The GraceKennedy Foundation Lecture, 2007

Information and Communication Technology

Shaping Our Lives

Kenneth Sylvester

The GraceKennedy Foundation

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The GraceKennedy Foundation

The GraceKennedy Foundation was established in 1982 on the 60th anniversary of GraceKennedy and Company Limited.
The Foundation expresses, in a tangible way, GraceKennedy's commitment to Jamaica's development by making grants to deserving community groups, in support of its stated objectives, which are as follows:

1. To develop and promote the arts, health, culture, and sports;

2. To establish and carry on programmes for the development of education and skills of people in Jamaica;

3. To develop programmes aimed at the upliftment of the spiritual well-being of individuals.

Guided by clearly formulated policies, the Directors have focused on assistance in three areas: community services; our heritage; and education; the last receiving the greatest emphasis. The Foundation's scholarship and bursary programme is, therefore, an important component of its activity.

By supporting capable and talented people and those who contribute to the development of their communities, the Foundation works towards achieving its main purpose, the development of Jamaica's human resources, on which our future as a nation depends.

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Copies of Lectures are available from the GraceKennedy Foundation, 73 Harbour Street, Kingston.

The GraceKennedy Foundation Lectures

The annual GraceKennedy Lecture has since 1989 addressed significant issues in our society. This year's Lecture is no different. We seek to heighten awareness of the impact of ICT on our lives now and in the future, in a networked world.

We hope you will leave the Lecture with a better understanding of the role ICT plays in our everyday lives, and be convinced of the need for countries and governments to leverage the benefits of ICT while minimizing the possible adverse effects. We trust that you will recognise the important role you must play as a citizen in ensuring that the "digital divide" is significantly narrowed so that the benefits are felt throughout the society.

By providing copies of this lecture to schools and public libraries the Foundation hopes to extend the Lecture's reach beyond the audience at the function. The Foundation, as always, welcomes and looks forward to your comments.

Patricia Robinson
Secretary/Executive Director
GRACEKENNEDY FOUNDATION

GraceKennedy Foundation Lecture, 2007

The advent of Information and Communication Technologies (ICT) has changed many things in our world. My grandchildren get homework assignments which start: "Go on the Internet…"; one of them wants to know if her mother got good grades in Information Technology (IT) when she was at school, and many teenagers today have mobile telephones, MP3 players and/or iPODS. None of these existed 20 years ago and IT was not a subject in CXC until a few years ago. In the space of a single generation meanings of words have changed; as one 58-year-old grandmother noted recently, when she was growing up "chip" meant a piece of wood, "hardware" was found in a hardware store, and "software" wasn't even a word.

The revolution created by ICT has implications for many aspects of our lives and lifestyles now and in the future. The cost of keeping pace with developments in ICT also raises the issue of a "digital divide", which may be experienced at global, regional and national levels. To share with us the possibilities, promises and challenges of the digital future, the GraceKennedy Foundation is honoured to have Mr. Kenneth Sylvester as its lecturer for 2007. Mr. Sylvester is the Chief Executive Officer of the Caribbean Knowledge and Learning Network (CKLN), an organisation established by the Heads of member states of the Caribbean Community (CARICOM) and the World Bank. The strategic objective of the CKLN is:

> To assist the Caribbean economies to become more globally competitive by diversifying and upgrading the skills and competence of its human resources capacities by leveraging the use of Information and Communications Technology (ICT) and collaboration amongst member states.

Mr. Sylvester is an ideal choice to guide us through the intricacies of the world in which ICT will have a significant role and influence. He is an alumnus of the University of Leeds in the United Kingdom and holds a Bachelor of Science (Hons) in Physics and a Masters in Quantum Mechanics. He worked with Fujitsu, the world's second largest Information and Communication Technology (ICT) company for over 28 years during which he was a truly global citizen, with assignments in the United Kingdom, Africa, the USA and the Caribbean. He held positions ranging from graduate trainee to IT specialist, IT consultant, General Manager, Managing Director and finally Chairman and Chief Executive Officer of Fujitsu's operations in the Caribbean.

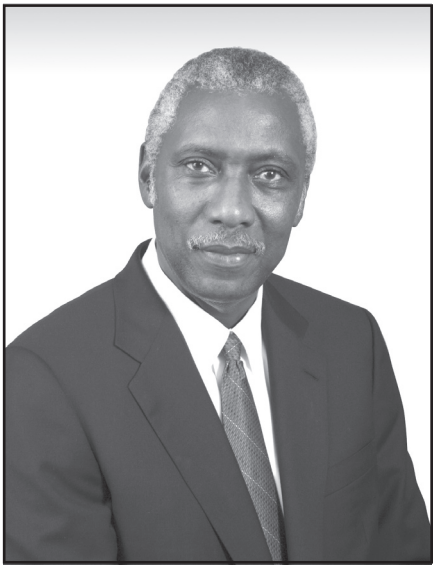
In 1998 he founded KnowledgeWare Development Ltd., a Caribbean-based consulting firm, to work with governments and large private enterprises in leveraging ICT for efficiency gains, business transformation and competitiveness. Many governments of the Caribbean region and funding agencies have engaged him to work and consult on national and regional ICT projects. In 2004, Mr. Sylvester was appointed as a consultant by the Heads of Government of the Caribbean Community (CARICOM) in collaboration with the World Bank, first to develop the project now referred to as the Caribbean Knowledge and Learning Network (CKLN) and subsequently to be the Chief Executive Officer of the now established CKLN Foundation, with headquarters in St. Georges, Grenada.

Distance education and e-learning are only two of the major outcomes which can be explored and implemented as a result of the CKLN. Capacity building, institutional strengthening and the provision of cost-effective bandwidth will facilitate the collaboration of tertiary institutions throughout the Caribbean in the development and delivery of distance education. This is expected to enhance the competitiveness of the region in general

and of the institutions in particular. The knowledge and learning network is only one of the many areas in which Mr. Sylvester has served as consultant. His work has led to the development of national as well as regional ICT policies, he has published several papers on information technology and development, culture and business transformation and he has been involved in curriculum development and the teaching of graduate programmes at the University of the West Indies. His work in e-learning is not restricted to the tertiary level as he is a member of the Board of Directors of the Instructional Technology Institute of Jamaica, which has oversight responsibility for the development and provision of courseware and the development of solutions for integrating ICT for teaching and learning in primary schools in Jamaica.

The GraceKennedy Foundation is honoured to introduce its 2007 lecturer: Mr. Kenneth Sylvester, ICT consultant and Honorary Consul for Grenada in Jamaica, and we anticipate that this lecture will not only be informative but will also be visionary in painting for us a picture of the amazing potential of ICT in almost every sphere of life.

Elsa Leo-Rhynie
GraceKennedy Foundation Lecture Committee
May 2007



Kenneth Sylvester

The Lecture

CHAPTER 1

ICT in Social and Economic Transformation

Introduction

If nations and their leaders do not fully grasp the implications and potential of information and communication technologies (ICT) for transforming their social and economic lives they will subject their citizenry to a chaotic future in which their values and actions will be determined by large multinational media houses, techno-centric individuals from the world fringes and developed countries that control what can be accessed through the Internet and on the World Wide Web (the Web).

The responsibility of leadership, therefore, in the twenty-first century, is to articulate a clear vision for the future, to define the desired state for the social, economic and cultural well-being of its citizenry and to develop action plans to achieve the desired outcomes.

The Networked World

If you are a 45-year-old upper St. Andrew mother who was educated to the tertiary level, either at a Caribbean university or at one in the United States, you can make a strategic decision to be connected to the Internet and increase the reach and scope of your interactions with the outside world, reconfigure your access to people, services and information and change the way you co-exist with colleagues and friends anywhere on the globe. The next 24 hours of your life could be configured in the following manner:

> You wake up at 6:00 am. While on your treadmill and watching CNN, you hear that YouTube has been showing the hanging of Saddam Hussein on the Internet. You are very surprised at the speed of the execution because you were following the trial through the many blogs that gave a more balanced view of the trial proceedings than did CNN or FOX, the so-called major networks. You are reminded of the power of emerging communication technologies such as videoconferencing and webcasting in getting news to people any place, any time. You recall how your friend woke you up on September 11, 2001, telling you to turn on your television set to observe the spectacle of the burning and then collapsed World Trade Centre, and you also remember the images of young Muslim men caught on CCTV in the London underground with their backpacks full of explosives. The news on BBC World said that the so-called bombers used their cellular phones to detonate the bombs that killed over 50 persons that morning on the London underground. You wonder whether it is similar technology that allowed a B-52 bomber flying at 50,000 feet to be able to destroy individual houses in Lebanon where they suspected a so-called terrorist to be.
>
> Before breakfast, you decide to check your e-mail. Your daughter has sent you some lovely pictures of the party she attended last night at her school in Miami. She asked for your opinion of the essay she wrote that should be submitted by 9:00

am the next day. She sent this as an e-mail attachment. Since you hope to go shopping by mid-morning, you check your bank accounts online. You notice that your current account has very little money and that your credit card is almost at its limit, so you transfer some funds from your US dollar account in Miami to both your current and credit card accounts. You are just about to logout when a new e-mail message comes in; you do not recognise the name of the person who sent it but you decide to open it and its attachment. You are offended by the sexually explicit material contained in the attachment. When you try to delete the mail, your computer stops working. You are now quite upset as you realise that you had received some spam e-mails that also had a virus.

