped market to be pursued, now that developed and middle-income countries are near full penetration. They see the biggest gender gaps (and thus the biggest potential markets) in South Asia, the Middle East and Africa. Their calculations maintain that 20% of BoP women already "own" mobiles; this figure is questionable and not well documented, especially since no mention is made of sharing, which is the dominant access mode for BoP women. The study centers on showing how both operators and BoP women would profit economically from mobile telephones. GSMA estimates that poor women who newly acquire mobile phones could be counted on for US$5.43 per month in ARPU (average revenue per user). This figure is a higher percentage of their income than men's, reflecting the lower level of women's incomes as compared to those of men. However, as we have seen, poor rural women have indicated their willingness to make such expenditures.

The main points of their economic and social case for women's empowerment are:

- Virtually all women said that they would feel safer with a mobile phone
- 55% of women in business said that the phone brought them additional income
- 41% of all women interviewed said that it increased their income and professional opportunities

In its recommendations, the study advises the mobile telecommunications industry to target poor women, emphasizing the phone as a life-enhancing and income-generating tool. This marketing strategy, however, fails to take into account the social, cultural, economic challenges that women face; the GSMA study overstates the benefits without discussing the constraints.

As follow-up, with funding from USAID in 2011, GSMA is sponsoring a major study to better understand BoP women as consumers, their mobile use patterns, and what services and products they want to improve their lives.

Mobile cellular operators campaigns to promote women's increased access to mobile telephony are part of the association's objective to increase mobile broadband as the developing world's (and particularly Africa's) main broadband Internet access method in the future. The operators see today's BoP women narrowband customers as tomorrow's broadband market, projecting women entering the smartphone market under the premise of "once they're in the mobile, they'll want to move up" (cost and access improvements permitting).

[17] While the study and its aftermath widely publicize figures of a gap of 300 million fewer women than men without phones in developing countries (where there is mobile coverage), there are no references for this figure. The statistic is based on the consulting firm's extrapolation from their field surveys in four countries, some academic case studies, private sector market research and aggregate statistics that were NOT disaggregated by sex. The shaky basis for this calculation points to the need for further quantitative research on this area — especially by national statistical agencies working in concert with the ITU. The study also makes the assumption that gender and age groups are distributed equally in areas that have mobile coverage; this is not the case with BoP women, who are more heavily concentrated in rural areas where they outnumber men. In the age groups that have gained some education in recent years, the population of young people is more heavily concentrated in urban areas (where they migrate in search of work).

## New Developments

### Combining mobile with the Web: more access, more information, more interactivity

New developments in the convergence of mobile phones with the Web that are appearing rapidly can help surmount the limitation of mobile phones to a largely known network of contacts and a limited amount of information. The barrier of cost is also beginning to be breached as Nokia and Google are both working to make their low-end mobile phones data-capable, and many inexpensive Chinese and Taiwanese phones already come data-ready.

One of the most exciting developments for increased access for poor, often illiterate, women in developing countries is that of combining the mobile phone with voice access to the Web. The aim of Project Spoken Web, also known as VoiGen, being developed by the IBM India Research Laboratory, is to address many of the issues that presently keep underprivileged users from deriving benefits from data and services accessible to WWW users. VoiGen enables ordinary telephone subscribers to create, deploy and offer customized voice-driven applications through a simple mobile-based interface accessible from telephone devices.[18]

VoiGen plans to develop a network of voice recordings in local languages that will provide information for farmers and villagers who can add their own voice sites to promote their businesses. Navigation and browsing take place by voice and the voice-based mechanism for local content creation will greatly help provide ICTs to rural areas. The information can be accessed from any phone, whether mobile or a landline. VoiGen maintains that its Internet access is superior to that at telecenters, which rely on human intermediaries to connect the end user to the Web, thus preventing the users from having direct access to it. (This overlooks the fact that the end user might both want and need an intermediary to access the Internet). They also stress the element of agency "by enabling users to *offer* their own data services rather [than] simply easing their *access* to such services." (Kumar et al., 2007, 11). This is very much in line with the objectives of engendering ICTD, which see women not just as users of the Internet, but also as active participants in its development.

## Prospects and Promising Areas of Future Work

Smartphones with substantial computing capability including a web browser have introduced a new way to access the Internet. The future for underserved women and the Internet appears to lie in 3G (or 4G, when it becomes easily available in developing countries) and mobile cellular networks (basically smartphones with increasingly large displays), if operators introduce handset purchase and use tariffs that are affordable to low-income women. There is no question that mobile phones have surpassed traditional media such as radio, television and standard desktop or laptop computers to become the most accessible form of information technology in the developing world. It also seems clear that Internet will come to be more easily available to the poor, both men and women, in developing countries through smartphones rather than desktop or laptop computers (although the convergence phenomenon is becoming greater everyday as various information technology media come to duplicate each other in functionality). This is still a long way off, especially in Africa, where the 2008 mobile broadband penetration level was only one percent among the population as a whole. But growth is strong and the phenomenal growth of basic cellular telephony over the last decade in the developing world could be a forerunner for continued rapid growth in this area.

[18] More information on VoiGen is available from Kumar et al., 2007.

### Low-cost phones

Smartphones employing the free operating system of Linux open architecture, with unrestricted application development, and possibilities of Wi-Fi hotspot Internet access without a data plan offer low cost communication possibilities that would be affordable and advantageous to many women. Adaptation of the Android platform to the needs of the poor in developing countries is already underway with A4D (Android for Development), a partnership of Fraunhofer Portugal, a non-profit applied research organization with Eduardo Mondlane University in Mozambique. Google (the major promoter of Android) has also started to provide refurbished Android phones to poor users and developers in Africa through its "Android for Good" program. Voice-only phones supplemented by community radio also offer low-cost information and communication possibilities with some Internet benefit to women in rural areas.

## Positive, proactive programs for women and the Web

It is not only in technology that exciting new developments are taking place. The social arena is seeing many projects utilizing new information technology with a focused concern on improving the lives of marginalized women in developing countries.

Perhaps the most active organization globally in promoting the use of the Internet and associated technologies for women and social change is the Association for Progressive Communication, especially through its Women's Networking Support Programme. Its programs include the following:

- Gender IT.org is an extremely well-documented resource web site and online newsletter on women and ICT policy, in English, Spanish and Portuguese
- The Feminist Tech Exchange trains women's rights advocates in developing countries in Internet, audio and other technical skills and serves as an information exchange for women working on innovative technology projects
- Gender Evaluation Methodology (GEM) is an evaluation tool that assesses whether ICT projects benefit men and women equally
- Take Back the Tech! has mounted a global campaign on the connection between violence against women and ICTs and aggregates information from local campaigns
- GenARDIS (Gender, Agriculture and Development in the Information Society) is a small grants project that since 2002 has awarded more than 35 grants to projects promoting information technology to improve women's agriculture in the developing world.

An increasing number of projects around the world are leveraging information technology on behalf of women's economic and social development. They include new approaches such as digital helplines and storytelling, special focus on the often-neglected area of women's agriculture, as well as technology training and jobs and social change through feminist community informatics.

#### *Helplines*

Helplines in Bangladesh and Philippines are using different aspects of mobile technology. The Pallitathya Help-Line project in Bangladesh deploys community women as "Mobile Operator Ladies" who go from door-to-door to enable other women to ask questions related to livelihood, agriculture, health, and legal rights via mobile phone, while help-desk operators respond to the women's queries with the use of a database-driven software

application and the internet. To expand the information database, resource persons from government, non-government organizations, health groups and human rights organizations help provide responses to frequently asked questions. Both the women operators and the women clients have gained knowledge, self-esteem and increased status through the project. In the Philippines, **the Center for Migrant Advocacy Inc.** has started an SMS helpline that provides emergency assistance and support for migrant workers, among whom are large numbers of Filipina women, by linking them to the appropriate government agencies and embassies.

### *Digital storytelling*

**Web-based films telling women's stories have been used in South Africa and the Philippines to elucidate and ameliorate women's situations.** The Sonke Gender Justice Network works with men, women, youth, and children in South Africa to achieve gender equality, prevent gender-based violence, and reduce the spread of HIV/AIDS by giving voice to those affected by violence and HIV. The Center's Silence Speaks initiative conducts digital storytelling workshops throughout the country and then webcasts the stories across southern Africa to educate local communities, train service providers, inform policymakers, and promote community action for change. **Women's Education, Development, Productivity and Research Organization Inc.** is a feminist collective in the Philippines that addresses the issue of sexual violence on former US military bases through training women in web-based technology for digital storytelling.

### *Violence against women*

Women in developing countries have become active in using the Internet to combat street harassment and sexual violence, afflictions from which poor women especially suffer. In New Delhi, which has the largest number of rapes and molestations of any city in India, women are using the ihollaback.com website to share experiences and plans to work with NGOs and the police to increase their safety. Women in Cambodia and Pakistan participate in Thepixelproject.net that actively campaigns around the world to end violence against women using various online channels including social media.

### *Agriculture*

In the border region of Uvira of the Democratic Republic of the Congo, pests were destroying women's cassava root crops. In order to help the women of this community increase their healthy crop production and agricultural knowledge, IFDAP **(***Initiative des Femmes pour le Développement, l'Auto-Promotion et la Paix* [Women's initiative for development, autonomy and peace]) trained them in Internet research so they could learn about the diseases affecting their crops. They also provided the women with mobile phones to contact potential buyers for their crops and trained women's groups in the use of information technology. A weekly radio show (The Voice of the Woman Farmer) was created, on topics related to gender and agriculture. Through the project, rural women increased their crop production and family income, purchased improved tools, and earned money to educate their children and provide better nutrition for themselves and their families.

Two projects in Kenya, both developed by Kenyan women technologists, assisting women farmers through information technology. iCow is a mobile phone app for cattle farmers, most of women are women. Created initially to help farmers track the fertility cycle of their cows, its services now extend to helping farmers gain access to veterinary officers and animal feeds. It also collects and stores farmers' milk and breeding records and sends farmers best practices for dairy management. M-Farm is an SMS and web-based application that disseminates agricultural information to largely women farmers. Farmers also use the platform to access real-time price information on different products at different markets and locations, eliminating the need for them to market through middlemen to make sales, thus increasing their earnings.

Accessing market information without having to go through middlemen is especially important for poor women producers. Projects concentrating on agricultural marketing are found in Zambia and Senegal, among many other places. In Zambia, the Chipata Women's Mobile SMS project utilizes mobile phones to help women's farmers associations to sell their produce at a good market price. The women also use their mobiles as payphones to extra some additional money. In Senegal, the mobile data services operator Manobi provides a free-access SMS and Internet market information service called Xam Marsé that provides users current market prices on products of interest in selected markets. Their fruit and vegetable information service that collects information from 10 markets everyday and makes it nearly instantly available is of special interest to market women.

### *Technology training and jobs*

One of the most important project areas for women and the Internet is in training girls and women for jobs in the knowledge economy. NairoBits is a digital design school that teaches web development and entrepreneurship, with a focus on student-created content. The project targets young women students, especially young girls around 16 years of age, many of whom are already mothers, from the poorest of Nairobi's slums. It has trained more than 6,000 students in Kenya alone. Currently being replicated in Uganda, Tanzania, and Ethiopia, it has a very high success rate in its graduates getting good technology jobs and transforming their lives. The cost of one year's training is 20,000 Kenyan shillings, or roughly US$214.

Samasource is an outsourcing firm that works with independently owned local firms in low and middle-income countries that hire workers who previously earned $3/day or less. The local firms agree to train their workers, and reinvest 40% of profits in training, salaries and community programs. Contracts come from the giants of the tech world including Google and Facebook. Samasource has employed more than 1,600 poor young women and other youth from East Africa, South Asia and the Caribbean, with a payroll of $1.2 million in its first two years. Among the work Samasource graduates perform is the digitizing of books. Training costs for one woman are $500.

In 2011, the Appropriate IT Development Academy opened its first center in Coimbatore, India with a pilot training on website development especially for young women from underprivileged backgrounds. The academy plans to establish 100 locally owned training centers in the next ten years, targeting young women for entrepreneurial development, with particular emphasis on software training.

### *Community informatics*

While many of the first established telecenters have gone by the way, a new generation of telecenters stresses community development, local content and social change. Among these is the Mahiti Manthana project in Mysore, Karnataka province, India, operated by IT for Change as part of Mahila Samakhya Karnataka (MSK), a grassroots initiative of the Government of India to empower socially and economically disadvantaged women in rural areas through self-help group activity. The community informatics approach uses ICTs to bring about positive social change, utilizing community radio, video strategy and telecenters, owned by members of the village collective. A young woman from the community operates each of the centers; she is trained as an information intermediary to guide community members regarding government information, entitlements and other schemes. The project has an open learning approach for largely illiterate adult women.

## Conclusions and Recommendations

While the Internet can exacerbate inequalities, it also offers immense opportunities to the marginalized. However, special efforts need to be made to reach women and girls. The key element is being aware of cultural and social contexts and of gender relations. In strategies, programs and projects, women need to be directly targeted. While access to the Internet is the sine qua non, it is not sufficient in itself. We have seen that the percentage of women's Internet use does not correlate directly with a country's rate of Internet penetration and that unless specific gender goals and strategies were implemented in ICT projects, women do not benefit equally with men. If women are not targeted as beneficiaries of the Internet, they will not be able to access the information they need to support their and their families' livelihoods and well-being; nor will they be able to interact meaningfully with their communities, civil society and the world. Unless efforts are made to meet women's information needs, they will not find information that is relevant and useful. Attention to gender issues is an absolute necessity in promoting and facilitating the equal access of women and girls, including those living in rural areas, to the Internet. The starting point of gender-related change is the acknowledgement of gender, with due attention to the particular ways it manifests itself in local contexts.

Actions at the project level need to involve local women in setting the agenda. Governments need to provide the enabling framework in the form of gender-aware policies and strategies, not only in ICT but also in other areas including education, health, labor and agriculture among others, as ICT is as transversal as is gender. There are many barriers to cross, but once crossed all of society will benefit from the full participation of all its members. The most hopeful sign on the horizon is the eagerness of the young of all nations to use the Internet, regardless of divisions based on education, class, income, residence, race, ethnicity, and gender.

# CHAPTER 12

## Language and Content

*Daniel Pimienta*

### Introduction

How important was, is and will be the *language factor* in the evolution of the Internet? What repercussions could have the Internet in the real life of languages? How are Internet contents and languages interrelated? Those are difficult questions to answer, partly because of the scarcity of solid data. This chapter addresses that issue.

The pioneers of the Internet are a large population, if one takes a wide definition of contributors and expert users from the 1980s and early 1990s. In parallel with the development of the Internet, they created a collection of terminology and expressions to capture the dimensions and originality of their creation. For example:

- The capacity obtained to expand smoothly from the local to the global level gave rise to the term "*glocal*", connoting something that existed at both levels.
- •*Anonymity* in cyberspace; some readers may remember the famous and funny 1993 New Yorker cartoon by Peter Steiner that stated, "*On the Internet, nobody knows you're a dog*"[1].
- Internet developers often state: "*The Internet has no frontier*".

One may wonder if those new concepts, which were created in English-speaking contexts, are still pertinent in a multilingual context. As for "*glocal*", the term is definitely not so relevant: for the large majority of indigenous language speakers who do not have English as a second language, it is not easy to relate their local environment and holistic culture to an English-speaking global space with a more regimented and analytical culture. As for the *anonymity* of the dog who was using the Internet, those days may be gone now, especially if the dog is socially networked. If so, many people are not only aware that it is a dog, but which breed it is and what it had for breakfast — unless, of course, it is not an English speaking dog. As for the term "*frontier"*, this may be the most interesting case of the three. In light of current situation, the concept of frontier may deserve to be deconstructed and reconstructed as a new expression: "*On the Internet, the only frontiers are languages*"[2] and there are hundreds of them[3] — many more than the number of countries on a world map. Only multilingual people can attempt to cross a few of those frontiers and, as tools are developing to tackle the linguistic challenge, the use of automatic translators is starting to offer some assistance, albeit it may be a blurry illusion, to those seeking to cross foreign territories.

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[1] http://en.wikipedia.org/wiki/On_the_Internet,_nobody_knows_you%27re_a_dog

[2] See for instance: http://googleresearch.blogspot.com/2011/07/languages-of-world-wide-web.html to sense how much the language territories tends to be impervious.

[3] The figure for the number of localized languages (languages which have a digital existence) is considered below 500 as of today.

The "*language territoriality*" of the Internet and how it relates to content has been often underestimated in the analysis because people naturally tend to think within their own linguistic boundaries. Yet it is important to discover and then analyze the *hidden dimension of inclusiveness* of the Internet in order to tackle the coming challenges of its latest stage of evolution, and especially spreading the benefits of the Internet and the Web to marginalized populations.

Language matters, perhaps more than ever before. In making the world smaller, the Internet increases the probability of encounters of people with different languages. What meaningful use would anyone make of their Internet access if their mother tongue was not recognized, or if there was no content in that language? Such issues were not obvious in the early stages of network development, when the majority of users were IT professionals, researchers, academics and international technology activists. These were highly educated people, for whom English was probably understood as wither a primary, second or third language. However, the Internet has spread widely since then, and linguistic issues have become paramount when the objective is to give access to everyone on the planet. Amongst the 7 billion human beings, less than 20%[4] are able to use English at all, and probably less than 15% can use it effectively. This statistic alone is a powerful indicator that the belief that English will be maintained as the *lingua franca* of the Internet may be shortsighted.

In the 21st century, the strategic advantage in the virtual world goes to *multilingualism*. Governments are gradually becoming aware of this and taking steps to encourage a shift to embrace other languages; for example, the British Council has warned young English citizens about the risk they take in the new economy of the European Union if they remain monolingual [Graddol-2006]. Therefore, the issue of language choice and diversity on the Internet is one of the keys to unlocking the doors to *digital inclusiveness* in a more direct and comprehensive manner. This is evident when the tight and complex link between *languages, the substrate of knowledge,* and *content*, key facets of the fabric of the network[5] is better understood.

[4] As usual in demo-linguistics, there is no accorded figure for the total population of the world in capacity to understand English as a second language. The population using English as a first language is estimated at less than 375 million (less than 6% of the world population). The figure for English as a second language holds huge variations, depending in particular of the definition of the threshold for the level of literacy, from 470 million to one billion (which makes the total English speakers in the world within the window 10% - 20%). [Graddol - 2006] offers the figure of 508 million for English speakers as second language (citing a 2005 reference from Ostler, N. 'Empires of the Word: a language history of the world. 'London, HarperCollins), but he estimated it could be as much as 1 billion. In 'The future of English', British Council, 2000, Graddol offered estimates (in millions) for the following 3 categories: English as first language (375), English as a second language (375) and English as a foreign language (750). The issue remains to determine the threshold for qualifying persons from the last category as efficient speakers.

[5] The other one being communication which is also sustained by languages.

## Current State of Play

What data can be collected at this stage concerning the range and proportional presence of languages on the Internet?

Before answering that question, it will be helpful to review some facts about languages and set the stage for assessing what is at stake. There are an estimate 30,000 languages that have existed in the world since human beings were capable of speech. From this figure, many languages have become extinct and in modern times, it is estimated that somewhere between 6,000 and 9,000 remain in active use. Bearing in mind the requirements for all languages to have a digital existence[6], consider the following facts concerning languages (Sources: [Lewis, 2009] and [Crystal, 2006]):

- 6 languages (English, Arabic, French, Spanish, Portuguese and Russian) are the official languages in 60% of the world countries.
- 1.3% of languages (85) are spoken by more than 10 million persons each and together represent 78% of world population
- 50% of all languages are spoken by less than 10,000 persons.
- 25% of all languages are spoken by less than 1,000 persons
- One language disappears every 2 months, on average.
- Less than 10% of languages have a written form[7].

The question about the presence of languages on the Internet may be addressed by crossing the ethnology data on languages[8] with the ITU data on Internet access[9]. It appears that there is a correlation between countries with high linguistic diversity and countries with low Internet penetration[10].

So what do we know exactly about the presence of languages on the Internet? The current situation is quite paradoxical and frustrating! For many years the subject was of only marginal interest and very few pioneers produced experimental indicators [Pimienta–2009-2]. Now the subject of linguistic diversity is gaining more attention, and, while some of the past efforts have lost capacity, there is a greater push to assess the deep changes that have occurred in the content universe. In seeking data on the number of Internet users per language, Globalstats[11] offered figures some years ago and was clear about the methodology that was used to collect them. Since 2007, Internetworldstats[12] has replaced this source and taken the lead; however the data is now limited to the top ten languages. The data for 2011 is contained in the following table:

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[6] Having a digital existence starts by the localization of a language, this concept refers to the encoding of its alphabet and it then implies a series of requirements from the existence of a set of software associated with this language (such as syntax correction or dictionaries) into the existence of meaningful content. See Diki Kidiri [2008].

[7] http://www15.gencat.cat/pres_casa_llengues/AppJava/frontend/sabiesque_detall.jsp?id=18&idioma=5

[8] http://www.ethnologue.com/web.asp

[9] http://www.itu.int/ITU-D/ict/statistics/

[10] Other two correlations which are striking matters for thought are between high biodiversity and high linguistic diversity and any one of the previous elements and poverty. In other words, the wealthiest parts of the planet are information-rich but linguistically poor.

[11] The source URL (http://global-reach.biz/globstats/index.php3) have disappeared but the "Wayback engine" of archive.org allows one to retrieve the last memorized snapshot from 2008, which shows data produced in 2004: http://web.archive.org/web/20041019013615/www.global-reach.biz/globstats/index.php3

[12] http://www.internetworldstats.com/

Table 1: Top Ten Languages Used in the Web (Number of Internet Users by Language) May 31, 2011

| TOP TEN LANGUAGES IN THE INTERNET | Internet Users by Language | Internet Penetration by Language | Growth in Internet (2000 - 2011) | Internet Users % of Total | World Population for this Language (2011 Estimate) |
|---|---|---|---|---|---|
| English | 565,004,126 | 43.4 % | 301.4 % | 26.8 % | 1,302,275,670 |
| Chinese | 509,965,013 | 37.2 % | 1,478.7 % | 24.2 % | 1,372,226,042 |
| Spanish | 164,968,742 | 39.0 % | 807.4 % | 7.8 % | 423,085,806 |
| Japanese | 99,182,000 | 78.4 % | 110.7 % | 4.7 % | 126,475,664 |
| Portuguese | 82,586,600 | 32.5 % | 990.1 % | 3.9 % | 253,947,594 |
| German | 75,422,674 | 79.5 % | 174.1 % | 3.6 % | 94,842,656 |
| Arabic | 65,365,400 | 18.8 % | 2,501.2 % | 3.3 % | 347,002,991 |
| French | 59,779,525 | 17.2 % | 398.2 % | 3.0 % | 347,932,305 |
| Russian | 59,700,000 | 42.8 % | 1,825.8 % | 3.0 % | 139,390,205 |
| Korean | 39,440,000 | 55.2 % | 107.1 % | 2.0 % | 71,393,343 |
| TOP 10 LANGUAGES | 1,615,957,333 | 36.4 % | 421.2 % | 82.2 % | 4,442,056,069 |
| Rest of the Languages | 350,557,483 | 14.6 % | 588.5 % | 17.8 % | 2,403,553,891 |
| WORLD TOTAL | 2,099,926,965 | 30.3 % | 481.7 % | 100.0 % | 6,930,055,154 |

*Source : http://www.internetworldstats.com/stats7.htm*

As for the structure of the content universe, in terms of languages, conflicting figures have been the norm in the period 1997-2007 [Pimienta-2009-2]. Some data sources show a stable (and exaggerated) presence of English (around 80% over the decade), other data sources, with more samples, show a constant decline, from 80% to 45%, in the same period. In recent years, the situation has become extremely complex mainly due to the structural and quantitative changes of the Web. While search engines were able to index[13] a significant part of the Web in the period 1996-2007 (around 80%), since 2007 the coverage has declined to probably below 10% and it is getting worse all the time. While many sources have attempted to quantify the size of the Web until about 2008 (see for instance [Pimienta – 2008]), since then there has been a dearth of such estimates, although quantitative data does exist in the forms of Internet users, registered domain names, hosts, and IP addresses.

Table 2: The Size of the Internet

| Internet element figure | 2008 | 2011 |
|---|---|---|
| Internet users (source: Internetworldstats) | 1.4 billion | 2.1 billion |
| Active Registered domains (source: http://news.netcraft.com/archives/web_server_survey.html ) | 70 million | 160 million |
| Registered domains (source:http://news.netcraft.com/archives/web_server_survey.html ) | 140 million | 463 million |
| Internet hosts (source: www.domaintools.com/internet-statistics/country-ip-counts.html) | 500 million | 3500 million |
| Web pages[14] | 140 billion [15] | ????? |
| Indexed web pages | 20-40 billion | Probably the same as 2008[16] |

[13] An indexed page is a web page which content has been analyzed, and information has been stored for further retrieval by search engines.

[14] If one considered the "invisible web" (dynamic pages mainly) it is supposed to be between 100 to 500 times larger following Bergman, M. The Deep Web: Surfacing Hidden Value - http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep;view=text;rgn=main;idno=3336451.0007.104, and then the figure would reach one trillion.

[15] In 2008 a new search engines was launched named CUIL (http://en.wikipedia.org/wiki/Cuil) which purports to have an index close to the size of the web, offering the figure of 120 billion web pages.

[16] http://www.worldwidewebsize.com/ gives a figure between 20-50 billion indexed web pages in 2011. Google itself is not providing public figures anymore (http://www.google.com/help/indexsize.html). http://dejanseo.com.au/measuring-size-of-googles-index/ gives a figure of 25 billion.

Beyond this confirmation of the very rapid growth of the Internet, this table suggests that the number of indexed Web pages had been reaching an asymptote by 2007 and thus the proportion of indexed pages has experienced a steady decline since then (from 80% to probably less than 10%).