You restart your computer immediately as you have to produce and e-mail an invoice to Knowledge Ware Enterprise, based in California, for the work you did for them on the Internet last week. As this is the last day of the month you must submit your invoice to Knowledge Ware Enterprise's global database system on their computer based in Dallas before 10:00 am your time, so that Delma Inc., an accounting firm based in India, can include your invoice in their payment preparation cycle that closed at 8:00 pm their time in India. Six months ago Knowledge Ware Enterprise outsourced their entire payroll and payment process to Delma Inc. India was one of the first developing countries to take a strategic decision to leverage its human resource capacity, especially in engineering and computer science, to develop an ICT sector. By meeting the deadline for invoice submission, you are very confident that Knowledge Ware Inc. will transfer your payment to your bank account by the first day of the month so you can send some money to your daughter's account in Miami to pay her school fees. If this new broadband provider had not come into Jamaica and run cables in your neighbourhood you would not have been able to get your ADSL installed for such a reasonable price so you can now afford to spend as much time as you need to on the Internet to do your work. The good thing is, of course, that for the same price you can get your Cable TV, your IP phone for making international calls and to surf the

World Wide Web for information at increased speed because of the increased bandwidth that you now have. Downloading takes a fraction of the time it took when you were using your old dial-up line.

You are quite satisfied with your accomplishment and reflect on the new possibilities available to you for shaping your life in rewarding directions. You cannot, however, stop yourself from thinking about other persons living in Jamaica, maybe in remote areas of the country, where there is no broadband connectivity or where the great majority of the Jamaican public who are not computer literate would not be able to, for lack of access. You have heard the phrase "digital divide" and your own experience of the new possibilities for your life as a result of your being able to connect to the Internet and use it to access people, information, services and other resources, reinforced in your own mind that there is a divide between those living in cities with connectivity and those living in the country without; a divide between those that can afford access and those that cannot and a divide between those who are literate and those who are not. In fact, you can now understand why it is often said that there is a digital divide between the developed countries to the north and those in the south; and you can also understand that there could be a digital divide between the white population in North America and the ethnic minorities there. Indeed, ICT has created both an opportunity gap and a development gap. You are happy that the situation in Jamaica will get better because you have been hearing that the Ministry of Industry, Technology, Energy and Commerce is developing strategies to help bridge this divide.

The thought of the spam with sexually explicit pictures continues to disturb you. You value the possibilities the Internet allows as you can do almost anything from your home, including having rewarding online contact with people you have never met or seen in person. However, you worry that the same Internet can be used by paedophiles who can assume fictitious virtual personalities to make contact with your 13-year-old daughter who spends a lot of time on the Internet communicating with

friends from all over the world. And the ease with which you have been using the Internet to arrange meetings with your friends who belong to the same charitable society that you do is also afforded to terrorists around the world to destroy a building in London or blow up a plane in the sky.

On your way to the mall that morning you receive an e-mail from your husband on your Blackberry, asking you to book a flight to New York for him for the next day and to make a reservation for dinner at one of the good restaurants on Fifth Avenue. He also asked you to book tickets to see a particular musical playing on Broadway. On arriving at the mall, still sitting in your car and using your Blackberry and the Internet, you book your husband's flight and pay for it using your credit card. Using the Web, you find a lovely restaurant and you also purchase the ticket for the Broadway show. While on the Web you decide to purchase that handbag you saw in Macy's online and also the books from Amazon your son had asked you for. You ask that they be delivered to your husband's hotel so he can bring them back to Jamaica.

On your way home from the mall you call your girlfriend who has been ill for some time. You advise her to use the Internet to contact other persons suffering from the same illness to get information on how it is being treated in the wider world. Your girlfriend informs you that she took some high resolution X-rays and, using a high-resolution scanner, sent the X-rays to a specialist in her illness in New York. The doctor concurred with the diagnosis of her local doctor and prescribed some medication which is only available in the United States. She ordered the medication on the Internet and DHL promised to deliver it in 24 hours.

When you return from the mall you decide to spend some time at your computer on the assignment that was set as part of the MBA programme you are taking at Brown University. The assignment is due to be submitted online to your tutor by 3:00 pm that afternoon. You decide to review the webcast of the last three lectures and you manage to complete the assignment and submit it with ten minutes to spare.

After preparing dinner, you remember that you had promised to play a game of bridge with the three partners you met on the Internet. Although it is 4:00 pm in Jamaica, it is 9:00 pm for Susan who is in London, 3:00 pm for John who lives in Australia and 3:00 am for Shereen who lives in India. You log on and have a wonderful game. You all decide that it is time for the group to meet face-to-face, so you agree to meet in New York for the summer at a jazz festival. You suspect that John wants the meeting very much because he and Shereen are developing a special relationship.

After bridge, you have a quiet evening with your husband; after all, he would be leaving for New York the next day and he would be away for ten days. You download some of his favourite music and you both listen to it over dinner. Before going to bed you purchase that Pay-Per-View movie that your husband always wanted to watch using the cable system. Not surprisingly, you both fell asleep before the movie was over. It had been a very long day.

On driving your husband to the airport at 5:00 am the next morning you realise that he will be away from home for a while. He depends on technology a great deal for business and social activities, so you ask him how he will manage when he is away. You are amazed when your husband rattles off:

"…I actually take an ICT-enabled 'virtual home' with me wherever I go. There are so many digital wireless and mobile technology devices available on the market today! There are portable 'laptop' pcs, cell phones, or multifunctional hand-held 'palmtop' computer-based devices such as the personal digital assistant (PDA), or 'third generation' (3G) cell phones that can integrate all or some of the capabilities of an Internet-accessible multimedia computer, telephone, diary, address book, notepad, calculator, digital camera and game station…".

Welcome to the networked world; a world in which space and time are no longer major determinants of human behaviour; a connected world of persons forming human ecologies and

communities of interest, where collaboration and co-evolution of different races, cultures and creeds are leading to possibilities that are transforming our lives in previously unimagined ways. Innovations in information and communication technology such as the development of microelectronics, optoelectronics, the Internet and the World Wide Web created this world, and innovations in chip technology coupled with the convergence of supercomputing technology, with nanotech, biotech and neurotech promise to accelerate the transformation of our lives in ways that will be reminiscent of living in the Matrix!

ICT and the Changing World

Every one hundred years or so innovation throws up new technologies with the potential for transforming our lives in ways that were impossible to conceive. The invention of paper and printing and the wheel were such inventions. Today we are witnessing significant transformations in our social and economic life brought about by innovations in information and communication technology. The major driving force behind the explosion in availability and use of digital electronic ICT has been advances in microelectronics, involving the packing of ever-increasing numbers of integrated circuitry onto a 'chip' of silicon, about the size of a human fingernail.

Microchips are at the heart of all digital ICT equipment, from pocket calculators to supercomputers. They are also the main components in a vast range of other equipment such as domestic appliances, consumer and security goods, and medical and other specialist systems. The rapid, relentless progress engendered by microelectronics since 1960 is captured by 'Moore's Law', which states that the capacity of microprocessors will double about every 18 months. The steady advance in capacity in this direction has allowed for the provision of greater processing speed, more

digital storage, more functions and increased reliability for less cost. The resultant substantial enhancements in the power and versatility of hardware at decreasing cost has offered the enhanced computing capabilities needed for software designers and builders to implement ever larger and more versatile programs to deliver a growing range of applications and services to users. More recently, microelectronics has been more closely aligned in many ICT developments with optoelectronic innovations such as high-performance optical fibre telecommunications links, flat screen computers and television displays. Amongst electronic ICTs, this has created greater advantages for digital over competing analogue technologies in media as diverse as television, radio, telephony, photography, music and film recording. In telecommunications, this is illustrated by the escalation in the amount of information (bandwidth) that can now be carried by a high-speed digital transmission link compared to both traditional analogue techniques and earlier digital connections. Bandwidth capacity has been dramatically increased from about 50,000 bits per second (bps) in a traditional, narrow-band copper wire telephone line to giga (thousands of millions) bps on broadband optical fibre and cable connections and even a million bps with telephone wires enhanced by digital subscriber links (DSL) technology. Extra bandwidth also makes possible the delivery through media such as cable and satellite of many more television and radio channels than was possible with traditional terrestrial media using narrow-band analogue techniques.

Digitisation can be used to enhance traditional media, for instance by "cleaning up" and better preserving early manuscripts, pictures, music recordings and films. It can also create entirely new digital forms as in services offering live online streaming from video webcams or when viewers can control what they see on television (for example, by choosing specific cameras at a

sporting event or through video on demand, where a movie can be watched at the time the viewer wants instead of only at its scheduled broadcast).