Why are those facts concerning search engines so relevant to the subject of linguistic diversity on the Internet? They have a direct impact on the study of linguistic diversity because some of the methods for evaluating the presence of languages on the Web have relied on search engines, which were able to count word occurrences. They also have an indirect impact because the other research methods relied on "crawling the Web"[17] and applying an algorithm of language recognition to each page. If the powerful companies developing search engines have resigned from *crawling* the entire Internet universe, how can a research unit of some other organization invest in such an expensive task? Finally, indexing is also relevant to the subject, by a kind of negative dialectic; the absence of a web page in the search engines indexes is practically a guarantee of invisibility. Furthermore, with the decreased percentage of indexing, which is not equitably applied among languages, there is a data bias which has critical implications for languages that are not considered globally relevant[18]. In one short and strong sentence: *the Web has become practically infinite* and new methods are required to understand the nature of the Web, the structure of its content, particularly in terms of language. However, it is not only a question of size: the nature of the Web itself has changed dramatically, as the concept of web pages has evolved from static (which was the old norm) to dynamic[19] (which has become the new norm). Totally new approaches are required to explore its complex structure and develop meaningful and accurate indicators of linguistic diversity. The search for those tools and methodologies would not only provide a way to characterize the vast substance of the Web and better understand the universe of Internet content; it could also open new avenues for a new breed of search engine (Search 2.0) that could be capable of rendering the info-diversity of the content universe in a better fashion. This is all the more important as that unique content universe is threatened by many factors now, including spam, copies, and lack of adequate language coverage.

## Vignette

Under the lead of MAAYA, top-level Research Centers are joining efforts with UNESCO, ITU, OIF, Union Latine and Funredes to open the field to advanced research projects which would seek to systematize the creation of linguistic diversity indicators in the digital world. The consortium is currently in a definition stage to target European Union research funds (Seventh Framework Programme[20]) as a preferred option due to the size of the required investment and the research innovation implied. Many of the partners, especially the international and civil society organizations, will maintain the pressure until budgets are obtained, since public policies, as well as the digital economy, will benefit from the development and maintenance of such indicators in order to progress (see http://dilinet.org.) In that context, characterized by a lack of stable, reliable and sustained production of indicators for linguistic diversity, and until projects such as DILINET provide the required fig-

[17] "Crawling the Web" refers to the mechanism use for instance by Search Engines to create their indexed data bases to systematically read each web page of each web site to analyze their content. The size of the web is so great that some tricks are used to avoid reading each single page (for instance by limiting the depth of getting into the tree of linkages in the same site).

[18] Note that it would be useful to be able to measure the linguistic bias of Search Engines and also that this situation should open avenues for the creation of Search Engines dedicated to language or family of languages.

[19] A static page has the property to appear always identical when called in a Browser (a software such as Internet Explorer or Mozilla) by indicating the Unified Resource Locator (URL) in the field for addressing pages, (an expression such as http://www.w3.org/Addressing/URL/url-spec.txt., A dynamic page has its content evolving with time and context (as for example in a data base access).

[20] http://cordis.europa.eu/fp7/home_en.html

ures, the only option is to rely on the figures provided by the three main players: InternetWorldStats, for figures of users per language, the Language Observatory Project[21] and FUNREDES/Union Latina[22], for figures of web pages per languages.

During the earlier 1997-2007 period, the referenced studies [Pimienta, 2009-2] have shown that in terms of language dominance, English was not as paramount as stated; the percentage of Web pages in English steadily declined, from 80% in 1998 to 40% in 2007. This trend followed, with some degree of parallelism, the percentage of Internet users who spoke English (source InternetWorldStats); estimated to be above 60% in 1998, and dropping to 32% in 2008, the current figure being now 26.8% (December 2011)[23].

The data show a first stage (1998-2003) when the ratio between content and users had little variation depending on languages. This offered the basis for arguments towards forming public policies of giving access to users as a natural way of generating content in a linguistically proportional manner. In a second stage (2004-2008), this ratio between content and users declined, suggesting that the last wave of Internet users was more often consumers of content than producers of it. This can be explained by the fact that the first Internet users held a higher digital literacy level. At that point in time, newcomers were taken by the virtual hand into *netiquette*[24] and digital behavior. In the current era, there is a valid argument for policies focusing on developing digital literacy of new Internet users and encouraging them to be producers as well as consumers of what is available on the Web.

A very important message has been established by the first studies (from Funredes/Union Latina as well as from LOP) about the digital divide in the South. It showed that the gap of content was one order of magnitude higher than the gap of access for international languages and several orders of magnitude for local languages, as shown in the following figure:

- 4% of global Internet access comes from Africa (Source: Internetwordstats 2007[25])
- 0.6 % of web pages in French are based in Africa (Source: Funredes/Union Latine 2007)
- 0.6% of web pages in English are based in Africa (Source: Funredes/Union Latine 2007)
- The percentage of web pages in African local languages vary from 0.06% to 0.0006%, depending on the language (Source: LOP 2007)

The digital divide may then be much more an issue of content and language than of access. This point is a powerful argument in favor of digital inclusiveness policies that do not stop at access but, together with access, focus on local content as well as on education to nurture new content producers, a process which starts by encouraging digital literacy[26]. As for the second period mentioned above, there are diverse findings which show several possible trends, albeit in the absence of stable indicator production. For example, the recent evolution on the Web has shown the total number of Chinese Internet users crossing over the line of the total number of US users in July 2008.[27]

- After the revolutionary movement in North Africa and Middle East, the space of Arabic in Facebook is

[21] The Language Observatory Project : http://www.language-observatory.org/
[22] Funredes' Observatory of Languages and Cultures on the Internet: http://funredes.org/lc or Union Latine http://dtil.unilat.org/LI/2007/index_fr.htm
[23] With Chinese very close at 24.2%.
[24] Netiquette is a neologism which refers to etiquette behavior in the Net. More details in http://www.albion.com/netiquette/.
[25] This figure has hopefully jumped to 11.4% in 2011, but the odds are high that the content divide has not evolved much.
[26] What is at stake is the concept of "ownership" of technology which does not come for granted with the access. See [Pimienta, -2009-1] for more development of that concept.
[27] http://www.nytimes.com/2008/07/26/business/worldbusiness/26internet.html

growing rapidly and if the trend continues, it will overcome English by 2012[28] within those regions.

- Wikipedia is the Internet space with the higher linguistic diversity, supporting approximately 271 different languages in contributing articles.[29]
- The maximum figure of 271 for Wikipedia is to be compared with the figures of 70 languages supported by Mozilla, 67 by Facebook, 63 by Internet Explorer, 51 by Google Translate, 50 by Blogger, 19 by YouTube, 6 by Flickr and 4 by LinkedIn[30].
- A study produced by Union Latine in 2010[31] developed a perspective on the evolution of the proportion of languages in various Internet areas, collecting a large number of online demographic and statistical sources[32]. However, there was a lack of a unified methodology for covering the sources and the data varied in levels of reliability, so the results may only be seen as rough indications of potential trends.
- Most of the figures are based on country traffic data using http://webboar.com, not directly on language and content.
- The search engines figures marked 'content' come from Funredes in 2007 and were not published because they were not considered reliable enough; they are however reliable enough to be taken as an approximation of the percentage of web pages in a given language in the search engine's index (only Catalan, English, French, German, Italian, Portuguese and Romanian were computed).
- Sometimes Russian figures include other countries such as Ukraine and Belorussia.

These figures confirm the strong trend of the internationalization of the Internet and the relative decline of English, which had been perceived in the previous period. The successful operation of a few search engines dedicated to specific languages (Chinese or Russian) could be the start of a new trend in generic search engines that will not bias their index towards English.

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[28] http://www.slateafrique.com/17731/sur-facebook-arabe-depasse-anglais

[29] Additionally, Wikipedia maintained a wonderful statistical data compilation about languages: http://en.wikipedia.org/wiki/Wikipedia:Multilingual_statistics. Apparently, another sign of changing times, this page has not been updated since October 2008, for some parts, and December 2009, for the direct data on each language. However, Wikipedia is offering now a new and very interesting page for statistics (http://stats.wikimedia.org/) which does include some data on languages (http://stats.wikimedia.org/#fragment-12).

[30] All those figures are 2010 and refer to the interface (not the content).

[31] This study has not been published yet and some extracts are presented hereafter with permission of Daniel Prado.

[32] Hereafter a selection of some relevant sources used for that study:
http://socialmediastatistics.wikidot.com/,
http://www.w3schools.com/browsers/browsers_firefox.asp
http://www.readwriteweb.com/archives/international_blogosphere.php
http://technorati.com/state-of-the-blogosphere/
http://www.mathaba.net/news/?x=408348
http://blogalize.typepad.com/micro/statistics/
http://www.sysomos.com/insidetwitter/
http://en.wordpress.com/stats/
http://www.p2pon.com/2010/02/19/10-million-downloads-of-pirated-games-in-december-alone-says-esa/
http://journal.webscience.org/209/2/websci09_submission_115.pdf
http://www.email-marketing-reports.com/metrics/email-statistics.htm
http://www.sifry.com/alerts/archives/000433.html and http://www.sifry.com/alerts/archives/000436.html
http://mashable.com/2010/02/24/half-messages-twitter-english/
http://www.vincegolangco.com/2010/very-interesting-social-media-statistics-facebook-twitter-flickr-linkedin-etc/

Table 3: Languages used in Select Internet Spaces

| INTERNET SPACE | ENGLISH % | OTHER NOTABLE LANGUAGES |
|---|---|---|
| Live Journal (Blog) | 55% | Spanish 6% - Russian 18% |
| WordPress (Blog) | 66% | Spanish 9% - Portuguese 7% |
| Facebook (social network) | 35%[33] | Spanish 10% - French 10% |
| Tweeter (social network) | 50%[34] | Japanese 14% - Spanish 4% - Malaysian 6% |
| Technorati (blog) | 25% | Japanese 25% - Chinese 31% |
| LinkedIn (social network) | 50% | Hindu 15% - Spanish 6% - |
| Second Life (social network) | 39% | French 17% - German 10% – Spanish 7% - Dutch 7% |
| Yandex (Search Engine) – Traffic | 1% | Russian 95% |
| Baidu (Search Engine) – Traffic | 1% | Chinese 96% |
| Yahoo (Search Engine) – Traffic | 36% | Hindu 9% - Spanish 7% - Arabic 5% |
| Bing (Search Engine) – Traffic | 40% | Spanish 10% - Chinese 7% - French 6% - Hindu 5% |
| Google (Search Engine) – Traffic | 38% | Hindu 9% - Spanish 6% - Arabic 5% - Chinese 4% |
| Google (Search Engine) – Content | 39% | German 7% - Spanish 6% -French 6% - Italian 4%- Portuguese 3% |
| MSN (Search Engine) – Traffic | 25% | Spanish 18% - Portuguese 7% - Japanese 6% - French 6% - Arabic 6% |
| MSN (Search Engine) – Content | 50% | German 6% - French 5% - Spanish 5% - Italian 3% |
| Exalead (Search Engine) –Traffic | 13% | Hindu 19% - French 17 % - German 11% - Spanish 7% - Chinese 6% |
| Exalead (Search Engine) – Content | 48% | French 7 % - German 4% - Spanish 4% - Italian 3% |
| MegaUpload (P2P) | 13% | Spanish 22% - Portuguese 11% - French 11% - Japanese 8% - Italian 5% |
| RapidShare (P2P) | 11% | Spanish 14% - Arabic14% - Hindu 8% |
| DepositFiles (P2P) | 10% | Russian 26% - Spanish 16% - Arabic 8% - Portuguese 6% |
| FileFactory (P2P) | 11% | Arabic 16% - Spanish 11% - Portuguese 8% - Hindu 7% - Japanese 7% |
| HotFile (P2P) | 13% | Arabic 11% - Japanese 11% - Spanish 8% - Hindu 7% |
| Skype | 9% | Portuguese 10% - Chinese 8% - French 5% - German 5% |
| Firefox Download | 23% | German 11% - Spanish 8% - Hindu 7% - French 7 % |
| Wikipedia (articles) | 23% | German 7% - French 6% - Polish 5% - Japanese 5% |
| YouTube | 27% | Spanish 12% – French 6% – Hindu 5% - German 5% |

To conclude, the following table summarizes a historical perspective of the evolution of networks as related to language diversity; it is proposed as a way to gain a comprehensive view, with the obvious limitations prone to arbitrary classifications and the risks inherent to providing a prospective vision.

[33] A more recent reference claims English at 52% and offers the 10 most used languages in Facebook, with, as a surprise, Turkish and Indonesian after Spanish and French (see http://www.insidefacebook.com/2010/05/24/facebooks-top-ten-languages-and-who-is-using-them/).

[34] A more recent reference claims English below 50% and presents in sequence Japanese, Portuguese, Malaysian and Spanish (see http://semiocast.com/static/downloads/Semiocast_Half_of_messages_on_Twitter_are_not_in_English_20100224_fr.pdf)

[35] Balanced in relative proportion of their speakers with variation depending of languages; French, German and Italian being represented above the proportion, as opposed to Portuguese and Spanish.

Table 4: Internet Eras and Select Data Points

| INTERNET ERA | TIME FRAME | USERS | CHARACTERISTICS | LANGUAGE WISE |
|---|---|---|---|---|
| PREHISTORIC | 1970 - 1990 | Up to 2M | - BITNET, UUCP and other networks.<br>- Users from IT companies, Researchers, Academics & Activists<br>- From dumb terminal access to mainframes to the birth of PC | - Global community of professionals with a large dominance of English.<br>- Not extended ASCII means no diacritics as in English |
| BIRTH OF THE WEB | 1990 - 1995 | Up to 15M | - Professionals users figure cross Researchers & Academics<br>- PC spread | - MIME<br>- Birth of Unicode<br>- English above 80% |
| WEB 1.0 | 1995 - 2005 | Up to 1B | - Internet become mass media<br>- Powerful Search Engines<br>- Multiplication of micro companies | - English decline to 50%<br>- Rise of occidental languages getting balanced[35] share with English |
| WEB 2.0 | 2005 – 2010 | Up to 2B | - Growing monopolies<br>- Reduction of Search Engines indexes size<br>- Rise of video<br>- Rise of mobile Internet | - English around 33%<br>- Rise of Asian languages<br>- Start of Arabic<br>- Growth of localization |
| NEXT ERA | 2010 - 2015 | Up to 3B | - Rise of Search Engines for specific languages<br>- Rise of digital library for specific languages<br>- Rise of non textual contents<br>- Rise of vocal interfaces<br>- Internet of objects | - IDN[36] generalized<br>- English asymptotic to 25%<br>- Rise of Arabic<br>- Rise of indigenous languages with large base of speakers[37]<br>- Rise of the use of translation by software<br>- Localization of hundreds of languages<br>- Balanced linguistic tools<br>- Localization of thousands of languages<br>- Public tools to support Language learning & multilingualism |
| FUTURE INTERNET | 2015 - 2030 | 75% of World pop. connected | - Screen everywhere<br>- keyboard fading to voice interfaces<br>- Pervasive translation software<br>- Search Engines new generation<br>- Digital libraries new generation<br>- Search Engines new generation<br>- Digital libraries new generation | - Rise of linguistic policies dedicated to the Internet<br>- Balanced contents language-wise<br>- Balanced linguistic tools<br>- Localization of thousands of languages<br>- Public tools to support Language learning & multilingualism |

## Impediments to Progress

Insuring the full presence of a language in the digital world is a complex process that requires a holistic perspective from encoding, keyboard production, linguistic software development (word processor and syntax checker, for example) to digital literacy and content production [Diki Kidiri, 2008]. Beyond those elements, the existence of digital libraries for literature in the language as well as online resources for learning and processing the language (such as dictionaries, grammar guidelines, glossaries) are also of great importance.

[36] An internationalized domain name (IDN) is an Internet domain name using a script different from the Latin without diacritics (the one used by English), thus allowing to write URL's in, for instance, Arabic, Chinese or French with diacritics (examples: çaetlà.fr or baño.es).

[37] Such as Quechua, Aymara or Guarani in Latin America; Creole in the Caribbean; Swahili, Berber or Hausa in Africa.

In some cases, linguistic leaders should join efforts and reach consensus on standards concerning their native languages, but this is not an easy task. Some negotiations with UNICODE may be required to define the coding schemes that cover all needs. Many languages have no written form and proponents will need to define an alphabet as a prerequisite to pushing them forward onto the Web. The option to use voice recording instead of text does exist and could be a fast track to online presence, but it will not allow the same level of integration as written forms and should only be the preferred mode for disappeared languages, endangered languages, or languages having a very small number of speakers.

The main impediments to progress are in the very systemic nature of the solution for one language and the huge number of languages that are involved[38]. However, if, for a given language, motivated champions take charge and the interested group has the political will to overcome the challenges, the systemic phenomenon could turn into a virtuous circle and progress could be achieved relatively quickly.

Not many languages have been the object of public policies to insure their revival in the real world (Catalan and Hebrew are two prominent success stories). However the goal in this context is to develop supportive public policies for languages *specific to the digital world*; this is a novel field of activity with little documented experience to date[39]. Most languages have some intersection with digital public policies; what is at stake is not simply the presence of new languages in the digital world, but also the promotion of existing languages on the Internet since there are significant economic, social and cultural implications in having a strong presence in cyberspace.

Some experts advocate for the emergence of linguistic policies focusing the Internet and offer an algorithm for weighting languages which encompasses some indicators related to the Internet [Calvet, 2009]. Such policies could serve as a basis towards designing and measuring policies for languages on the Internet (see http://www.portalingua.info/fr/poids-des-langues/, in French). A related task would entail sensitizing language stakeholders to the importance of such designs and measurements; time is of the essence for languages that are entering a phase of being threatened, endangered, or extinct. (See *Table: Categorization of languages for cyberspace policies requirements* in [Pimienta, 2009-2]).

## Current Work to Ameliorate Impediments

The key to reversing this complex downward spiral of some languages lies in raising the awareness of policy, institutional and foundation players and the emergence of a group of champions in each linguistic community capable to move the progress forward.

After many years of indifference, linguistic diversity on the Internet is gaining more attention from many stakeholders and its priority as an important matter in Internet governance is on the rise. The fact that English is losing its dominant position is an important factor in making room for others.[40] The strong push of internationalized domain names (IDNs) in recent years has been a symptom of the need for internationalization of the Internet and has served as a powerful trigger to push the comprehensive effort that is required. However, IDNs are just the tip of the iceberg of the requirements for a full representation of languages on the Net; once this step is taken, more requirements will appear and the development loop will have been triggered.

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[38] It is estimated that among the 6,000 existing languages only some 500 have a digital existence.

[39] For instance there was no evidence at the beginning that the creation of a linguistic domain dedicated to Catalan language (in 2006, the first and unique one of this kind) have boosted the content creation in that language. It would be very interesting to check if it is the case few years after as this has created a push for other similar linguistic or cultural domains (see http://en.wikipedia.org/wiki/Proposed_top-level_domain).

[40] The logic of numbers explain the current situation as the saturation of linguistic niche (English speaker penetration in terms of Internet users has gone close to 70%) opens the growth of niches which has at this time a low penetration (such as Portuguese or Chinese).

The UNICODE consortium[41], which provides standardization for characters encoding[42] in collaboration with the International Organization for Standardization[43], is playing a fundamental role in the boosting of linguistic diversity from the bottom up, allowing the crucial step of encoding new alphabets in the most efficient manner. Version 1 of UNICODE in 1991 coded a little more than 7,000 characters from the following 24 scripts : Arabic, Armenian, Bengali, Bopomofo, Cyrillic, Devanagari, Georgian, Greek And Coptic, Gujarati, Gurmukhi, Hangul, Hebrew, Hiragana, Kannada, Katakana, Lao, Latin, Malayalam, Oriya, Tamil, Telugu, Thai, and Tibetan. Version 6 of UNICODE has the capacity to code more than 100,000 characters from close to 100 scripts[44] this represents a growth of 400% in 10 years for the scripts and of 1,500% for the characters.

The time of dominance of 7-bit ASCII,[45] that originated with pre-computer teletype machines using 8-channel paper tape, is long past. This code obliged many users of the Latin alphabet to deploy their languages digitally without diacritical marks and gave a strategic advantage to English, the language with capacity to be written in completeness even with such limited encoding scheme.

## Important Gaps in Knowledge

After a language is localized, the major issue and the most difficult one to tackle remains the provision of content. What use is it to give access if there is no content in the language of the users? By granting such local-content-free access, are we merely increasing the danger of acculturation by the Internet?

In the current state of development, ICTs are not culturally neutral; they logically tend to reflect the preferences of the Western culture of the early designers in terms of communication and information. This long-standing internal bias may sometimes translate into failures in well-intentioned efforts to overcome poverty and marginalization by means of ICTs. There may be a danger of *computer-assisted colonization* as the product of naïve plans to "connect the world," which do not acknowledge the cultural dimension [Ess, 2006]. Such risks are manageable by adopting a conscious attitude towards cultural issues. If we agree that digital education is an essential component of the transition to an inclusive information society, it is also clear that such education should fulfill the fundamental ethical criterion of respect for cultural and linguistic diversity, and therefore to avoid the ethnocentrism and colonization that may be implicit in the underlying technologies.

Automatic translation is often considered as a backup solution to obtain content in some information-poor languages: caution must be applied in these cases, as culture is not translated in the process and also the ownership of the obtained translated content is not granted. In other words, while translation by software represents a wonderful avenue for the growing needs for mutual understanding across linguistic communities, it is simplistic, naïve and somewhat dangerous to believe that it will alleviate the need for content creation in each language with a presence on the Net.

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[41] http://unicode.org/

[42] "The Unicode Standard is a character coding system designed to support the worldwide interchange, processing, and display of the written texts of the diverse languages and technical disciplines of the modern world. In addition, it supports classical and historical texts of many written languages." (Reproduced from UNICODE site).

[43] http://iso.org

[44] Scripts are obviously related to language writing and some family languages may share the same script (totally or partially, like for instance the Latin alphabet), but some scripts are also required for notations not directly related to languages (as for example music symbols or emoticons).

[45] UNICODE generally uses a 16 variable-width encoding (UTF-16) and the need for extended characters sets such as Chinese, Japanese and Korean is solved by a 32-bit, fixed-width encoding (UTF-32).

## Future Prospects and Promising Areas of Future Work

In its historical evolution, the Internet and the World Wide Web are entering a new era when the issues of languages and cultures are becoming paramount. This creates a completely new and largely open field of research and development opportunities with an extensive coverage of disciplines and a comprehensive reach of Internet matters, from standards to traffic analysis, from interfaces to content, and from applications to impacts. If the frontiers of the Internet are languages, then the building of an Internet without frontiers starts with major challenges that can resurrect the sense of the pioneer days of the Internet and foster the collaboration without which tangible progress is difficult to achieve.

## Organizational Actors: Their Roles and Responsibilities

A growing number of actors are taking steps in the field of linguistic diversity in cyberspace, from international to civil society organizations and grassroots, including IT companies dealing with the localization of interfaces and the development of translation software.

Among the UN agencies, UNESCO is specifically dealing with the subjects at the intersection of languages and cultures on one hand, and cyberspace on the other hand. UNESCO, which has organized many experts meetings on the subject and funded related research and publications, is maintaining a permanent watch around those themes[46]. Although the 2006 Convention on the Protection and Promotion of the Diversity of Cultural Expressions[47] had few mentions of Information and Communication Technologies[48,] its stress on the importance of cultural and linguistic diversity makes it a general supporting framework for cultural and linguistic diversity. UNESCO has an especially deep interest in endangered languages and has built an appealing Atlas[49]. One of the UNESCO's programs, IFAP[50,] has organized two expert meetings on the subject of Linguistic and Cultural Diversity in Cyberspace, in 2008 and 2011[51] and maintains an Information Society Observatory with documents related to that subject[52]. Finally UNESCO is the UN organization that has had the closest collaboration with ITU[53] for the process of the World Summit of the Information Society (WSIS)[54], being the facilitator of WSIS action line C8[55] (Cultural Diversity and Identity, Linguistic Diversity and Local Content).

[46] See, as a starting point:
http://www.unesco.org/new/en/culture/themes/cultural-diversity/languages-and-multilingualism/
[47] http://www.unesco.org/new/en/culture/themes/cultural-diversity/2005-convention/the-convention/convention-text/
[48] Page 3 : "Noting that while the processes of globalization, which have been facilitated by the rapid development of information and communication technologies, afford unprecedented conditions for enhanced interaction between cultures, they also represent a challenge for cultural diversity, namely in view of risks of imbalances between rich and poor countries." and page 9 : (d) promote the use of new technologies, encourage partnerships to enhance information sharing and cultural understanding, and foster the diversity of cultural expressions"
[49] http://www.unesco.org/new/en/culture/themes/cultural-diversity/languages-and-multilingualism/endangered-languages/atlas-of-languages-in-danger/
[50] Information For All Program
[51] See http://www.ifapcom.ru/en/news/1230
[52] http://ifap-is-observatory.ittk.hu/
[53] International Telecommunication Union – http://itu.int
[54] http://www.unesco.org/new/en/communication-and-information/flagship-project-activities/unesco-and-wsis/homepage/
[55] http://www.itu.int/wsis/c8/index.html

ITU is the second UN agency playing a notable role on the theme of linguistic diversity on the Internet, indirectly through responsibility for the WSIS process[56], and through its inputs to ICANN[57] in the IDN process. Within the WSIS process, linguistic diversity has progressively gained importance and has become now one of the permanent themes addressed by the Internet Governance Forum (IGF[58]). ITU is also the leading actor in the Partnership on Measuring ICT for Development [Partnership, 2011], an international, multi-stakeholder initiative to improve the availability and quality of ICT data and indicators, particularly in developing countries. Among the WSIS targets to be monitored by indicators, Target 9 deals with encouraging the development of content and has put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet [ITU, 2010].

MAAYA (the World Network for Linguistic Diversity), a civil society organization, is a network of actors interested in linguistic diversity. Although its mission does not focus only on cyberspace, a large part of MAAYA's activities are related to the digital world. MAAYA is a by-product of the WSIS process and was launched in 2002 by the African Academy of Languages[59]. MAAYA organized two International Symposium on Multilingualism and Cyberspace, one, in 2009, in Barcelona[60], and another one, in 2011, in Brasilia[61]. MAAYA, which is about to publish a reference multi-author book about the stakes and challenges of multilingualism in cyberspace, has taken the initiative of the DILINET project to solve the bottleneck of linguistic diversity indicators in cyberspace. MAAYA's membership gathered some 25 actors of that field, including international organizations such as UNESCO, ITU, OIF[62] and UNION LATINE[63.] MAAYA is dedicating a great deal of energy towards the organization of a World Summit on Linguistic Diversity, with a target for 2015.