The human know-how that is an intrinsic part of technology has a special significance with ICT beyond the expertise involved in designing, using and enhancing the technology. This arises because most of the technology's transformative power lies in its ability to be programmed by software to enable the same hardware to do many different things in a manner shaped by and for users. Software is a form of codification of human knowledge with some types of expert and artificial intelligence (AI) systems explicitly seeking to mimic human reasoning[1] or to extract human reasoning from documents or observation. For example, scientific knowledge based on statistical biometric measurement is now an important element in many security systems at airports and other sites where strict personal identification is critical. Knowledge is therefore, in a sense, as much a core capability for ICT as microelectronics, screens and other hardware technologies.

The Internet and the World Wide Web

During the early 1990s two new ICT-enabled innovations were presented to the world: the Internet and the World Wide Web. The Internet is the worldwide, publicly accessible network of interconnected computer networks that transmit data by packet switching using the standard Internet Protocol (IP). It is a "network of networks" that consists of millions of smaller domestic, academic, business and government networks, which together carry information and services such as electronic mail (e-mail), online chat, file transfer and the interlinked web pages and other documents of the World Wide Web. Contrary to common usage of the terms, the Internet and the World Wide Web are not synonymous: the Internet is a collection of interconnected

computer networks, linked by copper wires, fibre-optic cables and wireless connections; the Web is a collection of interconnected documents and other resources, linked by hyperlinks and URLs. The World Wide Web is accessible via the Internet.

The Internet was initially funded by substantial public investments from the U.S. Department of Defence's Advanced Research Project Agency (ARPA).[2] The growth and early development of the Internet were encouraged by making its basic technologies and infrastructure available for free to academic and other research users, who also received much support from public funds. The Web emerged in the early 1990s from a similar environment at the European Laboratory for Particle Physics (CERN) in Switzerland.[3]

Opportunities for Enabling Social Transformation with ICT

At a basic level, the Internet and the Web provide three core functionalities: connectivity, access and collaboration. The choices we make with respect to how we use these functionalities can transform our lives in several arenas. ICT-enabled innovations such as the Internet can transform the way we work, live, form relationships, communicate and entertain ourselves and they play a role in almost all aspects of human endeavour.

Connectivity

The Internet allows connectivity that is one-to-one, one-to-many and many-to-many. By allowing one computer user in Jamaica to connect simultaneously to other computer users in Barbados, the United States and Russia, the Internet and the Web are encouraging new ways and choices for individuals. An accountant sitting at home can audit the books of a company based in another

country on a server situated in a third country that is remotely maintained by IT specialists in a fourth. These accounts could have been created by stay-at-home book-keepers in other remote locations based on information e-mailed to them from offices all over the world.

Access

By facilitating access by individuals to information and resources from any place and at any time, the Internet has transformed our social and business interactions. The fact that a Trinidadian office worker or manager, perhaps on the other side of the world attending a cricket match, can open a remote desktop session and log on to his office PC using a secure virtual private network (VPN) connection via the Internet, giving him complete access to all his files and data including e-mail and other applications while he is away, is clear testimony that the Internet has created opportunities for persons to make choices that transform the way they work and interact.

By connecting the people of the world together and creating the possibility of infinite conversations concurrently, as though space and time no longer mattered, the Internet and the Web have produced a world where new possibilities arise, not by design but through emergence. This destruction of a world order based on command and control, cause and effect and certainty, calls us to change the way we think and behave. It is a new day. In this new world, individuals are empowered to make choices on the basis of trust that other persons will behave in ways that lead to outcomes that support the development of the whole. The rules and laws governing the old paradigm in a world of separateness, certainty and control must change in order that we can peacefully co-exist in a new world made up of co-evolving knowledge and information workers.

Collaboration

The Internet and the Web can enable a computer file to be e-mailed to customers, colleagues and friends as an attachment. The file can be uploaded to a website for easy download by others. It can be put into a "shared location" or onto a file server for instant use by colleagues. In any of these cases, access to the file may be controlled by user authentication; the transit of the file over the Internet may be obscured by encryption and money may change hands before or after access to the file is given. The price can be paid by the remote charging of funds, for example, from a credit card, the details of which are also transmitted – hopefully fully encrypted – across the Internet. The origin and authenticity of the file received may be checked by digital signatures.

The low-cost and nearly instantaneous sharing of ideas, knowledge and skills has made collaborative work dramatically easier. Not only can a group cheaply communicate and test; the wide reach of the Internet allows groups to form easily in the first place, even among niche interests. An example of this is the Free/Libre/Open-Source Software (FLOSS) movement in software development, such as Linux, Mozilla, OpenOffice.org and Wikipedia.

Application

These simple features of the Internet, on a worldwide basis, are changing the basis for the production, sale and distribution of anything that can be reduced to a computer file for transmission. This includes all manner of office documents, publications, software products, music, photography, video, animation, graphic and other arts which are changing the way we access educational content and the learning process. We have been empowered to learn what we choose to, when we choose to, from where we choose

and at the pace we choose. The application of this functionality is causing seismic shifts in industry: the role of leadership has changed, the role of distributors has changed and the role of the teacher has changed. Fundamentally, all these groups have lost control of how these applications can be delivered.

Internet and Web Innovations

The emergence of the Internet created opportunities for people in developing countries to participate in the innovations that fuelled the growth of the Web. The innovations during the dot.com years were generally geared towards increasing access to the Internet to as many people as possible any time and any place and at prices that were affordable; and making it easy to develop content that could be placed on the World Wide Web to be viewed and/or modified by other persons and transmitted to any part of the globe by voice, image or data. The technology innovations that occurred during this period can be best described as set out below.[4]

Internet Access

Today the Internet can be accessed in various ways. This includes using dial-up, landline, broadband (over coaxial cable, fibre optic or copper wires), Wi-Fi, satellite and cellular (cell) phones. Wi-Fi provides wireless access to computer networks and therefore can do so to the Internet itself. Hotspots providing such access include Wi-Fi cafés, where would-be users need to bring their own wireless-enabled devices such as a laptop or PDA. These services may be free to all, free to customers only, or fee-based. A hotspot need not be limited to a confined location. An entire campus or park or even an entire city can be enabled. Grassroots efforts have led to wireless community networks. Commercial Wi-Fi services covering large city areas are in place in London, Vienna,

San Francisco, Philadelphia, Chicago, Pittsburgh and other cities including Toronto. The Internet can then be accessed even from a park bench.

The World Wide Web

Today the Web can be searched through keyword-driven Internet search. Using search engines like Google, millions worldwide have easy, instant access to a vast and diverse amount of online information. Compared to encyclopedias and traditional libraries, the World Wide Web has enabled a sudden and extreme decentralisation of information and data.

Many individuals and some companies and groups have adopted the use of "web logs" or blogs, which are largely used as easily updatable online diaries. Some commercial organisations encourage staff to fill their blogs with advice on their areas of specialisation in the hope that visitors will be impressed by the expert knowledge and free information and be attracted to the corporation as a result. One example of this practice is Microsoft, whose product developers publish their personal blogs in order to pique the public's interest in their work.

Communications

Today, many existing radio and television broadcasters provide Internet "feeds" of their live audio and video streams (for example, the BBC). They may also allow time-shift viewing or listening such as Preview, Classic Clips and Listen Again features. These providers have been joined by a range of pure Internet "broadcasters" who never had on-air licences. This means that an Internet-connected device, such as a computer or something more specific, can be used to access online media in much the same way as was previously possible only with a TV or radio receiver. The range of material is much wider, from pornography to highly

specialised technical webcasts. Podcasting is a variation on this theme, where – usually audio – material is first downloaded in full and then may be played back on a computer or shifted to a digital audio player to be listened to on the move. These techniques, using simple equipment, allow anybody, with little censorship or licensing control, to broadcast audio-visual material on a worldwide basis.

Webcams can be seen as an even lower-budget extension of this phenomenon. While some webcams can give full frame rate video, the picture is usually either small or updates slowly. Internet users can watch animals around an African waterhole, ships in the Panama Canal, the traffic at a local roundabout or their own premises, live and in real time. Video chat rooms, video conferencing and remote controllable webcams are also popular. Many uses can be found for personal webcams in and around the home, with and without two-way sound.

Voice Communications

VoIP stands for Voice over IP, where IP refers to the Internet Protocol that underlies all Internet communication. This phenomenon began as an optional two-way voice extension to some of the Instant Messaging systems that took off around the year 2000. In recent years, many VoIP systems have become as easy to use and as convenient as a normal telephone. The benefit is that, as the Internet carries the actual voice traffic, VoIP can be free or can cost much less than a normal telephone call, especially over long distances and especially for those with always-on ADSL or DSL Internet connections.

Thus, VoIP is maturing into a viable alternative to traditional telephones. Interoperability between different providers has improved and the ability to make or receive a call from a traditional telephone is available. Simple, inexpensive VoIP modems that eliminate the need for a PC are now available.

The Information Society

While we were sleeping innovations in microelectronics provided the opportunity for individuals, nations and regions to transform the modality of access to critical resources affecting their lives. Policy makers of the G7 group of nations recognised this transformation as is evidenced by the conclusion from the G7 Ministerial Conference on the Information Society in February 1995:[5] "Progress in information and communication technologies is changing the way we live: how we work and do business, how we educate our children, study and do research, train ourselves and how we are entertained." They recognised that a "new society" was emerging where the tools of production were no longer ploughs and lathes but information and knowledge. They termed this society the "Information Society."

There is currently no universally accepted definition of what exactly can be termed the Information Society. Wikipedia defines the Information Society as a society in which the creation, distribution and manipulation of information has become the most significant economic and cultural activity. An Information Society may be contrasted with societies in which the economic underpinning is primarily industrial or agrarian. The tools of the Information Society are computers and telecommunications equipment rather than lathes and ploughs. It is a society where information and communication technologies (ICT) have become central to our economic and social development. From an economic point of view, the most significant aspect of this new society is a shift in the majority of the labour force from agricultural and manufacturing sectors to the information sector.

The OECD description of the ICT sector is based on the International Standard Industrial Classification (ISIC) Rev. 3.1.1. This definition speaks to product and service characteristics and includes information technology manufacturing industries such as

telecommunications equipment, media equipment and receivers, computers, electronics and business equipment and information services such as computer and telecommunications services and software consultancy.

Most theoreticians agree that we are seeing a transformation which started somewhere between the 1970s and today and is changing the way societies work fundamentally. The American socialist Daniel Bell argued that information was the defining resource of a new post-industrial phase of economic development, just as raw materials were the core resource of the agricultural society and energy that of the industrial society.[6] The manifestation of the Information Society was first seen in the growth in service in the developed and advanced industrial countries followed by some developing countries in Asia through their growing use of broadband fibre-optic networks to provide ICT support, financial services and call centre operations that were accessed from around the world. It allowed businesses to extend their reach outside of their neighbourhoods to any part of the globe that had connectivity and access. Through its global reach, the Internet allowed corporations to re-engineer their operational and production processes to use the most cost-effective resources wherever they existed. It enabled collaboration of persons with disparate skills living in different parts of the world to work together in the design, development and production of goods and services.

The Information Society: Providing Opportunities for Economic Growth and Social Change

An Information Society comes into being when an environment is created that allows businesses and citizens to leverage the use of ICT to create new possibilities that affect significant aspects of their social and economic lives. When a significant percentage of a society depends on the use of ICT to conduct business

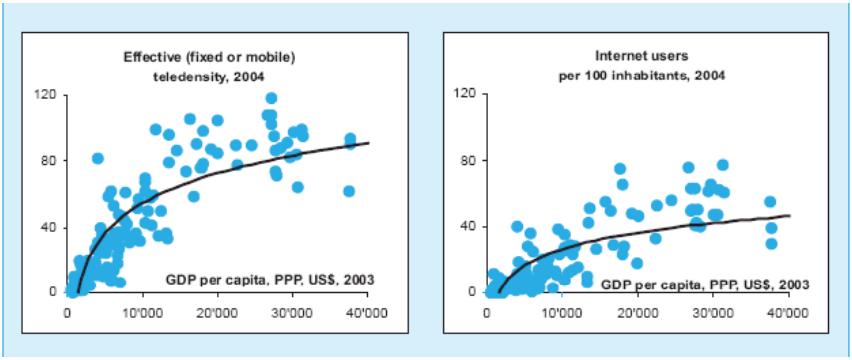
transactions, work, learn, form relationships and communicate, such a society can be termed an Information Society. There is now an abundance of evidence that both developed and developing countries which have made the necessary investments in ICT and deployed strategies for enabling and leveraging the use of these technologies have seen improved growth in Gross Domestic Product (GDP). The Commission of the European Communities[7] concluded that there is broad consensus based on statistical evidence that ICT increases productivity growth rates. The Net Impact Study[8] estimated in mid-2003 that the Internet will account for .43 percentage points of the future increase in U.S. productivity growth and had already contributed cost savings of Euros 9 billion and increased revenues of over Euros 86 billion in Europe. The telecommunications component of the ICT sector, which in most countries is larger than the ICT manufacturing sector, has proven to be the critical component in contributing to the indirect impact of ICT on economic growth in both the developed and developing economies. This sub-sector includes services related to fixed and mobile telephony and the Internet, and is growing at a rapid rate in almost every part of the world.

According to the World Telecommunications/ICT Report,[9] this growth is being driven by both demand side factors such as the increasing popularity of mobile phones and the Internet, and by supply side factors such as regulatory reforms, falling costs and prices and technological innovations.

The astounding speed at which ICT and in particular mobile phones and the Internet are permeating every country has been the major contributor to the development of a global Information Society. This is reflected in the turnaround in profits of the top ten telecommunications operators in 2003 and 2004. Further, several studies have been conducted in recent times to analyse the rapid growth in the telecommunications sector and economic growth around the world. Figure 1.1 highlights the relationship between

GDP per capita and the teledensity of countries and the GDP per capita and Internet penetration.

Figure 1.1



Sources: ITU World Telecommunication Indicators Database; World Development Indicators 2005, World Bank.

In addition to the relationship between mobile and Internet penetration and economic growth, a recent study by the European Information Technology Observatory (EITO) and International Data Corporation (IDC), published towards the end of 2005 and based on data collected between 1998 and 2000, shows that there is a relationship between broadband penetration and economic growth. The study concludes that, "communities in which mass-market broadband was available by December 1999 experienced more rapid growth in (1) employment, (2) the number of businesses overall and (3) business in IT-intensive sectors".[10]

Direct Impact of ICT on Economic Development

The impact of ICT on an economy can be analysed in several ways. Direct benefits could be in the form of ICT products and services such as computer hardware and software which generate

additional employment and the development of new revenue streams that contribute directly to the GDP of the country. According to the World Telecommunication/ICT Development Report 2006, a comparison of different regions and countries highlights that employment in the ICT manufacturing sector (as a percentage of total manufacturing employment) varies from 4.5 per cent in the Czech Republic to 14 per cent in the Republic of Korea.[11]

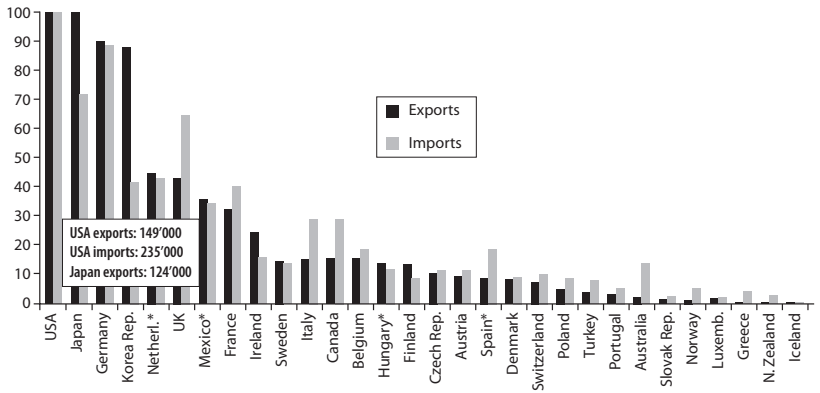
The available data on the contribution of an ICT sector to GDP or the number of persons employed in the sector as a percentage of overall employment in Jamaica is not available as discrete figures. The closest indication of direct contribution of the ICT sector in Jamaica is contained in the measurement of revenue contribution and employment in the combined sector of Transportation, Storage and Communications. According to STATIN, as of October 2005 this combined sector contributed 12.1 per cent of GDP with employment of 76,400.[12]

Direct benefits to the economy can also accrue by investing in ICT goods that are used to produce business applications and services for local use or for export. The size of these direct benefits depends on how large the goods and services producing sectors are relative to the economy and how fast they have grown. In Ireland, for example, total exports of ICT products and services amounted to almost Euros 30 billion in 2002, representing 34 per cent of all of Ireland's exports. There was no data available on export products and services from Jamaica.

Most studies on the economic impact of ICT focus on a limited number of industrial countries and there are few studies that try to analyse or measure the impact of ICT on the economies of developing nations such as Jamaica and the other Caribbean countries. There are some exceptions such as India and Malaysia. These are countries where the ICT sector has either made a

significant contribution to the country's economy (India) or where major efforts are made to promote an ICT industry (Malaysia). Figure 1.2 shows countries that are deriving significant benefits by virtue of the existence of an ICT sector.

Figure 1.2



Source: ITU

The Indirect Economic Impact of ICT

Whilst the ICT manufacturing and telecommunication sectors continue to have a real and significant impact on the economic growth of the more industrialised countries, the real and potential impact on the economic development of countries, especially developing countries, lies more in the use of ICT and their ability to impact the productivity of the wider economy, than on the ICT sector itself. This is generally achieved by transforming the way individuals, businesses and other parts of the society work, communicate and interact.

The indirect benefits of ICT on productivity, including the possibility of helping to reduce poverty, eradicate illiteracy and improve health care, are of particular interest to the world's development agencies.