IDRC[64]supports two regional programs dedicated to localization, one in Africa (http://www.africanlocalisation.net/) and a second one in Asia (http://www.panl10n.net/). Both involve a large network of field organizations.

W3C has an active working group whose mission is to enable universal access to the World Wide Web by proposing and coordinating the adoption of techniques, conventions, technologies, and designs that enable and enhance the use of W3C technology and the Web worldwide, with and between the various different languages, scripts, regions, and cultures.

ISOC[65,] in coherence with its slogan "*Internet is for everyone*" has shown a growing interest in the theme of linguistic diversity in the Internet[66].

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[56] http://itu.int/wsis

[57] The Internet Corporation for Assigned Names and Numbers (http://www.icann.org/)

[58] IGF (http://www.intgovforum.org) is a forum for multi-stakeholder policy dialogue which was created by WSIS to give continuity to the process. It is a permanent space for dialogue and a yearly meeting, where linguistic diversity is one of the treated themes, and a dynamic coalition is dedicated to the follow-on: http://www.intgovforum.org/cms/dynamic-coalitions/73-linguistic-diversity

[59] http://wwww.acalan.org

[60] http://www.maaya.org/spip.php?article105

[61] http://www.let.unb.br/simc/

[62] Organisation Internationale de la Francophonie (www.francophonie.org), an inter-governmental organization, is a very active actor of linguistic diversity and manages successful program for the creation of content in French or the large set of associated partner languages (see http://www.inforoutes.francophonie.org).

[63] Union Latine, an inter-governmental organization, has a department dedicated to language which is active in the subject (http://dtil.unilat.org) and maintains an observatory of languages in the world of knowledge (http://www.portalingua.info).

[64] International Development Research Center (http://idrc.ca), an arm of Canadian cooperation.

[65] Internet Society (http://isoc.org).

[66] See a briefing paper on "Multilingualism and the Internet of 2008: http://www.isoc.org/pubpolpillar/docs/multilingualism-20090514.pdf.

The issue of languages has also reached the business arena and there is growing interest from application providers to contribute to the cause, with a growing number of languages supported. Although it will probably take a long time to achieve an acceptable critical mass of such applications, this community is making a start.

There are a growing number of initiatives which are being taken on at a grassroots level. This is a sign that the subject is reaching maturity and that important changes are likely to occur in the future in a subject that civil society has not embraced with strength in the past. The time lag may be due in part to the fact that the skills involved in ICT4D were sufficiently technical, with a natural tendency to give priority to physical access, with less awareness and attention to cultural aspects.

Here are some additional initiatives:

http://www.enmiidioma.org/ : In Colombia, for Misak and Nasa indigenous languages.

http://www.enlacequiche.org/ : Enlace Quiche in Guatemala for the Mayan language.

http://borel.slu.edu/crubadan/ : Corpus building for minority languages.

http://indigenoustweets.com/ : Preserving Indigenous languages via Twitter.[67]

## Recommendations

Maintaining the same linguistic diversity in the virtual world that exists in the real world, contributing to the preservation of endangered languages, and keeping the memory of languages that have disappeared alive are complex and difficult objectives. However, given that the span of the Internet will eventually be comparable to the span of the real world, it is perfectly logical to try.

As in many complex issues, political will is a critical factor for success. The subject is still not well understood by civil society and advocacy and sensitization actions are required. The Internet actors have a particular responsibility in that process: the duty of coherence. The initial reduction of diversity that marked the first stage of network growth and development was the reflection of a tendency in the real world to rely on a monolingual path as the de facto quasi-technical solution for global information and communication. The shortest path to obtain a drastic change of attitude towards this complex subject would be to organize a World Summit on Linguistic Diversity that could conclude with a convention for linguistic diversity, complementary to the UNESCO 2006 Convention on the Protection and Promotion of the Diversity of Cultural Expressions. Such an approach could reveal that the Internet, rather to being a problem confronting linguistic diversity, could quite easily become a solution, given the appropriate will and resources.

It is impossible to develop efficient public policies without creating and maintaining a set of indicators that serve as qualitative and quantitative bases for evaluating the situation and its evolution; thus one of the top priorities is to build the capacity to produce indicators on the presence of languages in cyberspace.

Above all, it is important to nourish a wide range of bottom up initiatives and give them the opportunity to network among themselves so that groups with similar issues can be aware of innovative solutions to language diversity problems and benefit from them and reuse them. In this way organizational and individual energy can be directed in as highly productive and collaborative a manner as possible.

[67] See http://www.fastcompany.com/1747283/indigenous-tweet-preserving-indigenous-languages-via-twitter for more explanations.

# CHAPTER 13

## Culture

*Nnenna Nwakanma*

### Context

When we think of culture, we cannot help but reflect on ourselves. We seek to know our individual and common identity, our culture and its elements, as well as the cultures of others. In this chapter, we will look at the broad and narrow definitions of culture. We shall consider key cultural elements that will guide in our reflection, especially as they concern technology in general and the Internet in particular. We shall explore the arrival of the Internet and the cultural welcome that was reserved for it, as well as the very first reactions, fears and engagements. We shall look at some opportunistic uses of the Internet across developing countries and also the more general use, while paying special attention to the challenges and difficulties in its adoption. We shall explore the social media networks, digital culture as well as the extent to which the Internet has established a culture of its own, and where both digital and traditional cultures are beginning to fuse.

We will see what the developing world has to offer to the development of the Internet and finally, we will weigh the challenges and issues in making the Web more effective for supporting economic and social development from a cultural perspective. Our focus will be on maximizing the use of the Web for development in emerging economies to assist the poor and underserved.

### Elements of Cultural Expression

What do we mean by culture? The following descriptions seem appropriate for the purposes of a study focusing on the Internet community:[1] (1) an integrated pattern of human knowledge, belief, and behavior that depends on the capacity for symbolic thought and social learning; and (2) the set of shared attitudes, values, goals, and practices that characterize an institution, organization or group.

These elements suggest a focus on the shared patterns of attitudes, beliefs, behaviors, and practices, which are socially learned and characterize an individual, a group, or a community. In a broader look, we may extend our philosophical understanding of culture to embrace our education, the environment of that education, the knowledge acquired in the course of the education, as well as the value gained from it. In terms of human values, we may include our arts, sciences, civilization, conventions, customs, ethnology, grounding, lifestyle, innate behavior, knowledge and lore.

Some cultural scholars have gone further to include improvements, enlightenment, good taste, manners, refinement, savoir-faire, proficiency, skill, tact and perception in their view of culture. Regardless of whether we may prefer the larger philosophical sweep or the shallow framework, our look at culture will include the basics of our way of life as human beings.

[1] Other definitions of culture may also be found on Wikipedia: http://en.wikipedia.org/wiki/Culture

There are a number of common prominent elements of cultural expression.

**Language -** Languages are the fundamental means of human communication. They are the vehicles of cultural education, the upholders of speech and the guardians of tradition. While many languages belong to ancient language trees that have evolved over time, the developing countries of the world have more variety in languages spoken currently than the developed countries do[2]. According to the study on *"Upscaling Pro-Poor ICT Policies and Practices"* (2005), Asia alone has 2,197 spoken languages. Further in the issue of scripts and alphabets; "...while in Africa most scripts are based on the Latin alphabet or Arabic script (with the exception of the Horn of Africa), the situation is more complex in Asia, where Arabic, Indian, Chinese, Japanese as well as other scripts exist. These not only have technical implications for the generation of computer-based content, but they also have effects on the way information is classified."

**The Market Place -** The market place is the meeting space, the community place, the lounge, the agora, the town hall, under the baobab/banyan tree, the common grazing ground, or the park. It is a central place where the community comes together to share ideas, trade, learn, teach, express opinions, settle disputes, make merry, mourn together, and plan for the future.

**Travel** - Cultures are linked together by members of groups and communities crossing over to other groups and communities, learning from them and bringing back those lessons to the original group. Movement, travel and intercultural exchanges are all ways to enrich culture. The Igbo people, in the eastern part of Nigeria have a traditional saying that "he who has traveled is wiser than the gray-haired who has not been anywhere". Many developing countries still have communities whose cultural identities are linked to their continuous travel from place to place. Depending on where they are, such itinerant peoples may be called Nomads, Gypsies, Hippies, Pygmies, Travelers or Roma.

**Speech** - The term "speech" includes both verbal and non-verbal communication and encompasses the flow of information. It embraces self-expression, opinions, ideas, agreements and disagreements. The patterns may differ, the content may be diverse, and the manners as complex as the communities and groups who own them, but speech is fundamental to human culture in the same way that language, market place and travel are.

**Family** - The family is the first cultural learning and teaching space for all newborn babies; it is the first unit in a gradually expanding social and cultural network. Families may be related by blood ties, experiences, education, expertise, shared physical spaces and activities.

These are the five primary social elements to culture that will be considered in the framework of this chapter; however, there are other nuanced elements that also play a critical role in the elaboration of culture: hospitality, food, music, clothing, art and love; these facets of cultural life constitute a universal pattern for self-expression and the mediation of social relations in human societies.

[2] Gerster, G and Zimmerman, S., 2005. Up-Scaling Pro-Poor ICT Policies and Practices. Berne, Switzerland. http://www.deza.admin.ch/ressources/resource_en_24707.pdf

## The Cultural Advent of the Internet

The introduction to this publication notes that two major currents of change have swept over the world in the last half of the 20th century; the liberation and independence of colonies, and the evolution of information processing to the point where it is not only an essential factor in daily life for billions of people today, but it is also a determining factor in social and economic development. The second change is where the Internet comes in. In fact, the Internet is a major part of the change. It arrives and meets us in our diverse cultures. Questions are raised and answers are sought. What is this new technology and what kind of effect will it have on us?

In 1995, a series of studies on Internet and society began; the findings were presented by Wellman and Haythornthwaite (2002)[3]. In one of their key findings, they reported that, "most Internet users are more likely to be male, younger, better educated, more affluent and urban." The study noted the pessimistic view held in policy circles concerning the new technology, with some observers stating that "cyberspace cannot be a source of real community or it detracts from meaningful, real-world communities. They feared a possible reduction in the objectivity of traditional media if these media were to lose their status as a result of the growth of the Internet usage. There was fear that lack of access to Internet resources by various groups in the society would translate into a narrowing of the basis of political participation and the legitimacy of government. Some argued that the Internet would destroy the community groups and voluntary associations that are an integral part of democratic society, while others feared the Internet would absorb and dissipate the energy of the citizenry away from traditional political processes.

In "The Impact of Internet on our Moral Lives", Charles Ess takes a critical view of the Internet[4] :
"…we must then ask whether the lovely vision of an electronic global village in which Computer-Mediated Communication (CMC) would foster greater global understanding and thereby greater peace are simply the newest ideological veneer of Western colonialism."
In fact, in the 1980s and 1990s, as CMC technologies were deployed among an ever-wide range of people and traditions, these technologies evoked a range of diverse responses, including outright rejection and radical modification in order to preserve local cultural identities and practices. These responses make clear that, indeed, the optimistic vision of "wiring the world" with Western designed CMC technologies runs the risk of serving as the ideological justification of yet another form of cultural imperialism, a "computer-mediated colonization" that serves the power and interest of the West. Paradoxically, the icon of an electronic global village, precisely in its pretense to global validity, represents the danger of imposing specifically Western values and practices on multiple peoples whose deepest cultural values and communicative preferences are often quite different from those embedded in and fostered by Western CMC technologies.

In his work, *Virtually Embodied: The Reality of Fantasy in a Multi-User Dungeon* (1997), Mizuko Ito[5] highlights the enthusiastic "geek" perspective on electronic communications by suggesting that the "very success of interfaces that couple ever more intimately with their users tend to obfuscate the technological apparatuses that undergird the net. Much as language becomes transparent with mastery, Net travel and communication become increasingly effortless as users become savvier, relying automatically on a whole new series of semiotic technologies."

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[3] Wellman B, and Haythornthwaite C. A., "The Internet in Everyday Life", in the Blackwell Cultural Economy Reader. 2002, Wiley-Blackwell. Accessed through Google Books.
[4] Hess C., "Moral Imperatives for Life in an Intercultural Global Village", in The Impact of the Internet on Our Moral Lives. 2005, State of New York Press. Accessed through Google Books.
[5] Ito M. "Virtually Embodied: the Reality of Fantasy in Multi-User Dungeons", in Internet Culture. 1997, Routledge. Accessed through Google Books.

Mizuko completed an in-depth study of MUDs – Multi-User Dungeons, text-based virtual worlds in which the Internet users can create characters in a shared, interactive space. His interest is born from a keen desire to confront the tendency to view the virtual as a radically disjunctive and purely imaginary space that lacks consequentiality, location or materiality. He explains,

> "Your character has certain attributes and assets that improve as you accumulate more treasures or kill monsters and other players, and solve quests on the MUD. Gaining experience points, loots and levels, as well as social recognizability and connections, is a time-consuming process, so commitment to a particular character and MUD is solidified as one's character develops. While the first two or three levels might be gained in the first few days of playing, achieving the higher ranks of levels fifteen and above, out of a usual twenty or thirty levels can take months of very active engagement".

He was writing in the mid-1990s when these MUDs were the precursors of the online games of today. One might ask, "How can someone spend endless hours wrapped in the strands of a digital Web?" The answer brings us back to culture and identity:

"Higher-level players construct elaborate residences, costumes and social cliques. As in any community, in other words, a sense of belonging, identity, and social status requires substantial commitment on the part of its members. Top players in the MUD hierarchy are wizards, who have gained the highest levels and accomplished all the quests, and are responsible for actually building the environment and administering. Highest-level wizards are often called Gods and as the name implies, have near absolute power to implement decisions on their MUDs."

In The Cybercultures Reader (2000), Michael Benedikt[6] also conducted an exploration of cyberspace. Here is what he reported:

"Like Shangri-La, like mathematics, like every story ever told or sung, a mental geography of sorts has existed in the living mind of every culture, a collective memory of hallucination, an agreed-upon territory of mythical figures, symbols, rules and truth owned and traversable by all who learned its ways and yet free of the bounds of physical space and time. It is no surprise that young males and their cultural bent – indeed mission – to master new technology, are today's computer hackers and so populate the online communities and newsgroups. Indeed just as 'cyberspace" was announced in the pages of a science fiction novel, so the young programmers of online MUDs and their slightly older cousins hacking networked video games after midnight in the laboratories of MIT's Media Lab, NASA, computer science departments and a hundred tiny software companies are, in a very real sense, by their activity, creating cyberspace. In this context, cyberspace can be seen an extension of our age-old capacity and need to dwell in fiction, to dwell empowered or enlightened on other mythic planes, if only periodically, as well as this earthly one." While acknowledging the importance of the mythic planes, Benedikt concludes poetically that "Cyberspace does not exist".

The fears continued, so also did the quest for new forms of communication and new identities in the cyberworld. The pioneers referred to by Benedikt as the "slightly older cousins" and their likes pushed further into networking and connecting computers. By the time the 1990s came to end, the "Internet," as a single term, included the CMC, cyberspace and the entire digital revolution. Not only gaining ground in the developed world, adoption of the new technology came quickly in developing countries as well. This adoption was fueled by innovations in the hardware world, which made ownership of cheaper personal computers possible. Once it became possible to purchase a computer, it became much easier to "go online" and explore cyberspace.

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[6] Bendikt M. "Cyberspace: First Steps", in The Cybercultures Reader. 2000, Routledge. Accessed through Google Books.

> "A computer is like a person. If you don't take time to make friends with it, it will never be friendly with you. It will behave wildly. You have to take time to know it; show some patience for the new technology. It's not like a typewriter where you can just bang in a command. There is so much more to know about a computer. But when you are familiar with it, and with the Internet, your whole world opens up. The Net is like a free zone for women. A place where you can have control, say what you want."
>
> - Rosemary Orlale-Okello, Kenya[7]

However, not everyone was as brave in their approach to adopting the new technology. In the year 2000, my late father had gone to one of the earliest community access center of Internet in Nigeria to check on his Yahoo Mail. On finding the center closed, he came back to the village. When asked why, his explanation was simple. "I opened my email account there. Since they were closed, it meant I could not access my mails. They chose the password for me. I knew my password would not work anywhere else". He equated electronic mails to Post Office mails.

Elena, originally from the Czech Republic said, "When I was taught to send files by email, I did my best. But I could not understand why, after I attach a file and click 'send', the file still remained in the folder. So I used to send the same mail several times. Then I was told that a digital file makes automatic copies of itself. I said to myself, this must be a miracle." Elena was thinking that computer files were like her old paper files. Normally when they are "sent", they disappear!

Alka Larkan, a trainer once told a group "When my new computer came, I was happy. But for days, I could not figure out how to turn it on. I could not find the "ON/OFF" button. After five days of searching, I finally found it!"

Dr. Sugata Mitra, Chief Scientist at NIIT, was interested in bringing computers and the Internet to children in India[8] and on 26th January, 1999 Dr. Mitra's team carved a "hole in the wall" that separated the NIIT premises from the adjoining slum in Kalkaji, New Delhi. Through this hole, a freely accessible computer was put up for use. This computer proved to be an instant hit among the slum dwellers, especially the children. With no prior experience, the children learned to use the computer on their own. Encouraged by the success of the Kalkaji experiment, freely accessible computers were set up in other cities in India. These experiments came to be known as "Hole-in-the-Wall" experiments. The findings from Shivpuri and Madantusi confirmed the results of Kalkaji experiments. On their own, children picked up computer skills and could "roam" on cyberspace.

The advantages offered by the Internet were now being embraced. The questions were no longer "What is it?" and "Who is behind it" but "What can I use it for?" and "How can I benefit from it?"

## Issues in Internet Adoption

With the adoption of the computer and the Internet in developing countries, there are several obstacles to the effective use of the Internet for social and economic development. These are problems that hamper the individual, group and community maximization of the benefits of the Internet. Here are some of the key issues.

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[7] The Association for Progressive Communication (APC), FEMNET, Net Gains: African Women Take Stock of information and Communication Technologies. 2000. A Collaborative Research. http://www.apc.org/en/system/files/Net+Gains+Women+in+Africa+Take+Stock+of+ICTs.pdf

[8] http://www.hole-in-the-wall.com

## Access

The stories are many, and each is accompanied by its challenges, for example, there is the story of Mercy Wambui[9]. Wambui's first encounter with ICTs happened just before the Rio Earth summit in 1992, while she was working with EcoNews Africa, a Nairobi-based environmental NGO. Wambui recalls, "It was awful … there were so many commands and they were daunting. But I used to trouble shoot and experiment a lot. We did not have full access to Internet - just electronic mail and discussion groups. I used to download these and circulate them. We repackaged material for our constituents and fed their views back."

Access was expensive. Because she spent much time figuring out the system at home, becoming a regular Internet user cost her dearly. It could even have cost her going to jail, because at the time a rigid and archaic regulatory framework did not permit data transfer over a phone line. Ironically, once the daughter of the Minister of Communications, on holiday from a UK university and working on her thesis, asked Wambui to come and assist her with technical problems she was experiencing in transferring a draft to her supervisor using a PC and modem. It turned out that the minister's phone line was not working (a regular problem in Nairobi). And the minister had never heard of the Internet - until Wambui explained it.

I recall access in West Africa in the late 1990s too. I was fortunate to be one of the early ones. I worked, then, with the African Development Bank. So I got Internet connection at work, which was very rare. The first public offer of Internet service was made by a private telephone company – Publicom. We used to queue up and wait, and then we paid by the minute. At the national University in Abidjan, you needed to pre-book. Reservations were made at the library, where the five Internet-enabled computers were kept. To be able to get your turn, it was wiser to book a day or two ahead. Better still, try and do a "parallel" deal with the manager. Even then, priority was still given first to University administrators, then faculty, staff, researchers, post graduates, undergraduates and finally the public.

## Gender

The ICRW[10] raises the digital challenge in the context of gender; in its study on *How Technology Can Advance Women Economically*, it notes that a Growth Environment Scores (GES) study of countries in the Persian Gulf shows that technology is so critical to growth and economic well-being, that if lags in technology use were addressed, along with low levels of investment and human resource development, the region could effectively close its income gap with the G-7 countries by 2050. It offers evidence that economic growth in Malaysia and Thailand between 1995 and 2000 would have been negative without investments in information and communication technology (ICT). Unfortunately, the gender divide in digital technology is larger in low and middle-income countries, though it exists in both developed and developing countries. In most developing countries, women lag behind men in using the Internet, mobile phones, and radios; women are estimated to be just 25 percent or less of Internet users in Africa, 22 percent in Asia, 38 percent in Latin America, and a mere 6 percent in the Middle East. Even in rapidly developing countries, women still trail men in access to mobile phones, as in the Czech Republic, where only 60 percent of women had access to mobile phones in 2003, compared with 72 percent of men.

[9] Ibid.

[10] International Research Center for Women - ICRW, Bridging the Gender Divide: How Technology Can Advance Women Economically. 2010. http://www.icrw.org/files/publications/Bridging-the-Gender-Divide-How-Technology-can-Advance-Women-Economically.pdf

Four factors appear to be the most important with respect to gender with respect to ICTs. First, women in developing countries do not receive the basic education and training needed to be ready technology adopters and are often seen only as "users" or "receivers" of technology, rather than as innovators involved in technology design and development. Second, domestic chores and multiple roles as caregivers and economic actors mean that women have little free time to explore and experiment with new technologies. Third, women are constrained by social norms that confer control over technology to men. Finally, due to financial and institutional barriers, women lack the means to use, rent, or purchase established and new technologies that could help them advance economically.

## Language

Language has strong influence on culture and is also a key element in ICT use. Both Asia and Africa have a large number of languages; in Asia, approximately 2,197 languages are spoken, with about 20% of the population being able to communicate in English. In Africa, a wide variety of local languages are spoken with second and third languages often being those of former colonial regimes: French, Dutch, and English, though English is not a given across Africa or Asia. In addition to the varieties of spoken languages, alphabets and scripts are a key issue on the Internet. Most scripts are based on the Latin/Roman alphabet or Arabic script (with the exception of the Horn of Africa). The situation is more complex in Asia, where Arabic, Indian, Chinese, Japanese are dominant forms and a wide variety of other scripts exist as well. These written forms not only have technical implications; they also affect the way in which information is classified.

## Modes of Communication

Closely related to the question of language are the preferred modes of communication. Some scripts have not changed over hundreds or even thousands of years, which means that people are still able to read old documents today. On the other hand, there are languages that have no script, which means that passing on information relies on oral tradition. In the end, new technologies have to fulfill the human need to communicate and the different features that modern ICT offers can be used imaginatively to create new modes of communication.

## Taboos

Another important element of culture is taboos: not all issues can be discussed in public. In this respect, many of the new technologies offer some degree of anonymity, which facilitates the exchange of information on sensitive issues. Earlier, when making a call with a fixed telephone from home or from a shop, the phone set could not be moved. People could not talk about personal matters over the phone without others hearing them. Now they can take the mobile set and move to a private location and "do mobile". The fact that various ICTs enable anonymity has been mentioned positively in several projects dealing with HIV/AIDS. Sexuality is often associated with taboos; confidential counseling over telephone hotlines or anonymous interviews with HIV positive individuals addresses many taboo issues on the levels of individuals or communities. Furthermore, taboos are influenced by gender: a study regarding use of the Internet conducted in several African countries found that "school girls primarily used the Internet to search for information that is banned or taboo in their cultures." Another gender-biased taboo is reported from Pakistan, where a woman visiting an Internet cafe by herself is "undesirable practice". Taboos, therefore, relate not only to content but also to access.

## Poverty

The key challenges to the effective use of the Web for social and economic development in developing countries are all linked to poverty. While poverty alleviation is a goal, its constituent elements hamper the achievement of this goal, at least from the ICT perspective.

Gerster and Zimmerman (2005) have compiled an impressive list of "Ten Good Reasons Why the Internet Bypasses the Poor." First, a low literacy rate sets limits to using a medium that requires specific literacy. Second, the information needs of rural and urban poor differ from the information accessible on most of the existing Websites – relevant content is lacking. Third, available content may not be accessible in the required language – 70 percent of the websites are still in English. Fourth, existing software, including search engines, is targeted towards the needs of better-off people and regions. Fifth, there is limited connectivity in rural areas. Sixth, the poor suffer from barriers in mobility to reach centers. Seventh, the poor cannot afford sufficient time and incur income losses to attend training. Eighth, costs of hardware, software and connectivity are still considerable for poor people. Ninth, the poor lack knowledge of how beneficial and powerful the Internet could be in their hands. Finally, marginalization by ethnicity, caste or gender may add to the barriers.

## Government Interference

In 2006, Reporters Without Borders published the list of thirteen countries considered as "Enemies of the Internet". The countries were Belarus, Burma, China, Cuba, Egypt, Iran, North Korea, Saudi Arabia, Syria, Tunisia, Turkmenistan, Uzbekistan and Vietnam.

In Burma the military junta filters opposition websites. It keeps a very close eye on Internet cafes, in which the computers automatically execute screen captures every five minutes, in order to monitor user activity. The authorities targeted Internet telephony and chat services in June 2011, blocking Google's Gtalk, for example.

In Cuba the computers in all the Internet cafes and leading hotels contain software installed by the Cuban police that triggers an alert message whenever "subversive" key-words are spotted. The regime also ensures that there is no Internet access for dissidents and independent journalists, for whom communicating with people abroad is an ordeal. Finally, the government also relies on self-censorship. You can get twenty years in prison for writing "counter-revolutionary" articles for foreign websites. You can get five years just for connecting to the Internet illegally. Few Internet users dare to run the risk of defying the regime's censorship.

In Egypt, three bloggers were arrested in June 2006 and were held for several months for calling for democratic reforms. Others bloggers have been harassed, such as Coptic blogger Hela Hemi Botros, who was forced to close down her blog in August under pressure from the police. A Council of State administrative court recently ruled that the authorities could block, suspend or close down any website likely to pose a threat to "national security."