> ICT has had and will continue to have, significant economic implications. Businesses are transforming their supply and demand chains, as well as their internal organisation to fully exploit ICT. Governments are restructuring their internal functions and the way they deliver services and generally interact with citizens and business. People are modifying their consumption and spending patterns, as well as their behaviour. In the process, nearly every economic variable of interest is affected.[13]

The common factor in the described impact of ICT on business, government, household and society at large is usually change (transformation, restructuring, behaviour modification). The implication is that ICT-induced change results in economic growth and an increase in productivity. This positive impact will therefore cut across any sector of the economy that uses ICT and can help achieve economic development.

Measuring the Indirect Economic Impact of ICT

It remains a very difficult proposition to quantitatively measure the indirect impact of ICT on an economy. The measurement of impact has mainly been done in countries and sectors where access and usage levels are high enough to make an obvious change. The evidence suggests that countries, and the public and the private sectors, need to reach a certain level of ICT penetration to take advantage of ICT. According to the World Telecommunications/ ICT Development Report,[14] while the necessary level of ICT penetration that is required to make a noticeable impact on an economy is open to debate, it is obvious that the lack of critical mass will limit the effect of ICT. The report further notes that many of the areas and applications that have been linked to positive impacts (gains in productivity in the economy and business, reduction of costs and time through e-commerce, beneficial

impacts of e-government and e-education), are closely associated with broadband uptake.

Some studies in developing countries have tried to show how increased telecommunications investment and higher penetration levels would impact economic growth and lead to higher GDP.[15] Similar to the link made between GDP growth and ICT penetration, links have been established between a company's size and its level of ICT use.[16]

According to the World Development Report 2006,[17] one way of understanding the difficulty of measuring the impact that ICT has is to imagine the impact that electricity has had on economy and society. As with ICT, there is no denying that electricity has had important impacts on individuals, businesses and society at large but its measurement is elusive. Part of the difficulty is that both ICT and electricity are "enabling" or "general purpose technologies", which means that their use and their impacts are ubiquitous yet difficult to measure because they are mainly indirect. It is not electricity or ICT that makes the impact on the economy and society but rather, how they are used to transform organisations, processes and behaviours.

People, Process and Technology: Necessary Conditions for Transformation

While ICT enables transformation of organisational and production processes that can lead to management innovation, de-layering in organisations, extension of the reach of organisations and cost reduction, which all contribute to large productivity gains, these changes cannot be analysed in isolation. Numerous studies have suggested that the use of ICT can only bring about change in conjunction with other factors such as new skill sets and changes in organisational culture. Different surveys of small and medium enterprises (SMEs) in Central and Latin America

confirm that technical know-how and skills are crucial for the successful adoption of ICT.[18]

The experiences of many large enterprises and countries which have aggressively engaged in the use of ICT for economic and social development all suggest that the effectiveness of ICT depends on how ably they are implemented. This phenomenon is now referred as the "Wal-Mart Phenomenon".[19] This highlights that it was not technology alone that accounted for the U.S.'s productivity growth at the end of the last century, as much of the technology used had been in existence for a while; rather, it was management's use of the technologies to re-engineer processes that made the real difference.

The following case studies of three developing countries, summarised from the World Bank report *A Time to Choose*[20] demonstrate very clearly that for ICT to contribute to economic and social development it must be within a framework that includes the availability of appropriate human resource capacity, specific policy prescriptions and a managed process.

Country Case Studies

Ireland: The Irish economy has experienced a remarkable turnaround in about 10 years, that is, since it began on a major reform programme in 1987. The reform programme included a social pact (broad-based support for moderate wage increases), openness to Europe, the promotion of foreign direct investment (FDI), the break with sterling, substantial support from the EU, changes in technology, industrial organisation and an increased awareness of the role of information. While the role of the European Union was complex, it provided an institutional umbrella that helped drive the stabilisation process and galvanise it. It is notable, for instance, that during the programme of national recovery (1987–2000), GDP grew at an average rate

of 7 per cent, and the unemployment level went from 18 per cent to near full employment, while the debt/GDP ratio went from around 20 per cent to 40 per cent, and the primary balance went from a deficit of nearly 2 per cent to a surplus of nearly 7 per cent. At present, Ireland – a country of 3.8 million people – enjoys a per capita income of nearly $23,000.

Mauritius: The Mauritian growth performance has been formidable, especially since the 1980s, averaging 5.4 per cent per annum since 1981. Its initial conditions – high levels of income, commodity dependence, unfavourable geography – exerted a drag on growth. While trade performance through the creation of FTZs and the country's ability to fully offset the anti-export bias is one of the explanatory factors for growth, strong domestic institutions and ethnic diversity, matched with inclusive democratic traditions, provide the key explanatory factors for the exceptional growth. The diversity has important benefits, including diasporas that have important links with the rest of the world and the separation of economic and political power. At present, Mauritius, a country of 1.2 million people, enjoys a per capita income of $4000.

Singapore: Since independence in 1965, Singapore has achieved sustained and rapid economic growth, averaging 5.9 per cent per annum despite a virtual lack of natural resources. During this period the country underwent rapid industrialisation, transforming itself from a low wage, labour surplus economy to a dynamic capital-intensive producer. Macroeconomic stability underpinned Singapore's success and allowed the country to adopt policies to attract foreign investment and investment in human and physical capital. The government pursued an activist industrial policy for sectors deemed to have high growth potential including the chemical, electronic and manufacturing sectors. Through steady advances in technology and worker skills engendered by its development strategy, Singapore has achieved an impressive economic record as evidenced by per capita income levels that are amongst the highest in the world.

ICT Investment and GDP Growth

According to the World Telecommunications/ICT Development Report (2006), a recent comprehensive study compared the time period 1989–1995 with 1995–2003 to determine the correlation between ICT investment levels and GDP growth.[21] The group that benefited the most from ICT was the G7.[22] Almost one-third (27 per cent) of the GDP growth that occurred from 1995 to 2003 was due to ICT investment. The study found, however, that in major developing and transitioning countries, ICT investments played a smaller although increasing role. The results suggest that the contribution of ICT to economic growth depends on a number of factors outside the ICT area, including the market's regulatory framework and the ability of countries to develop skills and transform their organisational environment.

A recent study which analysed 50 major ICT spending countries stated that, "ICT contribution to economic growth is a global phenomenon, which is evident not only in developed economies but also in developing ones".[23] The study also reiterated the position that key determinants of why ICT contributes to economic growth vary and include education levels, institutional quality, and openness of economy.

Information on the economic impact of ICT on developing countries is scarce. A study in 2004 which analysed eight transition countries in Central and Eastern Europe highlights that: "ICT had a large contribution to GDP and labour productivity growth in Central and Eastern European countries".[24] However, similar to studies in developed countries, a major conclusion is that "ICT will not be productively utilized without changes in the structure, organization and business models of firms and without improvement in ICT skills of the labour force."

Potential of ICT to Shape Our Economic and Social Lives

Dutton asserts that:

> What is new about advances in ICTs such as the Internet is how they create the potential for you – as a user and a producer – to have more control over shaping your access to information, people, services and technologies around the world".[25]

He further argues that knowledge and other ingredients essential to the building of human and social capital are intrinsic to each of these. Social transformation arises when you and others reconfigure the electronic and physical process through which you access the vital social and economic resources.

Education, Learning and Knowledge Development

It is misleading to assert that technology actually creates knowledge. The real value of ICT is the role it can play in making knowledge and expertise accessible and its impact on the learning and administrative processes of educational institutions. The Internet and the World Wide Web in particular have played a significant role in reshaping our access to knowledge resources.

The framework within which innovations such as the Internet and other ICT elements can be applied to education and knowledge generation depends on the choices and policy prescriptions of institutions. For instance, the vision of a "virtual" university or classroom based on the use of networked ICT that eliminates the need for students to be physically present on a campus or a classroom has been important in e-learning.

Table 1.1 Interrelated roles ICT can play in access to learning and education

ICT role in reconfiguring	Examples of activities
Access to people	• Networking between students, teachers, external experts, parents and others in the community • Collaborative research projects • Institutional networking among administrators
Access to services	• Packaging and distribution of educational products and services • Breaking down distinctions between producers and users of educational content • Facilitating routine transactions such as Internet access to a course prospectus and online registration
Access to information	• Searching, screening and downloading multimedia content • Drill and practice software with personalized and immediate feedback • Visualising and learning by doing through interaction with animation and other media
Access to technology	• Learning about ICTs through routine exposure to the technology and its uses • Using ICTs to improve learning and education • Providing wired and wireless broadband access in classrooms, offices, on-campus cyber cafés, research laboratories, student dormitories

Source: Based on Dutton (2004)

Impact on Learning

Innovations like the Internet can be applied to transform the learning and administrative processes that can bring significant value to students and change the roles of teachers and librarians. Different configurations of ICT can provide student-centred learning and allow students to choose the time and place at which they receive lectures and tutoring. ICT can improve the learning process by leveraging its multimedia capabilities and presenting materials in a mixture of voice, text and graphics, thus appealing to more of the senses than "chalk and talk". By having access to the Internet, students can have access to the world's knowledge repositories using tools like Google to navigate their way and quickly find an abundance of references for any subject. Use of ICT in this manner can enable teachers to play different roles, among them that of gatekeeper to advise and guide students on how to access information, as well as fulfilling a mentoring and social role for students, thus enhancing their campus life. ICT can contribute to making campus life a more pleasant experience by streamlining the registration process through facilitating online registration and using the same medium for the submission of assignments. It can also facilitate greater access to tutors through the use of e-mails and chat facilities.

One of the greatest benefits of the Internet is its contribution to reconfiguring access to education through the development of virtual universities, "universities without walls". Students are able to learn at a distance at any time they choose. This has the potential to contribute significantly to the number of persons in a society that can access education, especially at the tertiary level.

Business

In the early 1990s, leaders and executives in industry became concerned that despite the high investments they were making in

ICT there was little or no improvement in their bottom line. This became know as the "productivity paradox". Under the sponsorship of leading ICT manufacturers and other global financial and manufacturing companies, the Massachusetts Institute of Technology (MIT) conducted a study in 1990 to determine the impact of ICT on the productivity and competitiveness of firms in the United States and Europe. The study showed that no technology as complex as ICT, however versatile and cost effective it may be, is guaranteed to contribute to the productivity and consequently the profitability of firms simply by being used. The study showed that unless organisations had a well-articulated business strategy and had developed an ICT strategy that was aligned to the strategic objectives of the organisation, the investment in ICT would not deliver on its promise. The study further showed that it is necessary for companies to define clearly their organisation's core business processes and use the capability and flexibility of ICT to keep these processes aligned with the overall strategic business objectives of the organisation. It also showed that strong leadership, with a well-articulated vision and an educated workforce was necessary to keep the business processes constantly aligned with the strategic objectives of the firm.

The study concluded that all three elements – educated people, the business processes and the technology – were equally important and must be equally served if firms are to get commensurate returns on their investment in ICT. This solution became known as the MIT paradox.

Resolving the Productivity Paradox

Achieving the objective of an ICT innovation requires making associated social and organisational innovations, which take longer and require more political will and commitment by individuals and groups than that involved in acquiring new equipment and systems.

Mindful of the productivity paradox of the 1980s, in the early 1990s companies embarked on the path of using the more flexible innovations such as personal computers, local area networks and wide area networks to re-engineer their business processes, together with the concept of creating learning organisations. These re-engineered processes resulted in changes to organisational structures. Specifically, companies were able to remove an entire management layer in the organisation and reduce their labour force by automating certain processes. This led to significant cost savings while improving service to customers.

Companies began to experience significant gains when they incorporated the functionality of the Internet into their operational, production and delivery processes. The Internet allowed firms to increase their reach to markets and customers anywhere on the globe where connectivity existed. It facilitated companies to engage in business activities, to outsource certain tasks in their production processes that could be done by other companies at lower costs and to use the expertise of persons on any continent to design, build, market and sell without them having to leave their country. The Internet allowed companies to "go global" and use the best of resources and facilities in an appropriate time zone to improve efficiency and profitability. Table 1.2 details the effects on organisational forms and benefits that can result from such changes.

Table 1.2 Dimensions of change in organisational forms tied to ICT

Organisational form	Operational aims
Intra-organisational: Virtual control	• Decentralise to less hierarchical control over decisions • Flatten hierarchies by illuminating middle management layers • Reduce proportion of administrative support staff and costs • Decrease formalisation of behaviours and job requirements
Intra-organisational: Horizontal coordination	• Organise workgroups by electronic workflow and not physical location • Establish concurrent engineering: simultaneous design by distributed teams • Implement production systems such as Just-in-Time (JIT) to minimise the need to store components near to production facilities
Internal and external resource balancing	• Cut staff, including a reduction in the number of hierarchical layers in the organisation structure • Outsource activities to external contractors or to a 'spin-off'; a once internal unit that has become an independent enterprise. • Establish a 'federated' organisation by decentralising within a centrally coordinated framework
Inter-organisational coordination	• Forge new inter-organisational relationships such as through e-business links in the supply chain • Build strategic alliances across industries to share information or networks • Experiment with new forms of linkage, for example 'coordinating associations' of a number of enterprises.

Adapted from Dutton (2004)

Governance

By reconfiguring access, the Internet has been used by governments to allow citizens to transact businesses such as filing income tax returns, paying property taxes, applying for services such as birth and death certificates and renewing licenses, all from the comfort of their homes or offices or wherever access to the Internet is available. It can also be used to improve transparency by allowing companies to submit bids for government contracts electronically. Politicians also use the Internet to solicit the votes of citizens, to provide a platform for individuals and groups to discuss issues, organise campaigns and seek to influence public policy.

The objectives of the activities above vary greatly, but generally they are aimed at using ICT to implement major e-government improvements in the support of administrative services (e.g. budgeting and personnel), decision making (e.g. using analysis to inform policy-making) and in improving the speed, efficiency, accuracy and effectiveness of delivering public services, often by emulating techniques that have been well proven in the private sector. In some developed countries the technology has been used to develop "e-democracy" capacity and infrastructure in order to bring government closer to citizens and to encourage broader, more active participation in decision making. Table 1.3 shows the potential benefits and threats associated with electronic delivery of public services to citizens.

Table 1.3 E-Government: Potential benefits and threats

Potential benefits	**Potential threats**
Lower administrative costs and management overheads	Apparent savings in some activities offset by increased inefficiencies elsewhere, including additional costs of implementing and maintaining ICT systems
Improvements to health, education and other services through the reallocation of staff and other resources from administrative to frontline activities	
Faster more accurate responses to, and processing of citizens requirements	
More convenient access to public services from any location, including remote areas during more time of the day (or night)	
Multiple public services available from 'one-stop' public service centers, multimedia kiosk, and other ICT based access points	More integrated databases and cross referencing between government departments used for increased unwarranted or illegal government surveillance and control
Wider and simpler access to all levels and kinds of government information through web portals, document and from downloading via the Internet	
Facilitation of government-government and government-business interactions	

Reduction of fraud in public services	New openings for cybercrimes, creating a requirement for new public cyberpolicing
Enhanced emergency procedures (e.g. for floods, hurricanes) using ICT based monitoring and coordination control	
Making feasible innovative products and services, such as charging traffic entering cities to reduce congestion and pollution or biometric checks at airport	Use of innovative ICTs against the interest of many citizens, for example for invasion of privacy and censorship of information and free speech

Adapted from Dutton (2004)

The Digital Divide

The ability or lack thereof to use ICT for reconfiguring access to new possibilities has produced a divide between countries that can afford to make the investment in the necessary infrastructure and those that cannot. It has also resulted in a divide between persons who can afford the technology tools to facilitate access and those who cannot. It has also opened a divide between persons living in urban areas where there exist more available options for connectivity and those in the rural areas who do not have physical access.

One of the most notable areas in which the traditional notion of physical access to ICT has been prominent is in concerns about the "digital divide" between developed and developing countries. Former United Nations Secretary General Kofi Annan observed that the "digital divide" is actually several gaps in one: a technological divide in infrastructure, with 79 per cent of the world's Internet users living in the 24 richest countries, which

contain just 16 per cent of the world's people; a content divide, with nearly 70 per cent of the world's websites in English and a frequent lack of locally meaningful material; and a gender divide, with women and girls in many countries, rich and poor alike, enjoying less access to information technology than men and boys. There are also divides between developed countries. In the case of Internet use, nations vary widely in the proportion of the public with access to the Internet. And within countries, Internet access tends to remain demarcated on the basis of wealth, age, skills, literacy, cultural background, class, disability, and many other factors.

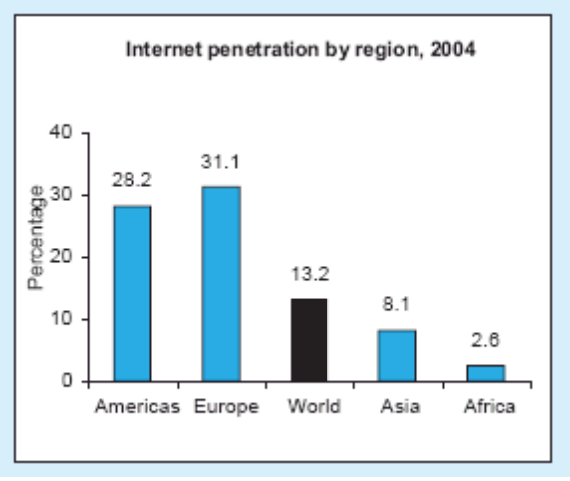
There is much debate about the precise nature of the digital divide. For example, the World Telecommunications Development Report from the International Telecommunications Union (ITU) explained that there is a "statistical divide" between developed and developing countries in terms of data about ICT access, even at basic physical levels.[26] According to this report, by 2003 about 60 per cent of surveys on Internet users had been carried out in the world's wealthiest economies, with no surveys in the 59 poorest countries. Figures from surveys on Internet access in some developing countries have produced results that are very different from earlier estimates, as in Jamaica where an estimate of 5 per cent Internet access was raised to 23 per cent after a detailed survey.