In Pakistan, on February 28, 2006, the government issued a blocking directive banning a dozen URLs posting controversial Danish cartoons depicting images of the Prophet Muhammad. In March, in a series of escalating instructions, the Supreme Court directed the government to block all websites displaying the cartoons, to explain why they had not been blocked earlier, to block all blasphemous content, and to determine how access to such content could be denied on the Internet worldwide. The Supreme Court also ordered police to register cases of publishing or posting the blasphemous images under Article 295-C of the Pakistan Penal Code, where blasphemy or defamation of the Prophet Muhammad is punishable by death.[11]

[11] Open Net Initiative aims to investigate, expose and analyze Internet filtering and surveillance practices in a credible and

## The Internet in Cultural Use

In this section, we evaluate the activities of people in the developing world on the Internet. We have seen the growing numbers and the increased use on mobile phones. Now we look at who is doing what and why. We are looking at how the Internet is affecting the cultural tenets of the developing countries, where most of the poor and underserved live.

### Language

In the earlier part of this chapter, we saw language as the fundamental means of human communication, the vehicle of cultural education, the upholder of speech and the guardian of tradition. We now look at some of the initiatives coming from developing countries in language promotion, use, defense and influence on the Internet.

#### *African Languages and Cyberspace: An ACALAN initiative*

In 2006, the African Heads of State and Government adopted the statutes of the African Academy of Languages - ACALAN with a mission of fostering Africa's integration and development through the development and promotion of the use of African languages in all domains of life. ACALAN's value is to cultivate respect for the cultural values of Africa, especially African languages on behalf of the African Union; integration of the African continent for an endogenous development; linguistic and cultural diversity as a factor of Africa's integration and the promotion of African values. In its "African Languages and Cyberspace" initiative, the institution seeks to use new technology to empower the use of African languages, including computer programs to facilitate typing, printing, publishing and use on the Internet. ACALAN does not participate in the debate on the digital divide. Rather, it devotes itself to deploying local policies to safeguard and preserve the African languages and their dialects, to ensure the promotion of content, and to develop the huge cultural heritage through cyberspace, to report on the state of the African languages in the Knowledge Society, and to find tangible tracks for the development of operational political frameworks, as well as the development of data-processing and linguistic standards for the industrialization of the endangered languages in the cyberspace

#### *Komunitas Blogger Indonesia*

The Komunitas Blogger Indonesia[12] is one of the largest blogger communities of the developing world that does not use any of the United Nations official languages. Bloggers use the Indonesia Bahasa. At the beginning of July 2011, there were at least 9,700 registered bloggers on the portal. The blogs cover various areas of social, cultural and economic life. There are 453 bloggers in the Computer section, 279 in the Internet section, 302 in Technology and 111 in Travel. There are more than 1,000 bloggers whose blogs are categorized under "Blogging"; these bloggers provide tips, information and online support to the others to enable them develop their own blogs effectively.

#### *FASOKAN, the Bambara rural blogger*

Boukary Konaté[13] lives in one of the villages of Mali, in the African Sahel. He is a certified Bambara teacher. His blog, Fasokan, is a very rare one, addressing mostly technology and cultural issues. He captures the village life, its challenges, and its joys. He also uses his Twitter account @fasokan to report festivities and some

non-partisan fashion. More and updated information on Internet surveillance and censorship is on http://www.opnnet.net

[12] http://indonesia-blogger.com/

[13] http://fasokan.wordpress.com/

traditional Dogon and Sahelian life issues. His blog posts are accompanied by vivid pictures of the life of the villagers that he talks about. Some are under the tag Laadalakow (traditional practices), and the others Togodaw (rural village life). At the end of 2010, Fasokan started teaching the Bambara language in cyberspace, offering language lessons to anyone who was willing to learn.

### *Michel Marteilly, President and Tweeter in Chief of Haiti*

Haiti was the first independent nation in Latin America and the first black-led republic. Its population of 10 million is one of the youngest in its part of the world. Haiti is the only predominantly Francophone independent nation in the Americas, and apart from the French language, speaks its own very Haitian Creole. In early 2011, in an election that saw great citizen mobilization, the country elected famous singer Michel Marteilly[14], also known as "Sweet Micky" as President. The President on his Twitter, Facebook personal page, Facebook personality page and YouTube spaces does one of the most extraordinary things a cultural icon can do: communicate in English, French and Créole. Not only does he engage his citizens and the world in real time, he does so in the languages that best drive home the message. Here is one of those messages:

> "Edikasyon se motè devlopman. Nou tout dwe met men pou voye timounn yo lekòl pou nou rebati yon lòt Ayiti"

This translates into:

> "Education drives development. We should unite in our efforts to send all children to school, so we can build a new Haiti"

The Internet supports many currently known languages.

## The Market Place

In December 1948, the United Nations adopted and proclaimed the "Universal Declaration of Human Rights", long before the arrival of the Internet. In Article 20, it recognizes that "Everyone has the right to freedom of peaceful assembly and association." [15] The need for association is fundamental to humanity. The Internet, above every other use, has proved to be "the" meeting place of minds, of thoughts, of people, of professions, and of cultures. At the end of June 2011, the world population is still estimated at around 7 billion and the number of Internet users had already gone beyond 2 billion.

At the end of 2010, the bloggers at Pingdom shared the following figures of exchanges on the Internet. [16] There were an average of 294 billion email sent per day on the Internet in 2010. Five billion photos were hosted by Flickr in September 2010. More than three billion photos were uploaded per month to Facebook. Two billion videos were watched per day on YouTube. There were well over a billion e-mail users. Twenty million videos were uploaded to Facebook each month, and 20 million Facebook applications installed each day.

Over the past 20 years, discussions, forums and communities have come online. In terms of the "market place, there has been a consumer revolution, considering the role played by listserves, community forums and mailing lists. Rapidly eclipsing the geographic constraints on word of mouth through face-to-face discussions, message boards, discussion threads and forum posts are now in place. Video and audio sources have also made a differ-

[14] The Public Page of Michel Marteilly has more than 40000 interests. https://www.facebook.com/martelly2010 He tweets on the handle:@presidentMicky.
[15] http://www.un.org/en/documents/udhr/
[16] http://royal.pingdom.com/2011/01/12/internet-2010-in-numbers/

ence. These days, many new products, particularly technology products are launched with an accompanying video, to explain how it works. Businesses also use videos to explain solutions to client problems.

In the services realm, there have been changes as well. Professional communities have made great use of the Internet: doctors, lawyers, artists, tradesmen of all skills may find communities online. Recently, online directories have also played a role in reaching potential customers. One may no longer need to go to the village square or park to "ask around" for someone with the skills that one requires. It is far easier to get information about services online. These professional associations, hitherto constrained to their physical space can now freely extend to "everywhere the Internet touches" which means, almost the whole world.

## Travel

Movement, travel and inter-cultural exchanges are some of the main ways to enrich culture. Man has used different means to transport himself. From traveling on foot, to riding domesticated animals, animal-drawn carriages, steam-powered engines, trains, ships, cars and finally airplanes. Air travel literally shrank the world, making it possible to move across continents in the shortest time in human history. Every day, millions of people fly from one point to another; air travel has become the fastest, safest and most voluminous method of travel in the modern world. The Internet has given air travel new methods and models for reaching and assisting customers in their travel planning.

The International Air Transport Association, IATA[17] was founded in Havana, Cuba, in April 1945. It is the prime vehicle for inter-airline cooperation in promoting safe, reliable, secure and economical air services for the benefit of the world's consumers. Until the advent of the Internet, flight tickets were printed on paper and cost $10 to produce. On the 1st of June 2008, the industry moved to 100% electronic ticketing and the paper ticket became a thing of the past. An electronic ticket (ET) holds all of the information previously held on a paper ticket. It requires a database, integrated with the airline's passenger service systems, that interfaces with all partners for the real-time processing of passengers by ground handlers and interline partners. Without the Internet, the generation of an ET would be impossible. Apart from substantial cost savings for the industry of up to three billion US dollars per year, it is also more convenient for passengers who no longer have to worry about losing tickets and can make changes to itineraries more easily

### *Virtual Tours*

Virtual tours provide the kind of travel where you stay home with your family and visit exotic locations around the world via the Internet. For example, it is possible to visit South America, to Peru and see the Inca trail[18], the United States of America, to see the White House[19], Geneva, Switzerland, to see the "Palais des Nations[20]" where the United Nations has its offices, France, and visit the famous "Musée de Louvre"[21], Robben Island, in South Africa and see the prison and cell of Nelson Mandela[22], and using Google Earth[23] visit the whole world.

Virtual tours serve the needs of those who cannot travel, but they also encourage us to travel, by offering a taste of what a place is like. While this has been possible in the past through satellite television and film, the prospect

[17] http://www.iata.org/pressroom/facts_figures/fact_sheets/Pages/et.aspx
[18] http://www.traveltocusco.org/incatrail4dayvirtualtour.html
[19] http://www.visitingdc.com/white-house/virtual-tour-white-house.htm
[20] http://www.unog.ch/virtual_tour/palais_des_nations.html
[21] http://www.louvre.fr/llv/musee/visite_virtuelle.jsp?bmLocale=en
[22] http://virtualafrica.co.za/virtualtours/googlemaps/robben-island-virtual-tour/
[23] http://www.google.com/earth/index.html

of taking a virtual tour any time provides a unique and pleasing immediacy to the consumer. In addition, virtual travel gives individuals from developing countries the opportunity to visit places that ordinarily would have been out of reach, either due to financial constraints or due to language barriers, thus offering a form of travel that still allows for personal and community development on a budget.

### *Remote Conferencing*

Travel does not just serve for tourism and cultural exchange; it also is the means of getting some important businesses done. The Internet has not reduced the need to travel; on the contrary, it might have increased the amount of travel. However the Internet also makes it possible to save on travel through the use of video conferencing based upon the integration of audio and video on the Internet. With a good Internet connection, anybody can speak at a conference anywhere. The Internet Governance Forum[24], which is an annual conference on Internet governance issues, has integrated what is now known as "remote participation" to its meetings. People from any country may now participate remotely in these high-level United Nations-sponsored meetings. The Internet permits viewing livecasts and textcasts, and depending on the session, remote participants can raise their hand and with their own web camera, make a point as any other person in the room.

The same technology is being applied to health via tele-medicine. For poor and underserved populations with little access to doctors, the Internet, can establish audio and video collaborations with doctors in other locations to consult with patients and local health staff.

## Speech

Article 19 of the Universal Declaration of Human Rights states that "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." This very right seems to be the one that has been at the center of many controversies between governments and citizens. Its violation and the corresponding activism for its protection have made headlines the whole world over. Media Rights Groups, Freedom of Expression movements and activists for the right to information have multiplied. Even the United Nations itself has appointed a special Rapporteur, Frank La Rue, on the promotion and protection of the right to freedom of opinion and expression. In his report[25] of May 2011, submitted to the 17th Session of the Human Rights Council of the United Nations, he indicated that:

"Unlike any other medium of communication, such as radio, television and printed publications based on one-way transmission of information, the Internet represents a significant leap forward as an interactive medium. Indeed, with the advent of Web 2.0 services, or intermediary platforms that facilitate participatory information sharing and collaboration in the creation of content, individuals are no longer passive recipients, but also active publishers of information. Such platforms are particularly valuable in countries where there is no independent media, as they enable individuals to share critical views and to find objective information. Furthermore, producers of traditional media can also use the Internet to greatly expand their audiences at nominal cost. More generally, by enabling individuals to exchange information and ideas instantaneously and inexpensively across national borders, the Internet allows access to information and knowledge that was previously unattainable. This, in turn, contributes to the discovery of the truth and progress of society as a whole."

[24] http://intgovforum.org/cms/
[25] http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf

As rightly pointed out by La Rue, traditional media have benefitted greatly from the Internet in many ways. They include the dissemination of traditional content online, as well as content adapted for the Internet, increasing audience size, and raising revenues. Furthermore, there are also benefits of freedom of expression in a virtual context. Information is now available for audience outside the "normal reach" of traditional media. Citizens can react to news items on the same platform on which the news was published. Citizens, who for one reason or the other may not have their voices heard in their traditional setting can be given "a louder" voice by news articles on the Internet. Media that may otherwise be banned from using national spectrum may now find space online. The use of instant citizen-generated content on hot topics allows for the possibility of better information flow. Information that may have been hitherto denied citizens can be accessed. Finally, the Internet may serve as the last platform for the expression of opinion in situations of political crises, where opponents may be under a government ban.

The Internet is proving itself to be the global "speech" platform, the vehicle for information *par excellence* and the world's platform for the expression of opinions. The possibilities offered by free blogging platforms like Blogger, Wordpress and Tumbler, coupled with easy blog applications that can be integrated into ordinary websites are making blogs prevalent in cyberspace. In this regard, the Internet safeguards speech.

## Family

Tucked away in a quiet corner of article 16 of the Universal Declaration of Human Rights is a line that many human rights activists seem not to have taken up as a battle case. It affirms that "The family is the natural and fundamental group unit of society and is entitled to protection by society and the State." Though family is not necessarily the object of great promotion, all cultures do have a respect for the unit. Families have not changed much over time. Parents still complain about how "kids these days" have no idea how good things were in the "good old days". Births, graduations, marriages, and deaths still are causes for in-person family gatherings.

The Internet is helping families keep together in the absence of regular direct geographical contact. Email, with its immediacy, helps keep family communication going smoothly. Chats are instantaneous and also help family members keep in touch. Video calls are an enhanced offering; bringing families together in a visual form, shrinking distances. Group video conferences, offered by many Internet platforms for free, are supportive on a broader scale. Webcasts allow family members to follow events at home live. Relatives can engage through remote participation at family events. When grandparents no longer want to travel, they can still be part of a party and give their blessings by video.

In an archival format, photos and videos on social media sites are also widely used for family connections and remembrances. Families are building websites, possibly using their online domain name. For example, I have reserved the Nwakanma domain name and I have informed members of my extended family of this. When we are ready, we will build up the website and all our children and their children and the children of their children can be on the family website.

All in all, the Internet has become a significant factor in assisting the well-being of the family unit. From birth through birthdays, school graduations, marriage, reunions, anniversaries, and death, families make use of the Internet to share, celebrate, remember, and grieve for their members. In this regard, one might say that the Internet itself has become a family member.

Abiodun Adeniji was the kind of guy almost everyone on campus knew. He was good in basketball and also played in the volleyball team. He could really dish out hot serves! He was not as tall as the other guys but he brought life to any team. He also had this wonderful personality that makes people feel like family around him. We graduated together in the class of '96. Then he moved over to London where he lived and worked with his family. We kept the '96 family alive through Facebook. In all, I had 134 friends in common with him.

On a Friday evening, in the first week of November 2010, he died in a tragic car accident.

Between that Friday and Monday, messages poured on his Facebook wall. Many of his friends were concerned with the immediate family, his pregnant wife and his old father back in Nigeria. Friends and families were scattered over the world but were brought together by death of a loved one.

We started a group on Facebook: "Family and Friends of Abiodun Adeniji". The group served as a virtual family circle, where members could express their pains and be comforted. But not only that, the group had plans of a prayer service. It was scheduled for Friday November 12th. It was going to be held on audio call. Someone managed the Web interface and recorded the call and made it available on the group's Facebook page. A priest was booked and the hymns were chosen. At one point, the old father was called by phone and he spoke to the extended family. After the session, people introduced themselves and it was remarkable how quickly the Internet could re-unite the family, albeit in unhappy circumstances.

## Social Media

Social media and social networks are now buzz words on the Internet. We want to understand their basic tenets, their influence on Internet use and in extension, and their role on culture. To begin, we consider one of the Wikipedia[26] explanations about social media:

"Social media are media for social interaction, using highly accessible and scalable communication techniques. The term refers to the use of web-based and mobile technologies to turn communication into interactive dialogue." The key characteristics of most social media include a web-based platform, good accessibility and scalability, reliance on user-generated content, and a capacity to mobilize groups of subscribers.

In social networking, it is important to distinguish between the social medium and the physical networks. In this case, the medium is the technical platform, which provides the means for the social opportunity, the possibility of connecting with others. The networks are the people. Networks may include members of organizations and institutions, family units, communities of geographical reach or communities of interest, friends, viewers, connections, followers and acquaintances.

Two prominent platforms for social media stand out, FaceBook and Twitter. FaceBook was born in Harvard dormitory room under the aegis of Mark Zuckerberg and co-founders Dustin Moskovitz, Chris Hughes, Eduardo Saverin. Since its launch in February 2004, FaceBook has captured a major share of social media networking site usage. FaceBook is a social utility that helps people communicate more efficiently with their friends, family and coworkers. It assists the sharing of information through the social graph, the digital mapping of people's real-world social connections. Anyone can sign up for FaceBook and interact with the people they know in a trusted environment.

Facebook is one of the most-trafficked sites in the world today. 50% of active users log on to FaceBook on any given day. The average individual user has 130 friends, spends 55 minutes on FaceBook, clicks the "Like" button on 9 pieces of content and writes 25 comments on FaceBook content per month, and is a member of 13 groups.[27]

[26] Wikipedia: http://en.wikipedia.org/wiki/social_media

[27] Although FaceBook may be the most widely recognized social network, there are many more. See http://en.wikipedia.org/wiki/List_of_social_networking_websites for a list of several hundred other social networking platforms, many of which have

The second prominent platform is Twitter. Initially, code titled Twttr, and inspired by Flickr, Twitter privately appeared in March 2006. Later, in June 2006, it was launched for public with the study Twttr.com and re-branded to Twitter.com in October that year. Twitter is a real-time information network offering an online application that is part social networking site, part cell phone/IM tool, designed to let users answer the question "What are you doing right now?" Users have 140 characters for a very short piece, posting (or "tweet") to state whatever they care to say.

In terms of online traffic density and visit frequency, Twitter leads the breed of social media sites. The number of Twitter users increases by 300,000 every day. Twitter's search engine gets 600 million queries each day. More than 70,000 applications have been created using the Twitter API. Twitter uses hash tags "#" that automatically transforms words into searchable topics. Tweets can be searched for and found with search engines.

Though the statistics are changing all the time, at the beginning of July 2011, Facebook had over 750 million users and Twitter had over 200 million users. *History and Statistical Data About FaceBook and Twitter* [28] gives more data. These are two of the most popular and cited sites currently. However, there are tremendous shifts in cyberspace and the social networking paradigm is ever-changing, with new players entering all the time.

## Digital Culture

How do these media affect human culture? Here are a few "shifts" in culture that the Internet has enabled.

**News:** News updates on Twitter and Facebook are published and reach friends and followers at the same second that you click "send". Due to the scalability of these formats, a single post can reach a million individuals in less than 1 minute. When a topic or a particular word is being tweeted by many users, Twitter automatically adds it to a "Trending Tweet" list. This means all users online will see that topic.

**Participation:** Social media allows for a greater participatory culture. Be it reviews, opinion polls, or just information, people can participate in issues, discussions and contribute through Facebook pages and Twitter hash tags. In Ghana, the Constitution Review Commission used Facebook and Twitter, among other media, to get citizen participation on the nation's constitution review.

**Political engagement:** The year 2011 may well be known as "the year of social media political engagement. The most outstanding were in Tunisia and Egypt. Facebook and Twitter served the citizens for initial platforms for political tug-of-war with Presidents Ben Ali and Mubarak. The calls were echoed across the world. Hash tags were used and updates on almost every aspect of the social uprising were fed in via Twitter. Photos, videos and information were published rapidly. The word "Tahrir[29]" was trending in Twitter for days. With bare hands, Tunisians and Egyptians, supported by social media, were able to oust their presidents.

**Social mobilization:** Without doubt, the 2011 election in Nigeria was the most unusual one. Not only was it globally acclaimed as "the first democratic, free and fair" election in Africa's most populous nation, it was also the one election where citizen mobilization was greatest. The Independent National Electoral Commission itself was on Facebook and Twitter and encouraged citizens' reporting. With #NigeriaDecides and under the leadership of young Nigerians, information about voting stations, conditions, results, and photos were sent and monitored all over the country. Before the end of the day, some defeated candidates had tweeted their acceptance of defeat.

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millions or tens of millions of users.

[28] http://www.converge2003.com/2011/02/history-and-statistical-data-about-facebook-and-twitter/

[29] Tahrir is the Arab for "Freedom" The "Tahrir Square" in Cairo was therefore the "natural place" to go to.

**Humanitarian action:** Following the post-electoral violence in Côte d'Ivoire at the end of 2010, the humanitarian situation was catastrophic. Citizens were faced with hitherto unheard of restrictions on transport and communication. There was no SMS service, airports, sea ports and land borders were closed, banks had shut down, and there was no commercial transport available. During critical weeks, a curfew was in place from 12 noon to 6 AM the next morning.

Many people had run out of cash. Being that telecommunications are mainly on pre-paid conditions and transactions were by SMS, many could no longer make calls. The only groups who had a clearance to move around all through the day were emergency services like Red Cross and Doctors Without Borders. Concerned citizens started CIVSOCIAL, a humanitarian initiative that was aimed at locating sick, most vulnerable and emergency cases. Through Twitter, Facebook or Skype, these cases were recorded and communicated to the volunteers who could attend to the needy. A call center was set up in the nearby country of Ghana and a call for volunteer experts was made. Doctors responded. Since sick people could not get to hospitals, clinical consultations had to be made on phone. CIVSOCIAL volunteers called the patient, got their information, called the doctor, and put both patient and doctor on conference call. With the tags #CIV2010 and #CIVSOCIAL, citizens have monitored elections, served as emergency relays, raised funding, and even mobilized for blood donations. The Prime Minister and the Minister for Youth have used Twitter to express gratitude to the initiatives.

**Human Rights activism:** Before the Internet, human rights activists had always relied on numbers to make their voices heard. These days, one can get hundreds of thousands to sign a petition online. Many automatic Twitter applications for petitioning exist and make it very easy to sign up for, or against an issue.

**Politics and Governance:** Globally, politicians are realizing that social media are here to stay. Originally resisted, the "political" adoption of social media is on the rise. When the 33 miners were trapped underground in Chile, the news made the rounds. On the day they were rescued, President Sebastien Pinera, using his Twitter account - @sebastianpinera – was updating the whole world. When the last miner was out, he sent his warm thanks to the world. President Paul Kagame of Rwanda also tweets on his personal account: @PaulKagame. In one of my earlier studies on "The role of social media and networks in citizen policy engagement in West Africa"[30], one of the results of the study was the overwhelming place that social media is now occupying in electoral processes. Hardly any presidential candidate in the developing world can afford to ignore social media.

A special mention to the President of Nigeria, Goodluck Jonathan, who not only tweets, but engages Nigerians on his Facebook page. At the time he was considering running for the 2011 April elections, he decided to run an opinion poll on his Facebook page.

**Business operations:** Businesses in the developing world are exploiting many social media possibilities, including asking for business ideas, searching for business partners, generating leads, marketing products, rendering after sales service, tracking clients, holding meetings, obtaining client feedback, tracking client satisfaction, and communicating with current and potential clients.

In the digital culture, the users are more important than the creators. The users form a community and serve as the standard by which expertise and fame are measured. The number of "likes" and sharing on Facebook and the number of re-tweets and "favorites" on Twitter will let you know if the piece of information given is important to the online community or not. In social media, people follow what they are really interested in; this explains why in many countries, the actors, comedians, artistes and sports stars have more followers than the Presidents and other key authority figures.

[30] http://www.diplomacy.edu/poolbin.asp?IDPool=1342

I live in Abidjan, the commercial capital of a West African country called Côte d'Ivoire. I run an Information and Communication Technology Consultancy. Though the business NNENNA.ORG is based in Abidjan, most of the work is done online. From hiring to task execution, payment, reporting and evaluation, I do not go to the office, I work from home. I pay $65 a month for an Internet connection of 512 KBPS. I rely on Facebook, LinkedIn, Twitter, Plaxo and my blog to keep the balance between my professional life and my social activism. So far, I have over 500 connections on LinkedIn, around 1,500 friends on FaceBook, almost 2,000 followers on Twitter and over 1,000 contacts on Plaxo. I have synchronized my Yahoo updates with Facebook and Twitter. I have LinkedIn, Plaxo and Facebook also synchronized with my Twitter and finally, I have my Twitter feed showing on my blog, where I have also added direct links to my many Web activities. I have a Klout score of 63 and have been ranked among the top 2,000 influential persons in Social Media by Social List. As an African woman CEO, I intend to make the best use of the Internet, not only in my business but to raise the living standards of my family, my immediate community and the society at large. I strongly believe in the potential of the Internet to foster socio-economic development in Africa.

*- Nnenna Nwakanma, CEO, Abidjan, Côte d'Ivoire*

## Internet Culture

Cultural communication and exchange having a very large geographic scope has been enabled by the Internet. This expanded range of communciations allows formerly local human activities to expand to a more global arena. Key activities among these are gaming, movies, sports, music and sex. The Internet has raised the scope of these activities from group or community activities to considerably greater global community engagement.

### Massive Multi-player Online Games- MMOGs

Massive Multi-player Online Games -MMOGs have now established themselves as a veritable global culture on the Internet. Wikipedia has registered that in December 2003 with an analysis in the *Financial Times* measuring the value of the virtual property in the then-largest MMOG, Everquest, to result in a per-capita GDP of 2,266 dollars which would have placed the virtual world of Everquest as the 77th wealthiest nation, on par with Croatia, Ecuador, Tunisia or Vietnam. World of Warcraft is also large; since its debut in 2004, it has grown to a subscriber base of 9 million in 2007. In 2008, Western consumer spending on World of Warcraft represented a 58% share of the subscription MMOG market. In 2011, hundreds of millions still play the free version of the game, while global subscribers remain at 11-12 million.

Other popular on-line games exist. Happy Farm has more than 200 million users and a daily login rate well over 20 million. Angry Birds, mostly played on the mobile phone, has experienced 1 million downloads per day. Mention also needs to be made of Farmville, Zuma Blitz and Mafia Wars. With increasing growth of Internet use on mobile phones, and the corresponding applications industry growth, MMOGs will most certainly see significant growth. If one also considers that most social media networks are automatically integrating these games, online games are here to stay as a part of the new culture.

In the East African country of Tanzania, a young man named Emmanuel Feruzi has founded a company called Tri-Labs to develop games. He is not the only African developer into the games business. He foresees offering his games to the global gaming market. Online gaming represents a huge potential for economic and social advancement for programmers in the developing world. Its virtual nature ensures that financial gains can be made from anywhere, including working in relatively inexpensive developing country environments.

## Movies

The Internet Movie Database – IMDb was established in 1990. It became very popular because it let Internet users access information about movies online. Movie service centers have included Flixster, FilmCrave, Flick-Chart, NetFlix and FilmMaster. Other than offering renting, pay per view, and online viewing possibilities, these sites have also become networking platforms for movie lovers, allowing discussions, debates, trackings, personal dashboards and public messaging. According to Big-Boards.com, the message boards at IMDb have 13 million posts, and over 4 million members, making it one of the biggest discussion communities on the Internet.

Facebook has opened up to movies as well. Though users mostly embed links from other sites, it is now possible for them to show their movies on their Facebook pages. Warner Bros, the film company has launched a movie renting service on Facebook and plans to extend its market online. Thomas Gewecke, its digital distribution president says "Making our films available through Facebook is a natural extension of our digital distribution efforts. It gives consumers a simple, convenient way to access and enjoy our films through the world's largest social network." Google has also implemented Google Movies for cell phones. YouTube allows uploading and watching of movies as well.

Perhaps the country in the developing world that has most benefited from this global movie culture is Nigeria. In less than 10 years, the Nigerian movie industry has established itself as what is now known as Nollywood. Nollywood movies are of a particular interest as they do not only depict African cultural issues, but are also shot in the different languages. Apart from the Nigerian movie industry becoming a strong economic sector in the country, it is also serving to preserve linguistic and cultural diversity in the web space.

Serious issues remain with respect to intellectual property protection of both music and movies, and the illegal trade in them. The problem is universal, but a comprehensive understanding of the problem and a harmonized approach to solving it does not yet exist.

## Sports

The Internet culture is a very interesting phenomenon in the way it evolves. The social networks are permeating the very soul of online life, giving rise to much fan, community and group activism in games and films. It therefore is not surprising that the Internet is well on its way to turning the whole world into one soccer field, one basket court, one golf course, one race track, one boxing ring, i.e. one giant digital sports complex.

Apart from viewing sports events, there is also a lot of online sports engagement. The Federation Internationale of Football Associations – FIFA, as well as other sports bodies now allow match-casting on their sites. Match-casting consists of minute by minute summary of match actions with regular photo updates. Match casts may also have a chat forum that allows fans anywhere to discuss the match while it is being played. Twitter has allowed sports fans all over the world to engage in tweet-casting also. Once a hash tag is created, all who are viewing the match can tweet their comments, questions, joys, disappointments, agreements and disagreements with referees, umpires and opposing teams. Information on players is shared rapidly. A cursory look on Twitter reveals that Wayne Rooney has some 2,258,560 fans and Tiger Woods has over 1,500,000. The "golden boot" goes to Brazilian Kaka, whose @kaka account is followed by over 7,436,000 people.

Africans who are international football stars have not only become national icons, they have also become economic and social development stalwarts. Apart from making extra money from publicity in their countries, many have joined forces to sensitize the public on key health issues like HIV-AIDS, female genital mutilation, girl child education and illicit circulation of fire arms. The United Nations has invested in several such as Roger Milla of Cameroon and Michael Essien of Ghana as goodwill ambassadors, making them development icons.

A number of players have established foundations that cater for young sportive Africans, support education, aid vulnerable people and cater for basic social amenities. Examples include Luca Radebe of South Africa, Kanu Nwankwo of Nigeria, Didier Drogba of Côte d'Ivoire, Emmanuel Eboué of Côte d'Ivoire and Samuel Eto'o of Cameroun.

## Music

Great as they may be, the games, the films and the sports are not the only cultural aspects that "rock" on the Internet. Music seems to be most dominant. This is evidenced by hardware producers who regularly update their stores for new music. Apple I-Tunes boasts of millions of titles on its store and so do other outlets. Music downloads representing a fair share of cultural activities on the Internet; it is no doubt that music stars figure among the most followed Twitter accounts. As at December 15, 2011, the charts were reading:

1. Lady Gaga - @ladygaga - 17,000,207
2. Justin Bieber - @justinbieber - 15,443,140
3. Barack Obama - @barackobama – 11,545,543

In other words, Lady Gaga, the famous musician and Justin Bieber the adolescent actor-singer each have enough Twitter followers to make up a sizeable country, more than the entire populations of either Belgium or Portugal.

African artists are using social media to reach out to a global population and are creating a wider fan base. These online friends, fans and followers are now a direct market for the artistes, as they notify their fans of new albums. This direct contact between the artistes and the fans eliminates charges that would have gone to marketing and gives the fans a greater access to their idol. Apart from selling to connected fans, there is a significant followership on YouTube channels of African music. Online sales have also followed, paving the way for African musicians to earn money in a global market.

## Sex

Arguably, the domain of human culture that most brings the Internet culture to the fore is sex. Due to its private nature, it is practically impossible to estimate how much sex is on online. However, the Internet allow for sexual exchanges of many kinds. The debate about online pornography is priority on the agenda of many of the stakeholders of the Internet Governance Forum. Governments are doing their best to track sexual offenders on the Internet, block child pornography and filter illicit sexual content.

The saga of the .xxx top level domain and the International Corporation for Assigned Names and Numbers (ICANN) indicates the ambivalence with respect to this topic on the Internet. The .xxx was first proposed in 2000 by ICM Registry and propose again in 2004, but it faced strong opposition. In 2005, the domain name received a preliminary approval but opposition in 2006 resulted in the approval being reversed. In 2007, ICANN sought further public comments on the domain name, and for the third time, the domain was rejected. In 2008, ICM filed for an independent review that was carried out and in March 2011, ICANN's board approved the execution of the registry agreement with ICM for the .xxx sponsored domain. The votes tallied were: 9 in favor, 4 against, with 3 abstentions.

Whatever the future of .xxx top level domain name, sex has come to stay on the Internet, as has music, sports, films and games. These are cultural activities that have risen above normal human cultural exchanges in groups and communities to real global phenomena. Over and above consolidating the "global village", these also represent high income potential for developing countries. On one hand, by guaranteeing that people from developing countries may get access to a kind of economic level playing field, and on the other hand, offering opportunities

for expertise from the developing world to be exploited in a way that contributes to social and economic development. As with e-commerce, e-learning and e-government, culture has not just made use of the Internet; the Internet has created a culture of its own.

## Rise of open source and open technology

The digital and Internet culture have given rise to what has formally been described as the open source technology. The term *open source* refers to practices in production and development that promote access to the end product's source materials. Though knowledge about products may have been shared in the past, the Internet and its capacity to globalize the human knowledge base has fueled a shift in the fundamental structure of knowledge sharing.

The fundamentals of open source are in giving source access to users, in allowing freedom to share, to modify and to release derivative of the original work. Openness in technology has conquered the software world, has made a great entry into the hardware world and is making a soft entry into the data domain. The economic, cultural and financial gains of open source software, open data, open hardware and openness in Internet-enabled platforms may arguably be the most important driving force behind the explosion of the use of the Internet in uncountable areas of human life. It is the open nature of the Internet that has made it possible for diverse people of diverse languages, and diverse cultures to benefit from it.

All across the globe, the open source movements have grown: the Open Source Initiative, the Free Software Foundation, the Open Data Foundation, Software Freedom Day, and the Creative Commons. In Africa, there is the Free Software and Open Source Foundation for Africa – FOSSFA, whose objective is not only to advocate for openness in technology development but actually seeks to infuse "the free software and open source (FOSS) model in African development"[31].

The Internet has given birth to a whole different meaning of the word *open.*

## Fusion of cultures

Needless to say, a lot has changed in the movement from "culture" to "digital culture". Some known "certainties" are being challenged by the digital way of doing things. We cast a cursory look at some key fundamental cultural notions that are being "digitally" challenged and are undergoing fusion.

**Cultural values:** Perhaps the biggest shift that digital living has brought to culture is in its core values around family, language, communications, and information. In early 2011, the Oxford English dictionary integrated words that can best be described as being of "digital creation". These included LOL, the shortened form of "laughing out loud" and OMG, the abbreviation of "Oh My God". Some books are now being published in the language that is most often employed to send messages across mobile phones, otherwise known as SMS-speak. Indications that many mothers may no longer need to scream "food is ready" to bring all members of the household to the dinning table are getting numerous. She may need to send a SMS to all! It is expected that e-parenting will increase over the next few years, meaning parents may have to be checking on their children's Facebook, Foursquare and Twitter time lines to know where they are and when they are likely to be coming home.

[31] http://fossfa.net/node/6 contains FOSSFA's mission statement.

**Generational roles**: For the greater part of the global population, roles can be very culturally determined. One example is in teaching and learning. The Internet is gently eroding these in many ways. At home, knowledge is believed to be with the "elders" or the "elderly". In fact, an African saying has it that "an old man who dies is a library that goes ablaze". Earlier behavior, therefore, was for children to "sit at the feet" of the elderly and learn wisdom. In the academic circles, where teaching and learning happen in a more formalized framework, more emphasis was on the teacher, since he was the person who could lead the learner to knowledge. With distant learning centers, open learning and open education resources; the Internet has shifted emphasis from the teacher to the learner. The wealth of knowledge available online has shifted wisdom from books, teachers and the elders to the Internet. The roles are now reversing, with the younger agile persons, who spend more time online, often being the teachers.

**Work vs. Knowledge economy:** The traditional "there is dignity in labor" saying implies that work needs to be at the base of economic freedom, financial buoyancy and personal wealth. Within the digital context, this seems challenged. The Internet has opened up great potentials in an "economy of knowledge". This knowledge economy is transforming knowledge from a tool to a product all on its own. The distributed or "crowdsourced" collection of information and ideas, technology platforms and tasks are making way for individuals to earn a living in non-traditional ways. In the entrepreneurial world, the attitude of coming to work in the morning and staying till evening is giving way to "a task oriented, location-independent" model in which people can work from wherever they are, over the Internet, and are evaluated only by the achievement of given deliverables.

**Morning and evening:** With increases in travel, innovative working methods and virtual collaboration across time zones, the cultural notion of morning and evening are also changing. Workers and collaborators are now based all over the globe, and work is now done at all hours. Time differences are becoming less of an issue, with continental telephone conferences, webinars, video chats and video conferences. In many developing countries, out-sourced service delivery is becoming an industry of its own. Indian service operators who handle clients of American, European and Asian companies work according to the day time hours of their respective clients, regardless of the time differences.

The Internet has fundamentally challenged, changed and eroded key cultural notions in multiple ways. The Internet has established itself as a determining force in the shared pattern of attitudes, beliefs, behavior, and practices, which is socially learned and characterizes an individual, a group, or a community. It has positioned itself in our education, the environment of such education, the knowledge acquired in the course of such education, as well as the value gained. In people values, The Internet is contributing to the "death of distance," and is building digital bridges for our expression of the arts, sciences, civilization, conventions, customs, ethnology, lifestyle, human tendencies, knowledge and lore.

We find ourselves in a rapidly changing cultural landscape. This basic understanding will be needed in strategically mapping a way forward, especially for countries in the developing world.

## What the Developing World Offers to the Internet

As a tool that fosters development for all humanity, it is important that the Internet also draws from the developing world. In seeking answers to the question: "What can developing countries offer the Internet", the following benefits emerge.

**Population:** Most of the world's population resides in developing countries. Among them, China, India, and Africa make up for more than half of the world's population. This represents a huge market for web products and services. In following the demographic trends over the past years, the percentage of the world's population that will be living in developing countries is on the rise. The human resource capacity, once developed and reinforced, stands to benefit the Internet.

**Inclusiveness:** In Kenya, Kibera is situated on the outskirts of Nairobi. It is reported to be one of the biggest slums in the world. At a time, it held over 2 million dwellers. The authorities knew that the place existed but had never taken the time to map it, so it remained a blank spot on the national map. That is now history. Young Kiberans themselves are up in open source tools mapping the slum themselves and doing an impressive work at it. The same spirit of inclusiveness and solidarity is evident in the EnoughisEnough initiative of Nigerian youth. The developing world can join in the development and use of a Web that relies significantly on volunteers for localization, topicalization and translation.

**Wealth of cultures:** In matters of cultural expression, the developing world can enrich the cultural and linguistic diversity of the Internet. Global cultural content input on the Web will be successful, if people are motivated to share their individual and collective cultures. In Africa, it is very unlikely to find an individual who only speaks one language; the average number of languages spoken is three.

**Youth work force:** While aging is increasingly becoming a problem in many developed countries, the developing countries have a blossoming youth population. With education infrastructure on the increase, an intellectual workforce is emerging that can contribute to the growth of the Internet. The small island nation of Cape Verde, located off the coast of West Africa, is becoming a software outsourcing location. Many countries are opening up technology hubs, villages and diverse Web-related virtual workspaces. India has distinguished itself in this area.

## Recommendations

The values of the Internet, the potential for it to influence all of life's activities and the multiple uses that poorer countries can make of it, qualify it as a prime tool in social and economic development. Nevertheless, there are key obstacles to the Web's ability to support and drive such development.

Recommendations for culture change are somewhat futile, since implementation generally cannot be forced from within. This section therefore highlights some of the cultural issues that stand as impediments to greater use of the Web for assisting poor and underserved groups and individual needs. A shift in cultural values will be needed in order for the Web to gain traction to support the poor and underserved.

### Access

According to the ITU in its publication *The World in 2010: ICT Facts and Figures*, at the end of 2010, half a billion households worldwide (or 29.5%) will have access to the Internet. In some countries, including the Republic of Korea, Netherlands and Sweden, more than 80% of households have Internet access, almost all

of them through a broadband connection. While in developing countries 72.4% of households have a TV, only 22.5% have a computer and only 15.8% have Internet access (compared to 98%, 71% and 65.6% respectively in developed countries).

The obstacles to access lie in four major areas:

**The physical location of Internet-enabled service centers:** As has been shown by the ITU data, only about 15% have Internet access, and many of those are in offices, not in homes. This leaves at least 80% of the population who have access to the Internet only through a public center: schools, cybercafés, Internet clubs, rural information centers and so forth. In addition, the hottest "Internet points" are mostly situated in cities, where there is security and minimal electricity. This leaves out the majority of rural dwellers. In some countries, Internet-enabled vans have tried going into rural areas, but they are relatively few and rare and cannot keep up with the demand.

**Relevant content:** Information is what makes the Internet and there is a great deal of information online. However, much of that information is geared towards a target audience. The publicity, marketing and business content that exist online are often not valuable to people of the developing world. Blogs that talk about rural life, like FASOKAN, are far and few between, because the creators of content follow their own needs. The dictates of mass modernized culture are not necessarily the needs of the billions who do not have access to the Internet and are poor and underserved.

**Language:** A large percentage of Web content is in the English language, which is a minority language in a global context. Most countries that use English have to learn it in school and it is normally used as the language for official business. The "Anglicized" Web gives the impression that the Internet is an "official business" and may not relate as clearly to personal issues and interests. Languages expressed in non-Latin character sets have more access challenges than others.

**Affordability:** Though the cost of access to the Internet has been decreasing over the years, it is still out of the reach of billions of people in the developing countries. The Federal Government of Nigeria has recently voted a minimum wage of around 125 US dollars a month. On the average, entry-level professionals still earn less than 500 US dollars a month. The poverty level and the quest to survive put access to the Internet in a position that can best be described as non-priority. For a 1-hour Internet access in a public center in Vietnam, individuals still have to pay almost 1 USD. For the income level of developing countries, the cost of Internet access needs to come down to an affordable level for the Web to effectively serve poor and underserved populations.

## Cultural Restrictions on Women

Efforts that enhance the ability of the Web to support social and economic development of developing countries, including bringing the Internet to homes, will also be highly beneficial to women. Internet access at home will counter-balance many of the cultural restrictions being placed on women in developing societies. In some Middle East countries like Iraq, and Afghanistan, women still have difficulties accessing basic education. In many Middle East countries, women cannot drive cars, cannot own property and cannot walk on the streets alone. There is no way a woman can access a public Internet facility on her own. Public places are male-only places. If Internet access is tied to public places, it will automatically remain a male-only facility.

Internet access at home can make it possible for women in developing countries to get the benefits of the Web while accomplishing their normal daily chores at home. Since the role of raising the next generation falls on women, an understanding and practice of the Internet at home by women will ensure a digital generation next for developing countries.

While many poor women in developing countries cannot afford hardware, electricity, and technical know-how, it is not possible for the Web to fully contribute to development without the full engagement of women. Any investment made to assist women to access the Web will contribute to sustainability in development.

## Literacy and Education

There is important link between literacy levels and the potential of the Internet to support economic and social development. Basic literacy precedes digital literacy. The countries classified as developing countries are the same that occupy the lower rungs of the global literacy list[32]. Having been adopted as the second of eight Millennium Development Goals, universal primary education is a key to optimum benefits of Internet potentials for development. The ability to read and write is a necessary condition for reading and writing online. Exploiting the Internet for development, therefore, must strategically include investment in universal primary education, adult literacy initiatives and ICT education in schools.

## Free Software and Open Source Technology

Free software and open source technology offer huge potentials to developing countries to carve a niche in the global development landscape. Access to the source material of software and hardware permits them to be modified to adapt to different cultural and linguistic contexts. Support in raising in-country capacities in free software and open source technology is a sure way to empower local and national Internet communities. Open data initiatives, open and transparent governance and citizen-generated and sourced information will go a long way in ensuring that developing countries make the best social, cultural and economic use of the Internet.

## Mobile Technology

The domain of mobile phones and mobile telephony will be instrumental in the access to the Internet and consequently, may play a greater role in the use of the Web for assisting the poor and underserved. In *The Rise of 3G*[33], the International Telecommunications Union noted that by the end of 2010, there will be an estimated 5.3 billion mobile cellular subscriptions worldwide, including 940 million subscriptions to 3G services. The uptake of mobile phones and mobile technology testifies to its potential for improving conditions of people in developing countries. By offering basic services and simplifying operations, the mobile phone has brought the Web home via the mobile telephony infrastructure. Nonetheless, Web access on mobile technology has yet to surmount the obstacles of language, content relevance and price.

## Openness, Democracy and Good Governance

Openness has been a fundamental principle in the development of the Internet. Web 2.0, which integrated interactivity in cyberspace, was also fundamental in engaging users in new ways. These days, social media depend greatly on user-generated content. Given this new paradigm, in governance, in platforms, in function and in content, the "openness" of the Web needs to be protected, promoted and safeguarded.

This capacity for citizens to express their opinions, including government criticism, on diverse Web spaces have not always been welcome by regimes that have dictatorial, proprietary and corrupt governance tenden-

[32] The list of countries by literacy rate is http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate

[33] 3G refers to mobile phones and telecommunications of the 3rd Generation. Their application services include wide-area wireless voice telephone, mobile Internet access, video calls and mobile TV.

cies. Web content still come under censorship in many developing countries. Bloggers and journalists are still being tracked and occasionally imprisoned. In worst cases, such as Egypt, China, Ethiopia, Myanmar, Syria and North Korea, national Internet access has either been completely disabled, disrupted or under very strict surveillance.

### The Internet as a Human Right

As at the time of this writing, Estonia, Finland and Spain have declared access to the Internet as a legal right for their citizens. Campaigns are beginning to table this on many other parliamentary tables. As seen previously, in his report to the United Nations General Assembly, Rapporteur Frank La Rue has suggested the same. In on-going Internet Governance Forum discussions across Africa, the topic is also being raised. Formally adopting access to the Internet as a legal right may drive budgetary allocations and help resolve some the financial challenges to more universal access. Other players may intervene as well; for example, more investment from multilateral and bilateral donors could be directed towards Internet access for the poor and underserved.

## Life, Living, the Internet

Without doubt, the Internet is changing our attitudes, beliefs, behavior, and practices. It is changing us. In Africa, the Internet is being compared to water. Water is nourishment, and the Internet has become the lifeblood of human culture. Ice is water that is available but not accessible; access to the Internet is still limited. Rain consists of showers of water, needed for sustainability; the Internet is needed to sustain us. Rivers, the highways of water, are like the highways provided by the Internet. Streams are like the inland cables, the last mile of connectivity. Reservoirs are like the reservoirs of knowledge and information. We filter water, and we filter content from the Internet. Dams regulate the flow of water, as ISPs and service providers regulate the flow of information. Clouds contain water, and clouds are a metaphor for the Internet. Cloud computing is a new frontier for the Internet.

What can we do without water? What can we do today without the Internet? In China, 17-year-old Xiao Zheng has been reported to have sold a kidney to buy an iPad. In an Interview with Shenzhen TV, he said “I wanted to buy an iPad 2, but I didn’t have the money.” Xiao traveled all the way north to the city of Chenzhou in the Hunan province, where the kidney was removed at a hospital. He reportedly received some 3,000 dollars, which allowed him to buy the iPad. This is an extreme example, but it leaves no doubt that the desire for the technology is powerful, to the point of transcending one’s physical self.

The Internet has become a part of us, a central element in human culture. It has changed our culture, our very beings, our life, our kind.

The Internet has changed man. We have become *homo numeris.*

# CHAPTER 14

# Conclusion

This chapter contains three distinct sections. It begins with a broad ranging discussion of aspects of development and growth, and the implications for the effective use of ICTs for contributing to them. This discussion is followed by a tour of current trends of interest that affect the future use of ICTs in all areas. Finally, the material of each of the preceding chapters is revisited, and for each chapter, highlights of the content as well as conclusions are presented.

## Development and Growth

### The Classical Model of Growth

#### *Industrialization*

The study of industrialization history and economic development has passed through various phases, and ideas that may have been fashionable at the close of World War II have been substantially refined, or in some cases, discarded as economic results in various nations have been assessed. In The Rise of "The Rest" – Challenges to the West from Late-Industrializing Economies, for example, MIT Professor Alice Amsden offers a deep analysis of the classic paradigm of industrialization in the developing world and offers a vast amount of data and commentary on the dramatic growth in nations such as Brazil, Mexico, India, China, Korea, and Taiwan.[1] In some cases, the journey towards industrialization is laid out on a well-worn path, and many countries may still pass this way. However, new facets of the global economy have demonstrated the high potential for ICTs to be applied in the development of other economic sectors, including textiles, agriculture, and the (sustainable) exploitation of natural resources.

This book has focused on the use of ICTs to aid in economic and social development in the context of poor and vulnerable populations around the world. As we have seen, the distribution of vulnerabilities is complex and it is important to be sensitive to various nuances of person, place, and gender in any prescriptive analysis. When talking about the disadvantaged, one may think first of those living in abject financial poverty in least developed nations. Seen in this frame by readers in the industrialized world, the vulnerable populations may seem to be remote and isolated islands of need. In reality, there are pockets of human vulnerability in every society. Marginalization can occur in East and West, North and South, rural and urban, and across regions that may appear to be generally affluent, but which contain serious shortfalls in the equitable distribution of resources beneath the smooth and shiny surfaces. Achieving a more equitable distribution of ICT resources initially involves deep engagement with the topics that have been covered in the chapters on Fundamental and Technical Access. As has been noted repeatedly, the costs of technology have decreased dramatically over the past few decades, usability from a technical standpoint has also improved in a dramatic fashion, and the popular acceptance of these technologies has been very impressive; the numbers of users of ICTs are in the hundreds of millions.

[1] The Rise of "The Rest": Challenges to the West from Late-Industrializing Economies by Alice H. Amsden (Oxford University Press: NY, 2001).

Looking at the way in which ICTs have swept around the world, changing the landscape economically, politically, and socially everywhere they take root, some observers have expressed concerns about a new form of electronic colonization. After World War II, there was a strong push for national independence and a subsequent drive to join the world community as sovereign states through participation in inter-governmental organizations such as the United Nations and the WTO. Ties to former colonial powers remained strong in many parts of the world as well, however, and this is evident even now through the formation of business alliances in the field of ICTs. When old colonies allow their former colonizers set up powerful telecoms providers within their borders, does this constitute the next wave of imperial power – a kind of proto-colonial digital imperialism? Furthermore, the forms which new and emerging ICTs take may also contain some elements of digital feudalism – the Cloud is dispersing along various platforms, but ICT consumers are potentially facing a serious lack of interoperability through the construction of branded silos and the formation of different clouds with different points of access. Will the ICTs of the coming decade evolve into a thriving ecosystem of interoperable components, or will they grow apart, each in their own vertical and proprietary walled garden?

These are important philosophical and technical questions, but the answers are beyond the scope of this book. Our team focused instead on best practices in several dimensions including the promulgation of policy on the governance of ICTs and the promotion of select sectors in emerging economies.

## New Perspectives on Growth

### *Development as Freedom*

In capturing new perspectives on growth, it is helpful to reframe the question of economic development in human terms, rather than strictly in terms of policy statements and statistics on GDP, employment, educational attainment, and measures of health and mortality. In the book Development as Freedom, Nobel Prize winning economist Amartya Sen provides a fresh definition of poverty as "capability deprivation".[2] While offering an insightful critique of traditional measures of growth and economic attainment, Sen returns to central humanistic themes throughout the book, covering justice, democracy, social opportunity, and human rights. Each of these elements is linked back to individual freedoms, and a compelling case is made that development, in the long term, cannot be pursued in opposition to freedom; they must move in tandem to ensure the best outcomes not only for the poor and vulnerable, but also the more privileged populations of the world.

Starting from that definition of poverty as "capability deprivation", it is important to examine the diverse components that will impact access to ICT-based capabilities and evaluate what those capabilities should entail. While this concept of poverty-as-deprivation is appropriate with regard to fundamental and technical access, it becomes even more powerful when one considers persons with disabilities, groups that face discrimination on the basis of age, gender, language, or culture, and those who cannot read or write. In these cases, simple access to standard technologies is not enough. In the case of persons with physical disabilities or literacy issues, adaptive technologies may be necessary. In the case of age and gender issues, there may be a need for special facilities, support for lifelong learning programs, and an affordable supply of technologies that are accessible in a mobile or home environment. In the case of language and cultural issues, special provisions may be made to ensure that as many languages as possible are available as options on ICT platforms and devices and that cultural elements are rich, welcoming and inclusive to all. Some of these provisions can be reinforced by enlightened educational policies. As the chapter on education points out, this is a multilateral process; naturally teachers are engaged in teaching students, but it is also important to make effective programs available for teaching the teachers, especially in the realm of useful new technologies for education and social development.

[2] Development as Freedom by Amartya Sen (Anchor Books: NY, 1999).

Education is a critically important component of capability and capacity building. One might even say that if we see poverty as a disease of chronic capability deprivation, then education may be the antidote in the form of continuous capability enhancement.