Despite the uncertainty about the statistical details, there can be no doubt about the existence of substantial divides between the developed and developing worlds. For instance, in 2003 more than 80 per cent of people in the world had never even heard a dial tone, let alone surfed the web. But although such data on physical access are relevant pieces of a wider picture, a more important overall issue is to gain an understanding of the social and economic dimensions of different kinds of divide.

Internet Penetration Trends

The Internet, which is fuelled by the use of network access technologies such as fixed line, mobile cellular, wireless, terrestrial and satellite, continues to grow at significant rates. By the end of 2004 there was an estimated 840 million Internet users worldwide and recent estimates put penetration rates at over one billion at the end of 2005. The highest penetration rates are found in Europe and North America where almost one-third of these populations are online. While in a number of countries over 50 per cent of the population is using the Internet, only an average of 2.6 per cent of Africans is online. Penetration rates in the Asia-Pacific region vary widely from over 60 per cent in countries such as the Republic of Korea, Australia and New Zealand to less than 5 per cent in a number of countries, including Bangladesh and Laos. According to recent statistics, Jamaica's Internet penetration stands at 90 per cent. Worldwide Internet penetration by region is shown in Figure 1.3.

Figure 1.3 • Internet penetration by region 2004



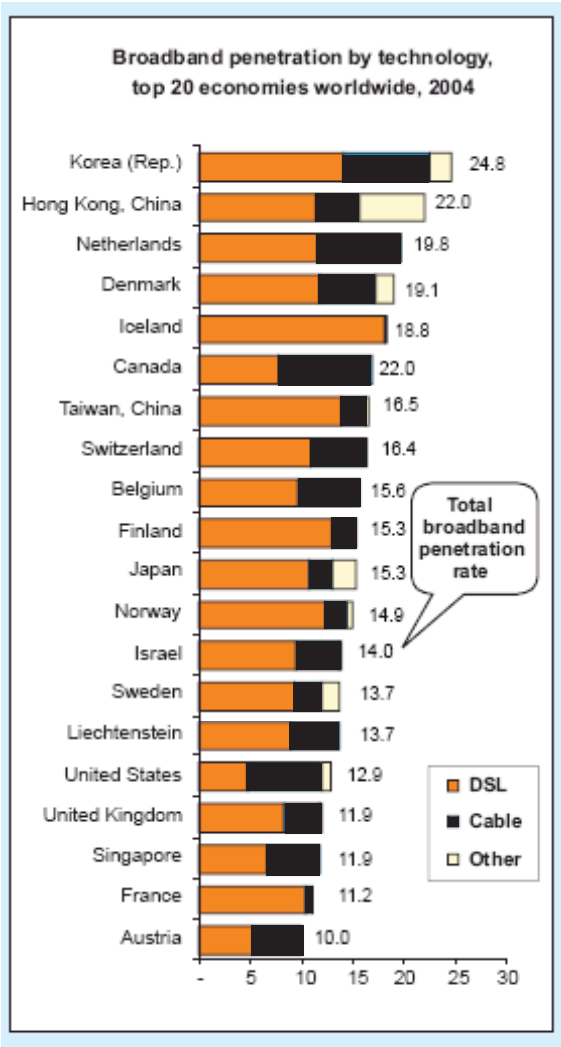
Source: ITU World Telecommunications Indicators Database

Broadband

Broadband technologies have transformed access to the Internet with regard to capacity and speed. This high-speed access has opened doors to a number of applications such as downloading and exchanging music, images and video files. Its greatest potential is in configuring its use in the transformation of a country's economic and social development through the development and deployment of services such as e-government, e-commerce, e-learning, e-health and e-democracy. More and more countries including those in the Caribbean have recognised the transformational potential of this technology and have created an enabling environment to secure the fibre infrastructure to bring broadband functionality to its citizens.

According to the ITU World Telecommunications Indicators database,[27] by 2004, broadband Internet subscribers represented approximately 2.5 percent of the world's population and 38 per cent of all Internet subscribers worldwide. Figure 1.4 shows the top 20 economies with the highest broadband penetration rates. This list includes 12 European countries, five Asian countries and Canada, the U.S. and Israel. The vast majority of today's broadband users are in the developed world and globally, Asia, Europe and the Americas represent no less than 99 per cent of all broadband subscribers. Many African countries have not yet launched high-speed Internet access.

Figure 1.4 • Broadband penetration rates



Source: ITU World Telecommunication Indicators Database

The status of the world's telecommunications/ICT development suggests that whilst the digital divide is closing there continues to be great disparity between the developed and developing countries in terms of ICT level. Whilst high growth

rates in the mobile sector have brought some benefits to developing countries it is not sufficient to bring digital opportunities to all and many developing countries risk falling behind, particularly in terms of Internet access and newer technologies such as broadband.

Leveraging the Use of ICT for Social and Economic Development in Developing Countries

The possibility that ICT can be effectively leveraged by developing countries to make them more globally competitive, contribute to the development of their economies and consequently help deliver on the Millennium Development Goals (MDG) of reducing poverty, eradicating disease and increasing literacy has not been lost on international development agencies such as the United Nations, the World Bank and organisations such as the International Telecommunication Union.

The UN General Assembly Resolution 56/183 (21 December, 2001) endorsed the holding of the World Summit on the Information Society (WSIS) in two phases. The first phase took place in Geneva from 10 to 12 December 2003 and the second phase took place in Tunis in November 2005.[28] The objective of the first phase was to develop a clear statement of political will and take concrete steps to establish the foundation for an information society for all, reflecting all the different interests at stake.

Nearly 50 Heads of State/Government and Vice Presidents, 82 ministers and 26 vice ministers from 175 countries as well as high-level representatives from international organisations, the private sector and civil society attended the Geneva phase of WSIS and gave political support to the Geneva Declaration of Principles and Geneva Plan of Action that were adopted on 12 December 2003. The Summit was hosted by then UN Secretary General, Kofi Annan. The declaration of principles states:

> We, the representatives of the peoples of the world, assembled in Geneva from 10-12 December 2003 for the first phase of the World Summit on the Information Society, declare our common desire and commitment to build a people-centered, inclusive and development-oriented Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life, premised on the purposes and principles of the Charter of the United Nations and respecting fully and upholding the Universal Declaration of Human Rights.

The Summit concluded with a number of action plans with an objective to:

> Build an inclusive Information Society; to put the potential of knowledge and ICTs at the centre of development; to promote the use of information and knowledge for the achievement of internationally agreed development goals, including those contained in the Millennium Declaration; and to address new challenges of the Information Society, at the national, regional and international levels.

The World Summit went on to set some indicative targets for improving connectivity and access in the use of ICT to be achieved by the year 2015, taking into account different national circumstances. These targets are:

(a) to connect villages with ICTs and establish community access points
(b) to connect universities, colleges, secondary schools and primary schools with ICTs
(c) to connect scientific and research centres with ICTs

(d) to connect public libraries, cultural centres, museums, post offices and archives with ICTs
(e) to connect health centres and hospitals with ICTs
(f) to connect all local and central government departments and establish websites and email addresses
(g) to adapt all primary and secondary school curricula to meet the challenges of the Information Society, taking into account national circumstances
(h) to ensure that all of the world's population has access to television and radio services
(i) to encourage the development of content and to put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet, and
(j) to ensure that more than half the world's inhabitants have access to ICTs within their reach

These targets are distinctive for several reasons. They are the first globally agreed targets for measuring ICT development. They also looked beyond the traditional telecommunications sector by including, for example, connectivity in government, schools and hospitals. Although a few ICT-related indicators are included in the Millennium Development Goals (MDGs) of the United Nations, they form part of a broader development framework. The WSIS targets are the first targets entirely devoted to ICT. Unlike the MDGs, they propose specific levels of achievement to be reached by 2015.

The WSIS targets have now been adopted as the international standard for measuring a country's readiness for leveraging ICT in the development of an Information Society that will lead to economic and social development. These targets go beyond the traditional measures of telecommunications development and include goals such as connectivity for governments, schools, hospitals and rural areas.

The Importance of WSIS Targets for ICT Policy Makers

An online survey conducted by the International Telecommunications Union (ITU) asked respondents to rank the WSIS targets by importance. Figure 1.5 below refers to the relative importance countries placed on the targets.

Figure 1.5 • Ranking of importance of WSIS targets

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CHAPTER 2

The ICT Sector in Jamaica and the Caribbean

Bridging the Digital Divide – Towards an Information Society

Despite the many ICT initiatives in the private sector since the 1980s and the deliberate strategy of the Jamaican government to create an enabling environment and attract foreign direct investment to build an ICT sector that would contribute to the development of the Information Society, according to studies by the World Bank and InfoDEV, Jamaica has not had the desired degree of success.