In further consideration of development as freedom, we must also consider areas where ICTs potentially impinge on freedoms. As ICTs have become dominant features of daily life in the industrialized world, they have brought great advantages in productivity, community building, and self expression. At the same time, they have also introduced serious new dangers into our environment. Overreliance on technology is in itself a danger; consider the effects of a widespread power outage occurring through a deliberate human attack or natural phenomenon such as a tsunami, earthquake or major solar storms, which are capable of disrupting satellite communications and impacting systems on Earth. Increased dependence on technologies at a societal level leads to a loss of control under such scenarios. There are also threats focused on data and information systems; some areas of vulnerability include infrastructure information and operations, personal data protection (including health care records), privacy, the security of financial information and financial transactions, corporate espionage, national security, and the creation of new routes for fraud, violent crime and terrorism.

These facets of the Information Age constitute the dark side of ICTs and it is a constant struggle to leverage the positive capabilities against the negative ones effectively. One key to realizing the promise of the Knowledge Society is to make economic advancement a reality for as much of the population as possible. If digital inequalities are addressed aggressively at a global level, there will perhaps be greater incentives to participate in the formal economy and diminished incentives to join the shadow economy. Such an effort must therefore take into consideration the human side of development once again.

### *The Elusive Quest for Growth and Hidden Fortunes: The Rise of Markets*

Following from the case made on behalf of incorporating humanistic goals into the quest for economic growth, it is useful to examine the role that incentives play in the dynamics of population groups and the lives of individuals. In The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics, academic and practitioner William Easterly argues that the disappointments experienced with many development assistance projects are not due to a failure of economics per se, but rather a failure to apply economic principles to practical policy work.[3] By focusing on the roles that groups and individuals play in their own development, one is reminded of the old saying, "Give a man a fish, feed him for a day. Teach a man to fish and feed him for a lifetime." This is a somewhat clichéd and not even completely apt aphorism, since even in the old context of paternalistic development, native populations knew how to fish, what they needed was better equipment, safer vessels, weather advisories, and policy assistance for the maintenance and preservation of fishing grounds, all in the face of environmental degradation, climate change, and pollution. Yet even in this case, the emphasis should not be on technology transfer alone, but on capacity building and resource development that lead to enhancements in productivity, sustainability, and deeper understanding of system dynamics.

Once the ground work has been laid for increases in productivity and output through the use of ICTs, the next step in the advancement of poor and vulnerable populations concerns the evolution and expansion of markets. In The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits, academic and emerging market business consultant C. K. Prahalad provides a road map for the navigation of the Bottom of the Pyramid (BOP) markets.[4] As discussed in several chapters in our book, there is money at the bottom, but localization,

[3] The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics by William Easterly (The MIT Press: Cambridge, 2001).

[4] The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits, by C.K. Prahalad (Wharton School Publishing: NJ, 2005).

customer participation, and trust feature prominently in the decision-making and purchasing processes. Firms seeking to offer products and services to the less advantaged members of global society are well-advised to study these dynamics carefully.

In addition to the potential for accessing new markets, there are also benefits for some industries in the enhancement of international communication and coordination with other governments and research organizations. For example, the ability to track health trends around the world enables health care and emergency management professionals to establish early warning systems and supports their ability to mobilize resources into regions in need more quickly through rapid response teams. Similarly, ICTs aid in the formulation of global responses to pandemics, in part by facilitating early detection of patterns of contagion and enabling health care workers to contain and treat afflicted people and areas more effectively. On a routine basis, ICTs augment the capabilities of rural health care professionals through access to experts and by improving measures of prevention, protection, and information management, even for the most common ailments and conditions, such as infections, the flu, pregnancy and child birth. Integrated knowledge management and information sharing systems have a powerful effect on the quality of local health care systems, from rural villages to urban centers, especially when those systems can be closely connected to appropriate sources of expertise quickly.

Another example of accessing the currently underserved markets and populations around the world may be found in finance, where new forms of electronic payments systems are helping the poor and vulnerable (the "unbanked") to develop their financial capabilities. Despite positive advances, ICTs have not integrated finance between the developed and developing worlds uniformly; there is still a two tier system (at least) where the industrialized world uses credit cards and the developing world uses M-PESA or similar options. The payment systems between these worlds do not always interface smoothly; major retailers may not accept those systems used by much of the developing world at this time. However, now that workable payment systems are in place, the solutions to this problem become more a question of recognizing the power of markets. For many forms of commerce, projected sales volumes are a key driver in the search for and retention of new customers.

Though they are beyond the scope of this book, future studies might shed light on some of the barriers to market entry in the so called "Bottom of the Pyramid" and also envision ways in which new technological forms such as the Cloud may help with access in this sense (marketing and consumer awareness) and with supply chain management, distribution and payments systems at the practical levels. We have seen that solutions to local problems ideally should draw on the knowledge of local people. One new twist on this is the migration of skilled technical and professional workers from the developing world. They may serve as diplomatic and cultural links between worlds, assisting not only with market access for existing firms, but also nurturing the growth of new firms to provide products and services in their native countries.

### *The Long Road Home – Adventures in Innovation and Entrepreneurship*

One of the major changes to the landscape in international development over the past few decades has been the rapid increase in labor and capital mobility. While economic advances in developing countries such as the BRICs have been dramatic, there has also been a massive migration of well-educated technical and professional classes. The United States, for example, has benefitted greatly from the "brain drain" from India and China, welcoming tens of thousands of skilled workers, first on temporary visas, but ultimately offering citizenship, when that is desired. However, the tidal flows are changing over time. In her book The New Argonauts: Regional Advantage in the Global Economy, Professor AnnaLee Saxenian, (an expert in technological innovation and regional competiveness), shows that many of the engineers and entrepreneurs who sought their fortunes outside of their home countries are now beginning to return to them, promoting local growth in select industries

in the newly emerging economies and creating centers of high tech excellence around the world.[5] For these new entrepreneurial classes, the paradigm has shifted from a cause for concern: Brain Drain, to a cause for hope and invigoration: Brain Circulation.

Clearly while ICTs have transformed how people communicate and conduct business, they have also stimulated a high demand for technical skills sets, a virtuous circle of skill building and deployment. Citizens of the BRICs, particularly India and China have gained greatly, both at home and abroad, by meeting this need. Such employment is a powerful force in reducing poverty in substantial ways and countries that have ridden the current technological waves are now engines of growth for their regions. As a result, in the country context, "access" analysis must be extended beyond fundamental, technical, and policy access with regard to ICTs; in the broader picture, the new technical and professional classes constitute fresh access to skills and knowledge that are key ingredients for the cultivation of successful new ventures. Along with the repatriation of wealth in the form of increased financial flows back home, the new labor mobility has resulted in widespread flows of technical and business talent. The growth of organized expatriate groups dedicated to working between their worlds, highlights the rising importance of international professional networks in this new phase of the global knowledge economy. In the context of high tech enterprises, these groups form a cornerstone of what are called Venture Support Systems, which rely on professional knowledge bases (e.g. technological or scientific domain expertise, corporate and intellectual property law, accounting), deep cross-border expertise, international alliances, and ties to powerful educational institutions and, through those colleges and universities, access to alumni networks as well as potential advisors and business partners.

Given the strong interest that many members of the international technology community express in taking the long road home, there are ways for other stakeholders to assist in this process. To return to the major theme of this book, "empowering poor and marginalized populations," from the broad actions of national governments to the local programs of the development assistance community, the objective is to form policies and programs that work for the most vulnerable populations in the world. A firm foundation for long-term growth must be based on the development of local business and entrepreneurial classes. This does not preclude market participation by outsiders; multinational corporations clearly have a role to play in the distribution, promotion, and education efforts regarding ICTs at the global level. However, there is a significant role to be played by social entrepreneurs, often working in conjunction with NGOs, regional or national governments, or private foundations to develop effective programs and businesses in areas of need. With the hope of enlightened government policy support and reliable expert guidance, the conversation turns back to the actions of dedicated individuals and teams working in the ICT environment. Social entrepreneurship is a promise and a process, ultimately evolving to meet customer needs and desires, so that in the end there will simply be successful entrepreneurship: innovation, productivity, and profits.

## Current Trends and Directions

Preceding chapters of this book cover a number of major domains where ICTs and the World Wide Web may be used in assisting populations that are poor, underserved and vulnerable to exclusion. Given the key findings in each case, we now ask, "What will assist these populations in benefitting even more from access to existing ICTs in the present and the further deployment of ICTs in the future?" While each chapter contains its own recommendations, there exist current overarching trends that span multiple areas of application of ICT and the Web. An understanding of these trends provide insight into key issues across domains and leads to conclusions that reflect the general state of technological advance and the interconnectedness of the world.

[5] The New Argonauts: Regional Advantage in a Global Economy, by AnnaLee Saxenian (Harvard University Press: Cambridge, 2006).

## Advances in Technology

While technology will continue to provide us with increased benefits at a fairly rapid rate, the technologies that either already exist or are in development today are more than sufficient to support assistance efforts for marginalized countries and populations. Relevant refinements in the near future include voice recognition and automatic language translation, both of which will enhance the effectiveness of the Web and Web-related resources in serving poor and vulnerable populations.

Even if technological progress were frozen in time today, the joint advantages of engineering process improvements and the economics of mass market access would prompt a significant reduction in the cost of ICT equipment in the years to come. As a thought experiment, one might ask what the proliferation of ICT equipment and services would be if their costs were reduced by 75% right now, and how, as a consequence of this reduction, could ICTs be used to deliver services to people in previously underserved segments of the world population.

This discussion leads naturally to the question of how organizations in the development and social services fields should organize themselves in order to exploit technological progress in ICTs. In the past, two different approaches have been taken. The first approach, having specialized ICT units advising separate units dealing with application areas such as education, health, and governance, provides the impetus for fostering research and development capacity within the organization. The second approach consists of mainstreaming ICT staff into substantive units, allowing for closer coordination and common understanding of real problems faced by technical and substantive staff teams together and driving joint efforts in the relentless search for solutions.

Unfortunately, the choice between these approaches has sometimes been influenced by conventional wisdom and unconnected external circumstances. For example, in the mid to late 1990s, at a time when there was frenzied speculation on the potential powers of the Internet, culminating in the dot-com boom, several development organizations invested significantly in central ICT groups. After the equity markets crashed in 2001-2, these organizations mainstreamed or abandoned their central ICT groups. There was little explanation for that action and, in fact, central ICT groups would have been useful in capitalizing on the glut of innovation that has occurred in ICTs over the past decade. Nevertheless, at this time, central ICT groups are generally not favored, and this weakens an organization's ability to plan for more effective use of ICTs in striving to improve social and economic conditions. Organizations currently working in development could generally benefit from a rebalancing of these approaches, in favor of increased investment in central ICT capabilities.

## Communications Revolution

Looking to another technological frontier, communication capability for both voice and data will continue to improve for the majority of the world's population irrespective of external influences because the market for such services is profitable and the global demand for them is high. While the shift from analog to digital communications technology is not yet over, its long-term victory is assured, allowing voice and data services to share common communications links easily, thereby increasing economies of scale in service delivery.

Assistance derived from both official government policies and from private sources will be useful at the margins, particularly with respect to those populations for whom the business case is weak or does not clearly exist at all. The implementation of universal service policies on the part of governments will do a great deal to minimize this problem. However, the concept of a universal service policy is not universally shared among countries, and its meaning, coverage, and specific service provisions vary from place to place. External policy assistance sources have a distinct role to play in helping governments devise a version of such policies that ensure a beneficial impact on marginalized populations in their regions.

## Technology Implementation

The production function for ICTs in the context of poor and vulnerable populations has undergone a fundamental change in the last 10 to 15 years. In the past, applications of ICT were primarily determined by experts in specific fields and were implemented in developing counties and/or within marginalized populations to determine how ICTs could be of the most help to them. In the past, self-help approaches in exploiting ICTs among such groups were the exception rather than the rule. The reasons were fairly straightforward, and included the cost of equipment, the lack of skills in the populations needing help, and the lack of inexpensive and effective communications channels between resource rich and resource poor environments. This environment led to a multiplicity of pilot programs and a dependence upon external evaluation programs as opposed to pragmatic local adoption analyses as measures of success. Scalability at marginal cost and replicability in different environments were prized goals because of the relatively heavy initial fixed costs, but unfortunately for both program sponsors and the populations they sought to serve, neither scalability, nor replicability were achieved in most cases.

In the last 15 years, this environment has changed dramatically. Capital costs have decreased, user friendly tools have multiplied, the human skills for using the tools have become more widespread, and communication throughout the world is now easier and less expensive. The locus of activity for helping these populations is undergoing an important shift from the donors in the developed world towards the ground operations in the local environment, with staff and programs based near or at the center of these populations themselves.

This reversal has major implications for how assistance can be provided. First, it suggests that the use of ICTs to solve social and economic problems is most effective when it occurs in the same environment as the problem to be solved. If the costs are sufficiently low and the knowledge and tools exist, this is quite feasible. Second, it lessens the need for the solutions to be scalable and replicable, since it is now the processes that are more scalable and replicable and they can be tailored to meet specific requirements. Finally, it indicates that there is a lot to be gained by the widespread distribution of inexpensive equipment and appropriate training on how to use it, since the adoption of ICTs both in developing countries and among marginalized groups tends to be relatively rapid.

## The Role of Standards

It is worth noting the role of standards in this paradigmatic shift. The last 15 years have seen a fair amount of convergence in important standards, encouraged by the TCP/IP protocol family of standards underlying the Internet. This development has been accompanied by a convergence in standards with respect to storage media and interfaces as well. Likewise, at the application level, since 1994, Web standards have been developed slowly and carefully by the World Wide Web Consortium (W3C). By following rules contained within this set of common standards, Web content can be placed on any Web server and can be viewed by any standards-compliant Web browser anywhere in the world. In addition, file compatibility between similar applications across operating systems is now much more the norm than the exception. Convergence towards and adoption of common standards allows the Internet and the Web to operate almost seamlessly and has allowed them both to achieve the dominant technological positions that they enjoy today.

## Interface Design

The improvement of user interfaces is a key area for research, development, pilot programs, and other experiments. Historians of computing understand this well. At every step in the evolution of computer interfaces — from punch cards with assembly language, to higher level languages, to command line interfaces, to pointing devices and to iconic representation — computers have become easier to use and the number of people who are able to use them has increased significantly.

In this book, we focus on the expansion of the use of the Web, as well as other Internet-based tools and the statistics world-wide are impressive. However, we must not become complacent, leaving parts of the world behind; those who cannot use the Web now are prevented from doing so for a number of reasons. Some may have special physical needs. Others may be illiterate. Still others may speak a language or languages that are not implemented or available on current ICT devices. While these challenges are not new and are well-recognized by the technology and international development communities, it has been difficult or costly to obtain and implement solutions in the past.

We are now at the point where ICT devices are sufficiently flexible and internationalized that an all-out attack on interface design is due. With a map of the special needs to be addressed, it should be possible to research and develop interfaces for people who fit into almost any scenario related to their status of being disadvantaged by poverty, illiteracy, or language. The technologies for providing broader access exist today and technical progress in the industry will only improve the scope of their ability to address the needs of these groups.

## Economies of Scale

Economies of scale in knowledge regarding ICTs and their uses are on the rise. Around 1980, Robert Metcalfe, the inventor of Ethernet, asserted that the value of a telecommunications network is proportional to the square of the number of connected devices of the system (nodes). This is frequently referred to as Metcalfe's law. This "law" has been often reinterpreted to apply to the number of people who are connected to a network, and reflects the benefits of economies of scale in group communications and activities. In short, the value of a network is greater than the aggregate value of its parts.

In particular, the widespread distribution of knowledge about ICTs has enabled groups formed around special interests to grow, advance, share, distribute and exploit this knowledge. One example of such a coalescing of people with similar interests and agendas may be seen in the growth of social entrepreneurship, a new socially-conscious business trend that has received significant attention in recent years. Assisting this phenomenon, ICT-based tools such as e-mail and the Web make it possible for experienced business people, financiers and entrepreneurs to form alliances at great distances from each other, overcoming geographical barriers, although they are not yet independent of the last barrier, language. Nevertheless, the ability of people anywhere in the world to assisting local entrepreneurs in nurturing new businesses in an efficient manner is a relatively new and growing phenomenon.

## Multidimensional Populations

In dealing with the populations that are the focus of this book, it is important to remember the disparate and multi-dimensional nature of those populations. Individuals can be disadvantaged, vulnerable and marginalized in different ways. Perhaps the simplest way is by geography; people who live in areas where there are few, if any, schools and a scarcity of traditional communication vehicles such as newspapers, books, libraries, radio, and television may not have any idea of the kinds of knowledge that are available in the world, or a view on how such knowledge may be used to solve problems and improve lives on a daily basis. This form of deprivation

—information poverty — is most likely to occur in the developing regions of the world, but it exists in pockets of the more developed regions, as well.

Other vulnerabilities may be less directly linked to ICT access, but secondary linkage is also important. For example, the standards of health care provision in communities that do not have adequate access to expert sources of medical information leave individuals in those communities vulnerable to infection, disease and death unnecessarily. In agriculture, the absence of competent advice in terms of choosing, planting, fertilizing, protecting and harvesting crops can result in hunger, malnutrition and death. Such information, often provided by trained intermediaries, is likely to be more geographically concentrated than not; improvements in ICTs may make this proximate shortcoming a thing of the past.

Other vulnerabilities emanate from incapacities or disabilities that have nothing to do with where an individual or group lives. Physical disabilities are, of course, individual characteristics and can affect anyone, regardless of their location, social class, or economic status relative to their community. Illiteracy, the result of educational deprivation, is for the most part a problem in developing regions, but still maintains a foothold in almost all countries. This book acknowledges the multidimensional nature of the communities to be served and seeks solutions that encompass appropriate modes of delivery and integration with local requirements.

### Looking Ahead

As with most complex problems, there are no panaceas for poverty, vulnerability, and social exclusion; the solutions of today are partial, at best, and vary in their effectiveness. And yet there is hope on many horizons. The chapters in this book are a testament to some of the most current thinking and practices of experts from each domain, both in the field (literally) and across a variety of institutional settings. In this final chapter, we will see some of the key themes and prospects for the developing world with regard to ICTs in the years to come. However, before turning to the macro viewpoints, let's review the key findings and recommendations given in each chapter by our team of practitioners.

## Chapter Summaries

In addition to those overarching conclusions, each of the chapters describes particular issues within each domain of expertise and offers recommendations that are specific to that domain of expertise.

### Introduction

We start with the history of ICTs, the specific case of software in the context of international development projects, and the evolution of the Internet and the World Wide Web. An important concern is the role played by standards, policy and governance bodies, particularly where they have impacted the evolution and effective use of the Internet. The discussion focuses on the active engagement of such bodies and highlights the importance of policies that enhance the growth of the Internet and empower individuals to exploit it.

Such policies include: (1) training of technical professionals; (2) hosting technical and policy workshops designed to increase human capacity in Internet and related technologies; (3) supporting efforts to encourage Internet Service Provider (ISP) formation; (4) promoting growth in the ICT sector; and (5) nurturing related entrepreneurial activity.

There are significant challenges faced in these endeavors, many of which exist at the national level. They include: (1) high prices for Internet connectivity and use; (2) a lack of competition in the telecommunications market; (3) high barriers to entry for ISPs such as strict licensing or high fees; (4) maintenance of a monopoly on the national Internet gateway; (5) discouragement or prohibition of national or sub-national Internet Exchange Points (IXPs); (6) high prices for computers and networking equipment relative to neighboring countries in similar circumstances; (7) prohibitive import duties and slow, inefficient or corrupt customs clearance procedures; (8) high local taxes, and finally, last but not least; (9) restrictions on competition with existing networks.

Policies can also result in impediments unrelated to price. They include mandating ISP liability solely for transport of illegal content, non-transparent or arbitrary e-commerce legislation, unpredictable licensing requirements, lack of protection for information confidentiality or privacy, insecure e-business transactions, information services that are subject to content restrictions or censorship, prohibition of security tools such as encryption, unpublished laws or regulations, lack of respect for intellectual property, and lack of formalization of digital contracts and transactions in law.

These impediments may act singularly, or in combination, to retard or block users from accessing affordable Internet and Web services. However, every one of these impediments occurs at the national level, and can be removed at the national level. The structure of the Internet has generated an enormous variety of information and services potentially available around the world to the extent that prospective users) an access and afford it. In general, the private sector is the driving factor to make this happen, and national governments can amplify their efforts by adopting progressive and enabling national policies.

## Fundamental Access

Chapter 2 highlights many issues related to the use of ICTs for the benefit of disadvantaged communities, and offers a brief survey of the institutions and dynamics involved in the broadband ecosystem. It provides detail for many of the issues, entities and technologies involved, including national governments, incumbent operators, mobile operators, market consolidation, international capacity, national backbone infrastructures, Internet exchange points, wireless technologies, and local content and applications. There is extensive commentary on the broadband ecosystem.

Three main issues affect the availability of Internet access for disadvantaged communities:

- Availability of local and global applications and content, principally: telephony and video conferencing, instant messaging and email, social networks, payment systems, educational resources, virtual private networks, content hosting and search services.
- Availability of access devices, such as the mobile phone, low-cost smartphones, the melding of the laptop into the tablet computer and the ebook reader.
- Availability of bandwidth/connectivity, a situation where most civil society effort and public resources are being applied to address disparities in access levels.
- Government policies can affect the rate of movement toward an efficient and effective broadband ecosystem by the following actions:
- Develop national broadband strategies including targets, and establish or use an existing agency to implement the plan
- Minimize the licensing burden and other barriers to entry for providers in order to maximize competition in the connectivity market

- Align taxation policies with the plans and objectives for increased Internet access
- Adopt appropriate land use planning regulations at the national level as well as metropolitan and rural district authorities
- Facilitate transboundary infrastructure deployment and cost-based access to rights of way
- Facilitate access to alternative infrastructure
- Be responsible for the incorporation of regional institutional directives into national legal and regulatory frameworks
- Be a model customer for Internet services
- Ensure transparency of decision-making

Regulatory authorities play an important part in creating enabling environments for infrastructure provisioning. The role of the national regulatory authorities (NRAs) should be to ensure the necessary sector regulations arising from the policies described above are in place and ensure that all actors abide by them, in particular the incumbent operators. This requires that NRAs be given sufficient financial resources and legal tools to enforce adherence to the regulations.

According to the Broadband Commission, NRAs will need to be able to prevent operators from refusing to grant network access, predatory pricing, mandatory product bundling, price discrimination, and cross subsidization. NRA support for improving the use of radio spectrum is essential for deployment of cost-efficient wireless broadband access, with particular attention given to ensuring that the spectrum freed up from analog to digital TV migration is made available for broadband.

Additional important issues include improving co-ordination of infrastructure deployment, supporting the emergence of more Internet Exchange Points and improving the capacity of existing IXPs, implementing strong penalties for theft or vandalism of fiber cable and other connectivity, and ensuring that handheld access devices can be easily configured for use on any network so as to maximize choice of service providers for consumers.

The chapter concludes with a list of suggested outstanding questions and potential research topics:

- To what extent does the bottom of the pyramid need Internet access, at what price, and on what type of device? In other words, what is the expected development impact, considering, at least in the short to medium term, the potentially high data costs, energy consumption, low functionality and small screens of handheld devices?
- What is the role of gender, age, literacy, language, cultural group and income levels on the level of access uptake under more ideal access cost and coverage scenarios? What are the missing content and applications that will encourage more members of disadvantaged communities to come online?
- Will the market size/economies of scale of the mobile operators result in their continued dominance of the Internet connectivity sector? Or are there other disruptive technologies and business models that may emerge to compete more effectively with them, for which provisions in market liberalization strategies need to be made? What potential do new technologies such as mesh-WiFi networks, Ultra Wide Band and software radios have in meeting the needs for connectivity in disadvantaged communities?

- Is there a need to continue government support for public access facilities or are they unnecessary now that that mobile broadband is so prevalent?
- Where are the disadvantaged population groups at most risk of being left behind? Island nations? Special language or cultural groups?

## Technical Access

Scaling down from the macro perspective of Chapter 2, Chapter 3 offers insight in the various factors that influence technical access to ICTs, starting with factors that influence usability. They include access devices, language and character set support, mobile device size, computer and language literacy, user experience design and usability guidelines, and technological progress.

Certain concepts and technologies have the potential to improve certain aspects of usability, although poor implementations may frustrate both novice and experienced users alike. The technologies include graphical user interfaces, widgets, voice input and output, use of GPS, social networking applications and low bandwidth text transmittal.

There are numerous impediments to progress in making ICTs and particularly Web access universally available and usable. Impediments where change is inevitable include decreasing price and increasing computer literacy. Impediments where change is coming, but can be greatly helped by policy and investment, include investment in high level computer related skills, interface design skills, general literacy, language, and evolution of services by wireless providers. Development that promise improvements include decreasing prices of access devices, innovations in input and output interfaces, such as touch-sensitive screens and motion sensitive touch recognition, speech recognition and speech synthesis.

Technical access will be strongly guides by the actions of organizations. With respect to computer literacy governments, with support of donors, should increase overall computer literacy of those involved in secondary education. Primary education is the ultimate goal, but cannot be a short-to-medium term goal for many countries. They should also strive to increase computer literacy of those involved in tertiary education to ensure that all graduates have hands-on experience and a good understanding of ICTs.

Overall recommendations include:

1. Donors in conjunction with governments should ensure that all universities have an adequate computer and networking infrastructure and that their staff, students and researchers have liberal access to them.
2. Donors should fund the pilot development of innovative applications of mobile computing with a focus on making technology useful to those with little ICT knowledge or inclination. Such pilot projects must include provisions for more widespread deployment if they are successful. The approach should focus on high-end smartphones and tablets as well as low-end SMS-based technologies to ensure the widest possible penetration.
3. Governments, through reduced taxation, regulatory or other measures, should make it attractive for technology and communications vendors to support innovative use of ICT to “push usage out to the edges”. Such incentives will make the private sector more likely to take risks in exploring new markets.
4. Donors or other research funding groups should fund studies on the use of speech for input and output techniques and on touch input with the goal of developing guidelines and/or standards for their effective usage.

## Internet Access: Policy Issues for Persons with Disabilities

One class of marginalized individuals consists of those with various types of disabilities. Even though there may be differing views as to what constitutes a disability, there is a growing recognition of the importance of mainstreaming the disability perspective for sustainable development. Accessibility to information and communications technology requires public policy recommendations to include the disability dimension in a broad spectrum of social and economic concerns. Three overarching public policy drivers now inform our public policies on ease of use for the Web:

Disability and Human Rights, including the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD);

Disability and Development, including the bidirectional link to poverty; and

Disability and Demographics, including global aging and economic sustainability.

The key issues affecting access for these populations are ease of use, availability, affordability, and accessibility; all of which are familiar in the mainstream circumstances as well. However, in the case of persons with disabilities, the situation is more complex because in these cases, even if Web connectivity and the ICT infrastructure support problems were overcome, the Web might still not be available for users who require assistive computer technology (AT) and further, in areas where there is great language diversity, they may require ATs to be available in the local language as well.

Steps for removing barriers to Web availability might include the following:

- If Web connectivity is via a specific facility, such as a school, multi-media Center, tele-center or Internet café, provide an accessible building for the Web connectivity, including an accessible path of travel, accessible doors and accessible computer workstations;
- If Web connectivity is via the mobile phone, ensure that the mobile phones are designed for accessibility, so that persons with visual disabilities can use all of the phone features, such as text-to-speech for menus and digital displays, font size/contrast and screen magnification options;
- Ensure that telecommunication operators do not inadvertently block hardware and software accessibility features of mobiles upon deployment;
- If Web telephone services are available, ensure that they are compatible with hearing aids and that total conversation is provided for people with hearing and speech disabilities;
- Ensure that Web browsers, user agents and mainstream Web software have incorporated accessible design or universal design features;
- Ensure that Web devices have mainstreamed accessible design features;
- Ensure that Web terminals available to the Public have AT that enable persons with disabilities to access the Web such as screen readers, refreshable Braille displays and magnification software for persons with visual disabilities; and switch interfaces, alternative keyboards or other AT for persons with mobility disabilities.

Even with the widespread ratification of the UNCRPD and the updated accessibility guidelines, accessible web design efforts continue to be affected by a number of negative factors, including:

- Lack of legislative adoption of accessible web design standards and funding support for implementation and enforcement;

- Lack of policy guidance and funding for the maintenance and enforcement of accessible web- sites where legislative adoption of accessible web design standards is already in place;
- Lack of education, training and web development tools in the local language;
- Lack of business incentives for upgrading and investing in accessible business websites; and
- Proliferation of mobile devices, as well as web development software and content management systems that do not mainstream accessible design requirements.

The following recommendations are offered as steps to mitigate some of these issues through direct intervention in and support of specific activities:

1. Provide funding support for the ITU Connect a School, Connect a Community Project
2. Provide funding support to Project F123 to bring free and open source assistive computer technologies to developing countries in the local language
3. Provide funding support for Raising the Floor and the Global Public Inclusive Infrastructure Project
4. Provide funding support for accessibility experts with disabilities to participate in ICT standards setting organizations
5. Provide funding support for accessibility experts with disabilities to participate in national and international Web policy and legislative development

## Governance

This chapter sets the stage for the series of chapters on specific domains, from Agriculture and Health to Education, Trade, and Finance. It offers a view of the environment in which ICTs for development have evolved and provides some observations on the future of governance in the multinational context.

Two distinct but related developments took place in the first decade of the 21st century. The first was the enhancement of the World Wide Web, which brought forward a more powerful and empowering platform often referred to as Web 2.0. The second development relates to the accelerated evolution of mobile technologies and mobile phones in particular. Wireless networks are today more pervasive than traditional fiber or other fixed line networks, particularly in the developing world and the rapid development of wireless broadband technologies such as 3G and 4G is starting to provide fast and relatively affordable Internet access in previously unconnected or under-connected areas.

Thus we are seeing a second wave in the "democratization" of access to new ICTs. Both of these democratization processes have benefitted not only from improved technologies and lower access costs, but also from the current wave in the globalization process that started in the late 1980s, and has interlinked most, if not all countries in the world economically, socially and politically. The Internet, social networks and mobile technologies have made it simpler for atomized communities of people to interact, associate, share and mobilize, thus lowering the barriers to collective action.

In spite of the impressive advancements, just like historic ICTs, social networks and mobile technologies are best regarded as a means to an end. After almost 20 years supporting the use of ICTs to promote human development, international organizations working on economic and social development are well aware that ICTs are enablers that must be strategically harnessed by all sectors — governments, business, academia and civil society— to have impact on development agendas and democratic participation.

The interactive nature of the Internet and 21st century ICTs, which includes user-generated content and multi-stakeholder mass communication, shows that the new technologies also have the potential of transforming the way we interact, not only with governments and other national and global instances of governance, but also with other stakeholders on a global scale. The "democratization" of access to ICTs, especially to mobile communications devices, also opens the door for rethinking the way in which development programs are designed and implemented. With this in mind, one key role is to promote the use of ICTs, social networks and mobile technologies to build or strengthen the dialogue and engagement between governments (national, local), civil society and non-state actors. This will fortify an already weak public sphere or public space where women and marginalized populations could have stronger voices and become a critical part of decision and public policies making processes that will directly affect their lives and futures.

Governments, particularly in developing countries, should be part and parcel of this process and need to take action before the window of opportunity closes. In terms of democratic governance, the real innovation brought forward by the Internet and new ICTs is not merely quantitative, as reflected by the billions of users of the various technologies and platforms. It is rather qualitative, as it engenders transnational, distributed and decentralized networks of stakeholders who can work together and address specific global or national governance issues. In other words, new technologies can transform the way in which democratic governance may be brought to bear in different contexts. However, this process is neither automatic nor inevitable. In the end, it is up to everyone, working and networking together, to make it happen.

## Agriculture

At the present time in developing countries, ICTs remain largely unexploited to support agriculture and rural development. Yet, in seeking technological solutions to common problems, what generally works for non-technical interventions targeted at smallholder agriculture – being need-based, localized, and participatory - also applies to harnessing ICTs for this purpose. Rich learning has resulted from past experiences; yet, there are gaps in our knowledge regarding application of ICTs. A few are described below:

- Information Dissemination: There is huge amount of agricultural information available in the form of books, reports, and electronic records, including remote sensing and hydrological data. The question is how to make this material accessible in a form that can be used locally and also reproduced or further processed for wider use? In the broader market context, access to such information can help firms design insurance and credit products that are suitable for agriculture.

- Language Barriers: Localization seems to be an important factor in the uptake of agricultural information service. In the ICT context, we need to know more about the interaction of local language content with content in other languages and assess the growth of content on both fronts. Illiteracy may also restrict Internet use, although text-to-voice technologies have the potential to create a new dynamic in the growth of Internet content.

- Manufacturing and Application Design for Rural Users: Mobiles have penetrated deeply into the developing nations and yet development of appropriate mobile handsets for rural users lags. Handset makers continue to see this only as a market for cheap phones without any serious attempt to design models driven by user needs. There is also a scarcity of applications developed specifically to target the needs of these groups.

Beyond the ability to deliver information efficiently and bringing feedback to improve quality of centralized decisions, ICTs can facilitate the rapid growth of peer networks and virtual collaboration. Supporting an ecology for social embedding of ICTs implies promoting user-centric ICT applications through seed support for testing ideas and for diffusion of products and services by encouraging entrepreneurship. How can agriculture benefit from these? Some suggestions follow:

- Support solutions for small holders: A large percentage of farmers are small holders facing challenges of low productivity and more recently consequences of climate change. Connecting them to sources of information, networks and institutions can help improve productivity, manage uncertainty and enhance access to essential services. ICTs can play a promising, even transformative role here.
- Support efforts to improve accessibility of information: Farmers and farming have yet to benefit fully from the vast amounts of agriculture information available and being collected. ICTs can help aggregate and deliver information throughout the agricultural value chain to manage cropping; accessing markets; improving accuracy of weather and climate forecasting; and providing timely information inputs for early warning systems.
- Create lab-to-ground facilities: With technology and its implications for society changing rapidly, the generation of effective ICT-based solutions needs an incubation type of environment. Such incubators offer the opportunity not only to create and test new ideas, but also to discard less effective ones before they attempt to scale. The incubation space is also critical in enabling the development of appropriate business models for the most promising ideas.
- Foster knowledge partnerships: ICTs allow for the integration of local concerns to convene and lead global efforts on research, dialogue, and policy, facilitating the potential for a decentralized design of solutions. Successful ICT solutions have resulted from collaborations of development actors, technologists and entrepreneurs. Apart from the lab-to-ground facilities, other efforts at bringing these actors on common working platforms to explore partnerships for development could speed up, spread and deepen the use of ICTs.
- Build and share evidence continuously: The exponential growth of digital and telecommunication technologies and the high rate of failure of initiatives attempting to use ICTs for development problems create the imperative to track, build and share evidence on the design and use of applications at a faster rate. Mechanisms that allow for this type of broad and deep analysis could become important resources for incubating ideas, building partnerships, and informing both policy and practice to harness ICTs for agriculture and rural development effectively.
- Supporting sustainable models – Agriculture in particular and rural communities in general can benefit greatly from the use of ICTs. The most critical issue is of finding practical and sustainable solutions. What will clarify and highlight the opportunity of rural information market? What kinds of investment will be needed to trigger collaboration between technologists and entrepreneurs? How can social embedding of technologies be encouraged to improve their chance of success in addressing agriculture and rural development concerns?

These are among the many areas for future research.

## Health

If one views health as a basic human right and that one should empower individuals to become active participants in their healthcare and well-being, it is clear that the Internet is one of the major tools to enable a people-centered healthcare system. This chapter outlines a number of general and specific resources that are available on the Internet and provides commentary on some of the main vehicles for the transmission of health care information and expertise.

Mobile health (mHealth) is the medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices. The implementation of mHealth programmes is not without problems and barriers, such as competing priorities, lack of knowl-

edge concerning the possible applications of mHealth and public health outcomes, lack of country or regional eHealth policy to recognize mHealth as an approach to health-related issues, cost-effectiveness of mHealth solutions, absence of legal frameworks and operating cost.

It is expected that the combined power of the Internet and the mobile phone will bring the major change in terms of access to health information in remote areas by both healthcare professionals and the public. Mobile Internet access will overcome the barrier of isolation and absence of broadband Internet in many countries and offer process and knowledge management improvements in several areas.

### *Electronic Health Records*

The electronic health record (EHR) is an evolving concept defined as a longitudinal collection of electronic health information about individual patients and populations. EHR and the many other similar systems such as electronic medical records, electronic patient records, and personal health records have become a central piece in healthcare delivery. EMR and HIPPA listed a wide range of benefits of using an EMR or EHR, including accessibility of charts, transcription costs savings, lab and x-rays results returned automatically, electronic prescriptions, drug to drug interaction checking, drug to allergy interaction checking, increased efficiency, better patient services, improved claim submission process, reduced medical records transportation costs, and generally improved workflow.

### *Patient Education and Safety*

The quality of health information on the Internet has been a subject of serious discussion among publishers, information specialists, researchers, academicians, pressure groups, NGOs, consumer associations, decision-makers and the public at large. In recent years, a number of codes of ethics or quality standards documents have identified key principles that should be considered in order to safeguard the quality of health products and services offered on the Internet.

According to Health on the Net Foundation the following principles should be considered. Any medical or health advice provided and hosted on the site will only be given by medically trained and qualified professionals, unless it is clearly stated otherwise. The information provided on the site is designed to support, not replace, the relationship between a patient/site visitor and his/her physician. The medical/health web site pledges to respect the confidentiality of data relating to individual patients and visitors to the site, including their identity. Where appropriate, information contained on the site is supported by clear references to source data and, where possible, has specific HTML links to that data. Any claims relating to the benefits/performance of a specific treatment, commercial product or service will be supported by appropriate, balanced evidence in the manner outlined above. The designers of the web site will seek to provide information in the clearest possible manner and provide contact addresses for visitors that seek further information or support. Support for the web site will be clearly identified, including the identities of commercial and non-commercial organizations that have contributed funding, services or material. Finally, if advertising is a source of funding, this will be clearly stated. A brief description of the advertising policy adopted by the web site owners will be displayed on the site.

While these principles support best quality information services and content on the web, in the context of the developing world, there are additional considerations, including language and complexity barriers, audience and contextual challenges, unavailability of specific services or products in certain parts of the world, difficulty in interpreting scientific data, ascertaining the accuracy and currency of information, and potential for source bias, source distortion, and self-serving information. Countries are encouraged to develop their own quality measures, guidelines and codes of ethics to help their populations make better judgments on what they find on the Internet and to help them develop their own health information products and services which will provide a high-quality response to the needs of their people.

### *eHealth challenges*

A number of insufficiencies have been identified to limit the introduction of eHealth in countries and organizations. They include lack of proper needs assessment, lack of vision, strategy, and national plans, lack of information and awareness about ICT applications, computer illiteracy, insufficient resources to meet cost, limited experience in medical informatics, weak information and telecommunications infrastructures, and an absence of legislative, ethical, and constitutional frameworks. These are formidable barriers.

As more eHealth applications and systems being deployed, more challenges emerge:

- Sustainability of projects as many start as pilots without a funding and/or cost-recovery model.
- Interoperability and standardization as many applications, even in the same organization were not designed to allow for data exchange among them or to be compatible.
- Lack of evidence on value, impact and return on investment of eHealth. Decision makers and donors are not convinced that eHealth reduces cost, improves quality of service and enables equity.
- Language and cultural barriers as many eHealth solutions were developed in and for environments other than those importing them. The vast majority of the Internet content is in English and many computer applications in health are in "foreign languages and made for a different culture".
- Lack of full engagement of healthcare professionals in development of eHealth solutions. This is coupled with an overabundance of commercially driven solutions.
- Many countries have not developed guidance, policy or regulations to protect personal data on the Internet on in electronic health records, reducing the trust in eHealth systems.

Information and communication technologies are enablers to management and utilization of health knowledge. The increasing volume of health information and the total dependency of the health sector on information requires proper ICT infrastructure. The use of ICT in health ranges from education, health promotion, medical education, health care delivery, surveillance and disease management, to diagnosis and treatment of patients. eHealth has the potential to transform the healthcare through its ability to manage health information, reduce medical errors, improve quality of health personnel, contributing to better lifestyle, improve transparency and accountability and reduce cost of care.

## Education

For the Web to be used effectively in support of learning, five critical things need to be in place:

- Governments need to have integrated national ICT strategies that incorporate explicit attention to the use ICT in education and learning. If the potential of Web-based learning is to be realized, then one must have broadband access and electricity available everywhere that learning takes place.
- These strategies must place teacher training at their heart. Teachers need to be trained in how to use ICTs for their own professional development, and in how to use them effectively in their teaching..
- Third, attention should be paid to the inclusivity of learning. Unless specific focus is placed on the needs of people with disabilities, the elderly, and the marginalized, there is a very real danger that Web-based learning will lead to further differentiation and disadvantage for the least advantaged.

- Despite the shift to the privatization of education in many global systems, utilization of the enormous potential of open educational resources needs to be specifically advocated.
- Much more attention needs to be paid to the effective use of mobile devices in learning. Most people will soon primarily access the Web through a tablet or mobile hand-held device. This will transform learning, and educators must prepare for this. Computer labs will soon become a thing of the past.

These are critical points of leverage that can enable education to be transformed through the use of the Web, and they provide the map guiding this educational exploration. Education needs to be examined in a development context, including connected learners, unconnected learners, and content. Significant emphasis needs to be placed on the importance of teaching educators in the use of ICTs both for classroom use and beyond.

Despite the vast amounts of information on the Web, its full potential has not yet been unlocked in terms of being a truly effective vehicle for education around the world. Even in the richest countries of the world, with computers in every school and interactive whiteboards in every classroom, the Web remains primarily a resource for gathering information; its potential for developing innovative forms of communication and shared knowledge creation is surprisingly underutilized.

Among the poorest people, and in the most marginalized communities, the Web is even less accessible, even though the information could help to empower them. This is not so much because of a lack of connectivity, electric power and infrastructure, but because the educational community has not yet grasped the full potential of the Web. As mobile devices become ubiquitous, and mobile Internet opens up the remaining 25% of the world that does not yet have connectivity, it is crucial that this opportunity is grasped.

Otherwise, like most technologies before it, the Web will continue to serve the interests of the richer and more powerful, to the detriment of the poor and marginalized. Many mobile learning initiatives have failed to take root, and it is remarkable how few university students yet use the full potential of their mobile devices to contribute to their learning. However, with the rapid development of mobile broadband solutions, with the creation of even better handheld devices in the future, and with the realization that such technologies can indeed transform education, then learners will increasingly demand access to appropriate and sophisticated learning resources that they can access through their mobiles to use the Web in innovative ways, especially for those who remain outside traditional educational systems.

## Commerce and Trade

Sustained equitable growth is essential for making substantial progress in creating wealth and reducing poverty. Enterprises play a crucial role in this context. However, benefits from ICT use are not an outcome of the technology itself, but rather of what the technology enables managers and workers to do. The positive impact of having access to affordable ICTs expands when it effectively meets the needs of the users. Although all enterprises have a need for effective communication and for accessing information of various kinds, the extent to which an enterprise could benefit from using ICTs for other purposes varies greatly.

For subsistence-based enterprises (i.e. those which provide the most direct livelihood support for the poor) accessing client markets (especially distant markets) presents a particular challenge, requiring interaction with market intermediaries. For most such enterprises, markets are restricted to the immediate community or district centers. Enterprises serving local markets often rely on information delivered informally through local networks of communication, where trust and risk reduction are major factors that govern their dependence on networks. Lack of timeliness of information is a serious, but common, failure of the information delivery system used and constitutes a significant aspect of the vulnerability of subsistence-based enterprises to changes in

the surrounding environment. The quantity and ranges of information obtained through traditional channels are also an issue, with barriers including literacy and fluency in non-native languages. Weaknesses in informal information sourcing should similarly be recognized.

Growth-oriented enterprises, by contrast, frequently seek to extend their market reach. Their sectoral value chains often reach beyond the district locality to main centers of population and sometimes across national boundaries. A higher degree of integration of enterprises into market systems requires more formalization of information systems. Particular characteristics of the transition towards greater formalization include (1) growing demand for an increased volume and complexity of information, as the value of information is better recognized; (2) reduced information needs gaps, as internal capacity to meet information requirements rises; and (3) greater emphasis on external communication. This transition may be accompanied by a move from a manual paper-based information system to the use of ICTs for internal processing of information (with PC applications), and from face-to-face contact or telephony (pre-existing landlines/payphones) to ICTs for external communication (using mobile phones or email/Internet).

By integrating into global value chains (GVCs), enterprises in developing countries can potentially access relatively secure and high volume markets for a broad range of goods and services. However, in order to do so effectively, they need the capacity to handle large-scale production for exports and to conform to strict product, process and environmental quality standards. This in turn often requires an even higher degree of formalization of information systems, including the use of ICTs. Therefore, those who lack the capacity and opportunity to comply with international standards tend to be marginalized and excluded from GVCs.

Judging from the available evidence, the main observed benefits of ICT use in enterprises of relevance to the poor are twofold: 1) a reduction in information search and transactions costs for those involved in enterprise; and 2) improved communications within supply chains, leading to benefits for individual enterprises and overall improvements in market efficiency.

### *Some Implications for Policy*

The expansion of the "information economy" has led to a restructuring of GVCs, with large shifts in the composition of world trade, both sectorally and geographically. In particular, improved tradability of services has led to the fragmentation of a range of business activities that were previously undertaken in-house. The trend towards open innovation and outsourcing of a diverse set of business functions has helped some developing countries to make inroads into global production and knowledge systems. Moreover, the changing ICT landscape in the past few years – especially linked to the spread of mobile telephony – has created opportunities for leveraging ICTs also among less affluent segments of the population. Such disruptive innovations as mobile money system are beginning to act as lubricants in the economy of some low-income countries, helping to facilitate a better and more efficient allocation of available capital. Recent introductions of cloud computing and smart electrical grids are further illustrations of how new technology is being applied in novel ways and in new areas.

Development agencies can help improve the evidence base by commissioning targeted research to help address remaining knowledge gaps. They can also develop guidelines for use by governments and other actors in different countries. Critical issues in any programme of research and analysis along these lines include: better measurement of ICT use by enterprises, assessments of the need among different enterprises for ICTs, systematic impact assessments of ICT use, and analyses of the best ways of using ICTs in the provisions of government support services to relevant kinds of enterprise.

Governments have an essential role to play in this context, to ensure that the outcome of more widespread use of ICTs is positive from a development perspective. Despite progress in infrastructure and connectivity, there are

many bottlenecks that prevent entrepreneurs and small firms from using ICTs efficiently. Its use is often limited by low levels of ICT literacy, slow connection speed, a lack of local content and high costs of use. Productive use of ICTs also requires laws and regulations to address a set of issues, such as the legal validity of electronic documents, e-signatures, privacy, intellectual property rights, cybercrime, building trust and protecting consumers.

Meanwhile, the readiness in the development community to leverage the new possibilities is currently far below its peak. A number of bilateral donors that invested significantly in ICT4D before and during WSIS have dropped explicit ICT4D programmes from their portfolios, even if they continue to support the mainstreaming of ICTs in other development sectors. The "ICT revolution" resembles previous technological upheavals that have had profound consequences for economic development.

Because the ICT revolution is relevant not just to the high-tech, information-intensive sectors, but also to the whole organization of economic life, its effects are spilling over more quickly into most sectors of the economy. In that context, developing countries may stand a better chance of sharing in its benefits than in previous technological revolutions.

## Finance

Internet banking has grown rapidly in the industrialized countries, but less so in the developing world due to constraints of infrastructure, access, affordability and user acceptance. Mobile phone networks, on the other hand, are close to providing a universal access infrastructure for data as well as voice transmission, offering a platform for a wide range of new mobile financial (m-finance) services that have the potential to reach the mass of populations located in both urban and rural areas of low income countries. M-finance is an umbrella term that incorporates a range of emerging services, including person-to-person (P2P) mobile transfers (m-transfers) and mobile payments (m-payments). Mobile banking (m-banking) can incorporate m-payments and m-transfers, but it is more concerned with delivering a broader range of banking services, such as account-based savings, credit or other transaction products offered by banks. M-payments and m-banking are subsets of the broader domains of e-payments and e-banking which incorporate other ICTs including web-based applications that integrate user interfaces and networks with back office systems and data centres which can be located anywhere around the globe.

Much of the optimism surrounding the potential for m-finance in developing countries is founded on early success stories. One of the most notable examples is M-PESA (meaning mobile-money), operated by Safaricom in Kenya, which is built on domestic m-transfers. Other examples are SMART Money and Globe GCash in the Philippines that offer a broader range of services (debit/credit payments through merchants, utility payments, domestic and international cash transfers). Against this background, two key questions arise. First, to what extent can the success of M-PESA, Globe GCash, and SMART Money be replicated in other country contexts? Second, how, and to what degree, can market penetration for m-payments be expanded to address a broader set of financial service needs of the unbanked? Although some evidence of greater financial inclusion is starting to emerge, this remains an open question.

### *Impediments to Progress*

Given the plethora of early deployments a key impediment to progress in m-finance is achieving scale and traction in individual markets. There are three factors that govern speed-to-scale. The first is the need to stimulate 'network effects', a process by which the benefits to the individual user grow as the network grows. Thus, a network with few active users will find it difficult to attract new customers, while one with a growing user base will gain momentum through this effect, also known as Metcalfe's Law.

Second is the need to attract both customers and distribution agents in tandem. It will be difficult to attract agents in a particular district where demand from customers is low. On the other hand, new customers cannot be attracted to a service without a local presence of agents (a chicken and egg conundrum). Third, new customers will most often be attracted and retained through building empathy with the system. Evidence suggests that in developing country environments, empathy (or trust) for first time users are driven largely by word-of-mouth recommendation from existing to new customers. A key requirement, therefore, for any m-finance offering is to inculcate a perceived need for the service: first, amongst customers – many of whom may be using formal banking services for the first time, and second, through incentivizing agents (in the case of m-transfers) or merchants (in the case of m-payments) to provide the service to customers. This requires a very high investment of money, time and human resources on the part of the service providers (mobile phone companies in partnership with banks) in marketing, promoting and supporting the services that have been offered.

Another key impediment is lack of interoperability between networks. Choice in the market has brought advantages of product innovation leading to differentiated services, competitive pricing, and rapid service penetration, but also disadvantages, primarily those arising from the lack of interoperability between competing service providers. Lack of interoperability is also an impediment for commercial transactions and payments – particularly those that may suit micro-entrepreneurs – who will increasingly demand a low cost means to facilitate electronic payment for the goods and services they offer.

Access for the financially excluded stands out as another barrier to wider spread adoption of m-finance. A key determining factor for financial sector participation is formal sector employment (implying higher and more regular levels of income and consumption). Other factors that correlate to adoption of the new technology include gender, age and poverty level proxy indicators such as ownership of assets. A further set of impediments are those that relate to the perception of potential users; this entails a complex set of factors that have yet to be researched in detail for current deployments. This includes trust in technological systems – in the less conspicuous software designs, network architectures and operational models that lie behind the hardware interface of the mobile handset. More critically, this also involves trust in the organisations that are offering the services. For agent-based services, this operates across two different levels – the agent/intermediary and the financial service provider.

Trust in systems is also threatened by the perceived or real threats to security, data privacy, theft and fraud. These may be threats to the individual user including loss or theft of the phone or SIM card and possible theft of identity, the defrauding of the customer by unscrupulous agents by demanding incorrect fees or the stealing of money by various false transaction means. There may also be threats to the integrity of the system as a whole which may include money laundering for criminal or terrorist financing, or organised criminal activity designed to exploit loopholes in the operators' systems.

### *Recommendations and Promising Areas of Future Work*

First, our approach to m-finance should move away from a prescriptive 'one-size-fits-all' approach. Rather we must recognise the considerable differences in the socio-economic environment within which m-finance initiatives are being introduced. The diversity of factors is important for understanding why m-finance technologies may achieve differing degrees of up-take and use in various countries or between groups and regions in the same country.

Second, there is a need to understand the potential of m-finance applications that move beyond m-transfers to encompass m-payments and account-based services, thus addressing the potential for greater financial inclusion directly. As suggested previously, the specific financial needs of the poor should drive consideration of applications that could be tailored to those needs. An initial requirement, for example, is to define the extent

and pattern of mobile phone ownership and use amongst the poor more accurately – this type of data is largely unavailable or unknown for most countries.

Third, if our focus is to be on the poor and disadvantaged, then we should consider applications that are clearly appropriate to their needs, particularly where existing platforms can extend the reach of services to the poor/unbanked in innovative ways. Areas of potential demand for m-finance may include the provision of micro-insurance and the facilitation social cash transfers. Micro-insurance can be used to protect against susceptibility to weather extremes, price variability and health risks. The ability of m-payment systems to reduce transaction costs could also be an important factor for enhancing their reach and sustainability.

Finally, there is a need to investigate the consequences of m-finance for non-users. Those who are already disadvantaged (the chronically poor and illiterate) may become further marginalized due to having to use more expensive and less reliable options and being cut off from the development of emerging financial systems. Access for those who cannot use textual interfaces can be also assisted by innovation in user-centered design that promotes alternative voice or graphically activated user interfaces. Alternatively, solutions could be far more opportunity and learning focused rather than technical fixes. In this respect, there is need to understand what forms of assisted or 'mediated' access are the most effective – kiosk operators, agents, community-based groups or other dedicated providers, or informally through family and friends.

## Gender

Gender issues with regard to ICTs are an important component of the potential for development, intertwined with the challenges of poverty, illiteracy, and discrimination in poor and vulnerable populations. In addition to the technical challenges of availability, affordability, and accessibility, gender adds a fourth dimension to the prospective inclusiveness of ICTs. There is much to be said regarding particular challenges faced by women with regard to the three categories above, and how technological advances offer some solutions.

Given the issues concerning both public and private Internet access, mobile phones are particularly useful for women's empowerment. They can be used even when working in the fields or when away from home. Initial capital costs are less than those of computers. Further, the learning curve is less steep than that of computers. Women appear to find mobiles more relevant for easy social contact with family and friends, small-scale business purposes (e.g. collecting outstanding debts, following up on orders), easy and fast communication at all times, emergency communication, increased security at night, and reduced travel costs.

Mobiles have been shown to offer economic benefits, health information benefits, and security benefits to women. It is a reasonable projection that just as non-Internet connected phones have spread widely through developing countries, with significant numbers of women using them, current mobile phone users in developing will come (albeit more slowly than in developed countries) to mobile broadband. As awareness of the Internet grows, the poor will try to take advantage of the opportunities it offers, with smartphones becoming the most accessible means of access, particular as the costs of acquisition and use drop.

While the Internet can exacerbate inequalities, it also offers immense opportunities to the marginalized. However, special efforts need to be made to reach women and girls. The key element is being aware of cultural and social contexts and of gender relations. In strategies, programs and projects, women need to be directly targeted. Attention to gender issues is an absolute necessity in promoting and facilitating the equal access of women and girls, including those living in rural areas, to the Internet.

Actions at the project level need to involve local women in setting the agenda. Governments need to provide the enabling framework in the form of gender-aware policies and strategies, not only in ICTs, but also in other

areas including education, health, labor and agriculture. There are many barriers to cross, but once crossed all of society will benefit from the full participation of all its members. The most hopeful sign on the horizon is the eagerness of the young of all nations to use the Internet, regardless of divisions based on education, class, income, residence, race, ethnicity, and gender.

## Language

One important component of the so-called digital divide is a language divide. Digital inclusiveness policies cannot stop at access but, together with access, focus on local content and local language as well as on education to nurture new content producers, a process which starts by encouraging digital literacy. Insuring the full presence of a language in the digital world is a complex process that requires a holistic perspective from encoding, keyboard production, linguistic software development (word processor and syntax checker, for example) to digital literacy and content production. Beyond those elements, the existence of digital libraries for literature in the language as well as online resources for learning and processing the language (such as dictionaries, grammar guidelines, glossaries) are also of great importance.

In some cases, linguistic leaders should join efforts and reach consensus on standards concerning their native languages, but this is not an easy task. Further development in cooperation with UNICODE may be required to define the coding schemes that cover all needs. Many languages have no written form and proponents will need to define an alphabet as a prerequisite to pushing them forward onto the Web. The option to use voice recording instead of text does exist and could be a fast track to online presence, but it will not allow the same level of integration as written forms and should only be the preferred mode for disappeared languages, endangered languages, or languages having a very small number of speakers.

The main impediments to progress are in the very systemic nature of the solution for one language and the huge number of languages that are involved. However, if, for a given language, motivated champions take charge and the interested group has the political will to overcome the challenges, the systemic phenomenon could turn into a virtuous circle and progress could be achieved relatively quickly. Not many languages have been the object of public policies to insure their revival in the real world. However, most languages have some intersection with digital public policies; what is at stake is not simply the presence of new languages in the digital world, but also the promotion of existing languages on the Internet since there are significant economic, social and cultural implications in having a strong presence in cyberspace. The key to reversing this complex downward spiral of some languages lies in raising the awareness of policy, institutional and foundation players and the emergence of a group of champions in each linguistic community capable to move the progress forward.

### *Recommendations*

Maintaining the same linguistic diversity in the virtual world that exists in the real world, contributing to the preservation of endangered languages, and keeping the memory of languages that have disappeared alive are complex and difficult objectives. As in many complex issues, political will is a critical factor for success. The subject is still not well understood by civil society and advocacy and sensitization actions are required. The Internet actors have a particular responsibility in that process: the duty of coherence.

It is impossible to develop efficient public policies without creating and maintaining a set of indicators that serve as qualitative and quantitative bases for evaluating the situation and its evolution; thus one of the top priorities is to build the capacity to produce indicators on the presence of languages in cyberspace.

Above all, it is important to nourish a wide range of bottom up initiatives and give them the opportunity to network among themselves so that groups with similar issues can be aware of innovative solutions to language

diversity problems and benefit from them and reuse them. In this way, organizational and individual energy can be directed in as highly productive and collaborative a manner as possible.

## Culture

Culture may be loosely defined as (1) an integrated pattern of human knowledge, belief, and behavior that depends on the capacity for symbolic thought and social learning; and (2) the set of shared attitudes, values, goals, and practices that characterize an institution, organization or group. We may extend our philosophical understanding of culture to embrace our education, the environment of that education, the knowledge acquired in the course of the education, as well as the value gained from it. In terms of human values, we may include our arts, sciences, civilization, conventions, customs, ethnology, grounding, lifestyle, innate behavior, knowledge and lore. Some cultural scholars have gone further to include improvements, enlightenment, good taste, manners, refinement, savoir-faire, proficiency, skill, tact and perception in their view of culture. Regardless of whether we may prefer the larger philosophical sweep or the shallow framework, our look at culture will include the basics of our way of life as human beings.

### *Digital Culture*

How do ICTs and digital media affect human culture? The shifts in culture that the Internet has enabled are many and diverse, including the reporting of news, range of societal participation, ease of political engagement, social mobilization, scope of humanitarian action, human rights activism , political expression and involvement in governance, and business operations.

As a tool that fosters development for all humanity, it is important that the Internet also draws from the developing world. In seeking answers to the question: “What can developing countries offer the Internet”, the following benefits emerge.

- Population: Most of the world’s population resides in developing countries. This represents a huge market for web products and services.
- Wealth of cultures: In matters of cultural expression, the developing world can enrich the cultural and linguistic diversity of the Internet. Global cultural content input on the Web will be successful, if people are motivated to share their individual and collective cultures.
- Youth work force: While aging is increasingly becoming a problem in many developed countries, the developing countries have a blossoming youth population. With education infrastructure on the increase, an intellectual workforce is emerging that can contribute to the growth of the Internet.
- Inclusiveness: The developing world can offer new perspectives on the development and uses of a Web that is truly inclusive as all members of the global society and providing guidance on initiatives for localization, topicalization and translation.

A shift in cultural values will be needed in order for the Web to gain traction to support the poor and underserved. The obstacles to access lie in a number of major areas including the physical location of Internet-enabled service centers, relevant content, language, affordability, cultural restrictions on women, and illiteracy. To address these issues the following concepts are suggested.

### *Literacy and Education*

There is important link between literacy levels and the potential of the Internet to support economic and social development. Basic literacy precedes digital literacy. The second of eight Millennium Development Goals, universal primary education, is a key to optimum benefits of Internet potentials for development. The ability to read and write is a necessary condition for reading and writing online. Exploiting the Internet for development, therefore, must strategically include investment in universal primary education, adult literacy initiatives and ICT education in schools.

### *Free Software and Open Source Technology*

Free software and open source technology offer huge potentials to developing countries to carve a niche in the global development landscape. Access to the source material of software and hardware permits them to be modified to adapt to different cultural and linguistic contexts. Support in raising in-country capacities in free software and open source technology is a sure way to empower local and national Internet communities. Open data initiatives, open and transparent governance and citizen-generated and sourced information will go a long way in ensuring that developing countries make the best social, cultural and economic use of the Internet.

### *Mobile Technology*

The domain of mobile phones and mobile telephony will be instrumental in the access to the Internet and consequently, may play a greater role in the use of the Web for assisting the poor and underserved. By offering basic services and simplifying operations, the mobile phone has brought the Web home via the mobile telephony infrastructure. Nonetheless, Web access on mobile technology has yet to surmount the obstacles of language, content relevance and price.

### *Openness, Democracy and Good Governance*

Openness has been a fundamental principle in the development of the Internet. Web 2.0, which integrated interactivity in cyberspace, was also fundamental in engaging users in new ways. These days, social media depend greatly on user-generated content. Given this new paradigm, in governance, in platforms, in function and in content, the "openness" of the Web needs to be protected, promoted and safeguarded. This capacity for citizens to express their opinions, including government criticism, on diverse Web spaces have not always been welcome by regimes that have dictatorial, proprietary and corrupt governance tendencies. Web content still come under censorship in many developing countries. Bloggers and journalists are still being tracked and occasionally imprisoned. In worst cases, national Internet access has either been completely disabled, disrupted or under very strict surveillance.

### *The Internet as a Human Right*

At the present time, Estonia, Finland and Spain have declared access to the Internet as a legal right for their citizens. The issue is being discussed, including in some parliamentary bodies. Formal adoption of access to the Internet as a legal right may drive budgetary allocations and help resolve some the financial challenges to more universal access. Other players may intervene as well, and more investment from multilateral and bilateral donors could be directed towards Internet access for the poor and underserved. The counter view is that it is access to information that is and should be a human right, and not access to a specific tool to obtain that information. We are still some distance away from even achieving that more overarching human right on a global basis.

## Conclusion

The contribution of ICT to development and to addressing the needs of the poor, the underserved, and the marginalized is a complex subject. This book has attempted to offer insights into a number of dimensions of this issue, and to provide not only an appreciation of the dimensions of the subject, but also some practical measures for increasing the contributions that can be made.

A main focus has been on the World Wide Web, arguably the best organizer of content and knowledge available on the Internet for all to access. Since its inception, content has continuously migrated to the Web where it can be efficiently observed, searched, augmented and used. The evolution of the Web itself has spawned entirely new applications and services, and is likely to be the primary ICT vehicle both for achieving development goals, whether they are defined by country, region, population group, or income level, and for ameliorating the information poverty and resulting loss of potential assistance for poor, underserved and marginalized groups. This book has been written to provide a better understanding of the Web's potential to improve the state of such groups, and the authors hope that it has succeeded in doing so.

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# Author Biographies

## Najeeb Al-Shorbaji

Dr. Najeeb Al-Shorbaji has been working as Director, Department of Knowledge Management and Sharing at the World Health Organization Headquarters (WHO/HQ) in Geneva since September 2008. Prior to that, he held the posts of Information Scientist, Regional Adviser for Health Information Management and Telecommunication and Coordinator for Knowledge Management and Sharing for WHO Eastern Mediterranean Region until August 2008. During his 20 years of work for the WHO Eastern Mediterranean Regional Office (in Amman and Cairo), he organized over 15 regional conferences on information networks, eHealth and health informatics, he initiated a number of eHealth and knowledge management projects, he lead the development of the regional health knowledge network and assisted countries in development of national eHealth plans and activities.

Dr. Al-Shorbaji's current portfolio covers WHO publishing activities and programmes, library and knowledge networks, knowledge translation, eHealth, and WHO Collaborating Centers. He is a member of a number of national and international professional societies and associations specialized in information management and health informatics. He has authored over 80 research papers and articles presented in various conferences and published in professional journals. He has given a number of webinars and interviews on eHealth.

He is from Jordan, married and holds a PhD in Information Sciences since 1986.

## Richard Duncombe

Dr. Richard Duncombe is a researcher at the Centre for Development Informatics (CDI) at the University of Manchester in the UK. His previous funded research projects have assessed the role of information systems and technology (including eCommerce) for small enterprise development with a country focus on Uganda, Botswana and India. Current research is focused on assessing the design, adoption and impact of mobile services and technologies in developing countries. Dr. Duncombe has also carried out a range of consultancy in the field of ICTs and socio-economic development for The World Bank, DFID, the Commonwealth Telecommunications Organisation (CTO), UNIDO and UNCTAD.

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## Torbjörn Fredriksson

Torbjörn Fredriksson is Chief of the ICT Analysis Section of the Division on Technology and Logistics at the United Nations Conference on Trade and Development (UNCTAD). In this capacity, he is responsible for the Information Economy Report, one of few annual publications that monitor global trends related to ICTs from a development perspective. Mr. Fredriksson is also in charge of UNCTAD's work related to measuring the information economy, and a member of the Steering Committee of the Partnership on Measuring ICT for Development, an international, multi-stakeholder initiative to improve the availability and quality of ICT data and indicators, particularly in developing countries.

Mr. Fredriksson previously led the Policy Issues Section of the Investment Analysis Branch of UNCTAD's Investment and Enterprise Division. From 2000-2008, he was one of the principal authors of the World Investment Report. Before joining UNCTAD, Mr. Fredriksson was Head of Research at the Invest in Sweden Agency, Head of Section in the Ministry of Industry and Commerce in Sweden, and a researcher at the Industrial Institute for Economic and Social Research in Stockholm (1992-1994). Mr. Fredriksson is the author of several books and has published articles related to international trade and investment in such publications as the Journal of International Business Studies, International Journal of Industrial Organization and the Journal of World Investment. He holds an MSc in International Economics from the Stockholm School of Economics.

## Alan Greenberg

Alan Greenberg has spent the majority of his professional career in positions related to the development, support and management of computing and telecommunications resources. His interest in user interfaces dates back almost forty-five years when he was responsible for designing an early interactive computing system aimed at non-technical end-users. He was one of a handful of people who brought the Internet and its predecessor networks to Canada and worked on a variety of Canadian and international networking initiatives.

He has been active in supporting the growth of the Internet and other technologies in the developing world, initially with the Internet Society's Network Training Workshops and later as an independent consultant supporting bilateral development cooperation. In the latter capacity, he has been involved with the formulation and evaluation of operational projects in developing countries and has helped donor countries establish their development cooperation policies for ICT support. He also works with ICANN, the organization responsible for Internet domain names supporting the needs of Internet users. Mr. Greenberg has a BSc in Mathematics and Physics and an MSc in Computer Science, both from McGill University.

## Nancy J. Hafkin

Nancy Hafkin has been working on research and information issues in developing countries, with a focus on gender, for 40 years. This engagement began with her Ph.D. in African history and publication of Women in Africa: Studies in Social and Economic Change. In 1976, she began working as head of research, in the first international program on women at development, located at the United Nations Economic Commission for Africa in Addis Ababa, Ethiopia. She went on to head the United Nations program on promoting information technology in Africa in 1986, where she founded and coordinated the African Information Society Initiative, as well as the Partnership for ICTs in Africa (PICTA). In 2000, the Association for Progressive Communications established the annual Nancy Hafkin Communications Prize competition.

Nancy has written widely on information technology, gender and international development, most recently with Sophia Huyer in Cinderella or Cyberella: Empowering Women in the Information Society and Engendering the Knowledge Society: Measuring Women's Participation. She is a member of the Scientific Committee of the IDRC-sponsored Pan African Research Agenda on the Pedagogical Integration of ICTs, a project to develop, collect and disseminate indicators of computer use in African schools, and she serves as a board member of the international development NGO PACT. Nancy currently lives in Framingham, MA (USA). She is the mother of two children and the grandmother of one.

## Michael Jensen

Mike Jensen is a South African independent ICT consultant who has assisted in the establishment of Internet-based communication systems in more than 40 developing countries over the last 20 years, mainly in Africa. He provides advice to international development agencies, the private sector, NGOs and governments in the formulation, management and evaluation of their Internet and telecommunication projects, ranging from national ICT policy development to international fibre and rural wireless telecommunication feasibility studies.

Having graduated in ecology in Northern Ireland, Mike sent his first email 30 years ago while studying for his Masters degree in rural planning and development in Canada. He subsequently returned to South Africa to work as a journalist on the leading national newspaper in Johannesburg, the Rand Daily Mail. When the paper closed in 1983, with little sign of improvement in the political situation in South Africa, he moved back to Canada, and in 1987 he co-founded the country's national Internet service provider for NGOs, called coincidentally, The Web.

Mike's clients include The World Bank, African Development Bank, the Internet Society, the UK Dept for International Development, the UN World Food Programme, UNESCO, the Canadian International Development Research Centre (IDRC), and the Bill and Melinda Gates Foundation. A member of the African Conference of Ministers' High Level Working Group which developed the African Information Society Initiative (AISI) in 1996, Mr. Jensen's recent projects include strategic advice on cross-border fibre provision in Africa, and a case study of national broadband deployment in Brazil, and an evaluation of the Government of Sri Lanka's public access to ICTs programme.

## Shalini Kala

Shalini Kala has had a strong interest in rural livelihoods and agriculture for over 20 years. During this time, she developed and managed programs on rural enterprise and livelihoods for marginal and poor farmers, conducted research on agricultural policy reform and assisted with programs to improve linkages among farmers, agricultural research organizations, and public agencies.

In the last 10 years, her focus has been on research to improve conditions for small holders and the landless, with a particular emphasis on providing access to information, strengthening rural knowledge systems to improve market linkages, productivity and incomes and the role that information and communication technology can play in these endeavors. She has worked across the Asia-Pacific region and has contributed to programs in Africa, the Middle-East and Latin America. She has an advanced degree in Economics. Shalini lives with her family in Delhi, India, enjoying its cultural diversity and its short spells of autumn.

## Barbara J. Mack

For the past ten years, Ms. Mack has worked as a consultant, writer and researcher on projects involving international development, social entrepreneurship, technology, trade and investment. She has particular expertise in venture capital and private equity investment, emerging technologies, and public-private partnerships. She also has experience in supporting and evaluating business-government-university collaborations.

Ms. Mack's previous work experience includes appointments as a Research Associate at Harvard Business School and a Case Writer at Harvard Kennedy School of Government. She has worked with expert teams at MIT's Sloan School of Management, the MIT Computer Science and Artificial Intelligence Lab (CSAIL), and the Media Lab. She has also served as a writer and consultant on projects for The World Bank, the World Economic Forum, the Climate Change Secretariat of the United Nations, and the World Web Foundation. Ms. Mack's international experience includes projects in Western Europe, Japan, and Singapore.

Ms. Mack earned a Bachelor of Arts in English and Anthropology from Tufts University and a Master in Public Administration from Harvard Kennedy School. Further information about her consulting firm, Pingry Hill Enterprises, Inc., may be found at www.pingryhill.com

## Nnenna Nwakanma

Nnenna Nwakanma is the Founder and CEO of NNENNA.ORG and focuses on making ICT expertise available to governments, businesses, think tanks, development partners and the members of civil society. She has been on the board of directors of the Open Source Initiative and is currently the Chair of the Free Software and Open Source Foundation for Africa - FOSSFA. She also has professional experience with the African Development Bank (AfDB), The Helen Keller Foundation (HKI), The Global Digital Solidarity Fund (DSF), the Diplomacy Institute and the African Information Society Initiative (AISI).

Nnenna ranks first across social media platforms in her West African base country, Côte d'Ivoire, speaks 5 African languages, has lived in 7 African countries and mentors dozens of young men and women in the use of web for personal growth and development. She trained across Sociology, English Language, History, International Relations and Law. Nnenna now spends some 100 hours on the Internet every week and believes that broadband Internet access should be a fundamental human right.

## Daniel Pimienta

Daniel Pimienta was born in Morocco, read Applied Mathematics in Nice and holds a Ph.D. in Computer Sciences. After creating a software house specialized in APL, he joined IBM France, (La Gaude Laboratory) and worked 12 years as Telecommunication System Architect and Planner, participating in voice/data integration products, videotex and OSI protocol testing. In 1988, he joined Union Latina, in Santo Domingo, as Scientific Advisor and Head of REDALC project, focusing ICT for development (ICT4D). With the support of European Union and Unesco, his team designed the first PC based multilingual interface to networks (MULBRI 1989) and built (and operated) Research and NGO networks in Peru (1991), Dominican Republic (1992) and Haiti (1993).

In 1993, he launched the Foundation Networks & Development (FUNREDES) and defined and managed several projects on virtual communities, sensitizing and educating users, elaborating multi-stakeholders strategies, experimenting appropriate methodologies for sustainable development, with a special focus on participative democracy with ICT, research-action on social impact of ICT, observation of ICT public policies and alternative methodologies for IS Indicators, promoting Caribbean region integration, observing languages and cultures on the Internet and fostering linguistic diversity in the Digital World. FUNREDES is member, among other global fora, of the APC Network and of the Executive Committee of the World Linguistic Diversity Network.

Daniel Pimienta is an international consultant, speaker and writer on ICT4D and an active civil society player around Information Society themes; nominated in 2003 for the "World Technology Award for Innovation" in Ethics, he was given, in 2008, the Namur Award (IFIP WG9.2) for his comprehensive actions in the perspective of a positive social impact of ICT.

## George Sadowsky

George Sadowsky studied and taught mathematics at Harvard and received his Ph.D. in Economics from Yale. He worked as a mathematician and programmer and headed computing centers at the Brookings Institution, Northwestern University, and New York University. At the United Nations, he supported technical assistance projects and he has worked in more than 50 developing countries.

He has been a consultant to, inter alia, the U.S. Treasury, UNDP, USAID, the Web Foundation, the Swiss Government, and The World Bank. He has served on Boards of AppliedTheory Corporation, educational networks CREN and NYSERNet, and the Internet Society, where he directed ISOC's Developing Country Network Training Workshops. He was Executive Director of GIPI, the Global Internet Policy Initiative. He is currently a member of the ICANN Board of Directors. He has written and lectured extensively on ICT and development. More detailed information is available at www.georgesadowsky.org.

## Tim Unwin

Tim Unwin is Chief Executive Officer of the Commonwealth Telecommunications Organisation (http://www.cto.int), Chair of the Commonwealth Scholarship Commission in the UK (http://cscuk.dfid.gov.uk), UNESCO Chair in ICT4D, and Emeritus Professor of Geography at Royal Holloway, University of London. From 2001-2004, he led the UK Prime Minister's Imfundo: Partnership for IT in Education initiative based within the Department for International Development, and from 2007, he was Director and then Senior Advisor to the World Economic Forum's Partnerships for Education initiative with UNESCO. He was previously Head of the Department of Geography at Royal Holloway, University of London (1999–2001), and has also served as Honorary Secretary of the Royal Geographical Society (with The Institute of British Geographers) from 1995-1997.

He has written or edited 15 books, and more than 200 papers and other publications, including "Wine and the Vine" (Routledge, 1991), "The Place of Geography" (Longman, 1992), as well as his edited "Atlas of World Development" (Wiley, 1994) and "A European Geography" (Longman, 1998). His recent research has concentrated on information and communication technologies for development (ICT4D), focusing especially on the use of ICTs to support people with disabilities and to empower out of school youth. In 2011, he spent three months in China teaching and undertaking research on the use of mobile devices for learning by farmers in Gansu and people with disabilities in Beijing. His latest collaborative book, entitled simply ICT4D, was published by Cambridge University Press in 2009. He is a Fellow of Education Impact and Honorary Professor at Lanzhou University, China.

Further information may be found at http://unwin.wordpress.com, http://twitter.com/timunwin, and http://www.ictd.org.uk

## Cynthia D. Waddell

Cynthia Waddell is the Executive Director of the International Center for Disability Resources on the Internet (ICDRI). ICDRI is a member of the Global Alliance on Accessible Technologies and Environments (GAATES) where Cynthia serves as First Vice President. She is also President of the Board of Directors for the Silicon Valley Independent Living Center in California; serves as an invited accessibility expert for the U.S. Department of State International Telecommunications Advisory Committee; and is the Government Services Accessibility Expert for the Global Initiative for Inclusive ICTs (G3ict), a project of the UN Global Alliance for ICT and Development (GAID).

A founder of the Internet Governance Forum Dynamic Coalition on Accessibility and Disability and the Internet Society Disability and Special Needs Chapter, she is active in both public policy and industry setting standards activities.

Cynthia is Co-Editor and Co-Author of the 2010 joint ITU/G3ict Online Toolkit for Policymakers on the eAccessibility and Service Needs for Persons with Disabilities. She is also co-author of two books: Web Accessibility: Web Standards and Regulatory Compliance (Apress 2006) and Constructing Accessible Web Sites (Glasshaus 2002, reprinted Apress 2003).

She has received a number of awards for her work in bridging law and public policy with technology and technical standards implementation. In 1998, she was named to the "Top 25 Women on the Web" by Webgrrls International and in 2003 received the Government Technology Inaugural Award for "Leadership in Accessible Technology and for Pioneering Advocacy and Education."

Cynthia holds her Juris Doctor from Santa Clara University School of Law where she was designated a Public Interest Disability Rights Scholar. She received her B.A. cum laude, from the University of Southern California.

## Raul Zambrano

Raul Zambrano is Global Lead on ICT for Development and e-governance at the United Nations Development Programme (UNDP) Democratic Governance practice based in New York. For the last 20 years, he has supported the deployment and use of Information and Communications Technology in over 90 developing countries with the goal of fostering development agendas and promoting social inclusion, working together with national governments, the business sector and civil society organizations.

His current portfolio focuses on e-governance policies and programmes that enhance public information and service delivery for the poor and promote participation of stakeholders and marginalized communities in public policy and decision making processes. In addition, his work supports the use of social networks and mobile technologies to provide a voice to all stakeholders and to enhance human development, especially for marginalized groups and under-served areas.

Before he joined UNDP in the early 1990s, Mr. Zambrano worked in the academic sector in the US. He has a background in engineering, sociology and economics.