Under the direction of the Ministry of Industry, Technology, Energy and Commerce, the Jamaican government has sought to create an enabling environment to support the development of an ICT sector and an Information Society. It has established an implementation and monitoring mechanism, the Central Information Technology Organisation (CITO), charged with the implementation of the country's national ICT strategic plan and its continued refinement. In 2001, the government passed a Telecommunications Act which established the Office of Utilities Regulation (OUR) and the Spectrum Management Authority (SMA). This paved the way for the introduction of competition for service delivery of mobile communication, Internet access and data communication in the first instance, followed by the introduction of competition in the domestic market for Internet service providers (ISP) and finally, total liberalisation of the telecommunications market which began in 2003. Until then 410 telecommunications licences had been issued in areas such as

Internet access, data services, international voice and data services and domestic voice and data services.

The government of Jamaica has also sought to create opportunities for diversifying and improving the technical skills and competencies of its human resources in areas such as computer programming and networking by the establishment of the Caribbean Institute of Technology (CIT) and the CISCO Regional Networking Centre. Further, the government has established a Universal Access Fund to extend broadband facilities to schools, public institutions and the wider society and has also set up E-learning Jamaica to develop content, provide infrastructure and teacher training for secondary schools throughout the country.

Direct Impact of ICT on the Jamaican Economy

Data and statistics are inconclusive to make a determination of the direct impact of the ICT sector on the development of the Jamaican economy. According to the paper titled "Transformation of the ICT Sector",[1] whilst investment in the sector over the previous four years amounted to US$700 million mainly in infrastructure, the sector employs only 14,000 persons, which represents a small percentage of the work force. Statistics such as the percentage contribution to GDP and rate of growth of the sector compared to the overall growth of the economy and other sectors are not available. The Statistical Institute of Jamaica, in its latest report, has not identified ICT as one of its economic sectors. Data has been provided on the combined Transport/Storage and Communications sector, with no disaggregated data on each component.

Beginning in the early 1990s, several companies in Jamaica including the ICWI group, Jamaica National Building Society, the ICD group and other entrepreneurial start-ups such as Advanced Integrated Systems made unquantifiable investment in developing

the ICT sector mainly in software development and data entry. This was followed by significant investment in call centre operations. Countries that have experienced direct contribution to economic development resulting from the presence of an ICT sector agree that it takes time for these benefits to accrue and to be measured. However, measurement of the sector is critically important if we are to make informed judgements on issues affecting its development. The business community is well aware that a business cannot be successfully managed if key elements such as market size, cost structure, revenue and employment are not consistently measured and monitored.

Early Attempts at Developing an ICT Sector in Jamaica

Starting in the late 1980s, Jamaica made several attempts to develop an ICT sector. Several local companies were established to provide data entry services for the North American market. This opportunity was short-lived as continuous innovation in technology made this requirement redundant. In the early 1990s, several local companies developed a business model of using less expensive Indian resources to develop business application software such as payroll and general ledger, and verticals such as banking and retail.

Mona Informatix

Mona Informatix was established by the University of the West Indies. The first line of business was to develop very robust business processes to convert drawings and maps from analogue to digital form using advanced computer-aided design (CAD) software. By leveraging the relationship with the Jamaican Diaspora in the United States, a contract was secured with one of the United States' largest aeroplane manufacturers. The business

proposition was to use well-trained, lower cost Caribbean skills to work with the CAD software tools to convert analogue engineering drawings of parts of aircraft to digital form so they could be easily manipulated and used in the production of new parts or the redesign of old parts. By the mid-1990s, Mona Informatix had become a very profitable company employing more than 50 persons. Today, Mona Informatix's main activity is the scanning and digitisation of drawings for companies on the local market.

Call Centres

The attempt of Jamaica and other Caribbean countries to develop call centre businesses is well documented. Significant investments were channeled into attracting foreign investors and providing incentives for local entrepreneurs to enter the call centre market. The outcome of these initiatives has fallen far short of expectations.

> Call Centers Antigua Limited (CCAL) was a joint venture between the government of Antigua and Barbuda and Caribbean Information Technologies (CIT). The government invested US$1.1 million for a 40 per cent stake in the call centre, with the goal of creating an IT-skilled workforce of 850. Offering wages of US$110–150 per week compared to manufacturing jobs that paid close to US$200, and high-tech jobs in Internet gaming of US$750/week, the centre essentially became a temporary holding place for those who were between jobs, looking for better opportunities. CCAL, which had promised to create more than 800 jobs, only employed close to 200 people and eventually closed.

Jamaica had a similar experience to Antigua. A fund was created from the proceeds of telecommunications spectrum sales to encourage the development of international call centres. The

funds were lent at highly concessionary rates and invested with varying results. Most investors became frustrated with the shortage of skills in the local labour force and inadequacy of local business rules and regulations.

Lessons Learnt

The reasons for the failure of Jamaica and the Caribbean to develop an ICT sector that contributed to the countries' direct development have been researched and articulated by InfoDev. In its draft Executive Summary, March 2005, titled "Improving Competitiveness and Increasing Economic Diversification in the Caribbean", InfoDev has noted that low-end ICT clusters have been unsuccessful in the Caribbean because:

> The perception of ICT as a high-growth sector has led many countries to attempt to replicate successful international experiences. These include those in Bangalore and Singapore, where high technology firms came together in clusters and had a positive development effect on the economy. This approach has been attempted frequently in the Caribbean, with almost universally poor results, due partly to the choice of low wage dependent clusters such as call centres, as well as the failure to link foreign investment to local skills.[2]

The report went on to say that outsourced business processes began in the Caribbean in the 1980s, with multinationals seeking low cost markets near shore. While some businesses such as Caribbean Data Service from American Airlines were initially successful, they eventually relocated to lower cost centres such as India and the Philippines. As service demand became more complex, the Caribbean's ability to compete faltered due to poor technological and communications infrastructure and lagging skills levels. Instead, almost every Caribbean country experimented

with subsidised telemarketing call centres, which depend on low labour and connectivity cost, neither of which the Caribbean could supply.[3]

According to the InfoDEV report, free trade zones (FTZ) and cyber parks have also been established in Jamaica and the wider Caribbean in the hope of attracting foreign investment, providing employment and technological spillovers but their success elsewhere has not been replicated in the region. For example, the Dominican Republic's cyber parks experiment cost US$30 million and failed to live up to expectations due to a lack of political will and inadequate management. The decision to establish cyber parks in the Caribbean has been ad-hoc rather than based on planning and a strategic vision of the role of these facilities in overall development. Cyber parks in other parts of the world such as Indonesia, Malaysia and the Philippines have seen their success underpinned by two key factors: (1) integrating technologically modern facilities with technical universities, research centres, business incubators and other support services; and (2) a long-term commitment by the government to provide the expensive infrastructure, sustained intellectual capital through learning institutions and skilled management to integrate the many components.

The InfoDEV report sees the Caribbean software industry as another failure, notwithstanding the opportunities that exist for local companies in programming in Open Source Software (OSS) which could expand to industry-specific software. InfoDEV reports that companies like BP in Trinidad, for example, outsourced US$500 million in geological services and software from Houston because Trinidad and Tobago lacked the technological capabilities.

Indirect Impact of ICT on the Jamaican and Caribbean Economy

There is now an abundance of evidence to support the assertion that when ICT is enabled within a national strategic plan where the leadership of the country takes ownership and provides the policy framework that includes investing in the development of human resource capacity and makes the necessary investment in a national ICT infrastructure, economic growth will follow. This assertion has been made demonstrable in developed countries in the mid-1990s and there are now sufficient case studies to show that this also works well for developing countries. The Ministry of Industry, Technology, Energy and Commerce acknowledges that this indirect contribution of ICT[4] to the development of the national economy is fundamentally and strategically important and has developed ICT plans and strategies to create an environment in which businesses and citizens can leverage ICT resources and services to transform their businesses and their social lives.

ICT offers developing economies enormous opportunities to boost their economic growth by enabling innovation, facilitating product development, enhancing productivity and efficiency of enterprises. It also facilitates trade and expanding market reach by allowing firms to reach new customers in a competitive environment. One of the major opportunities ICT presents to developing countries such as Jamaica is providing opportunities for migrants to become involved in the development process of their countries of origin and for diasporas to be important intermediaries between their countries of origin and their adopted country, thus contributing significantly to economic and social development.

Examples of ICT-enabled Businesses in the Caribbean

One area in which there has been demonstrable evidence of the indirect impact of ICT in Jamaica and the Caribbean is in small and medium enterprises (SME). The InfoDEV Report of 2005 cites several examples where ICT is making a meaningful difference in SME in the Caribbean.[5]

Using ICT to Communicate with Customers and to Implement a Forward Integration Strategy

Unique Jamaica, a cluster of 100 small hotels and attractions, has successfully exploited ICT through a collaborative initiative of joint marketing and upgrading efforts. This cluster of businesses devised a vision to attract adventure and nature tourists and created several customised tour packages around the theme of nature, culture and culinary arts. ICT allowed them to launch a cost-effective marketing campaign, to communicate amongst their members and develop an interactive, web-based booking engine.

Another example, Bermuda Escapes, founded by Axiom Computer, has demonstrated how a simple technical solution of cataloguing and coordinating tourist experiences through a simple back-end database can make a significant difference in the tourist's experience. Concierges are able to arrange complete itineraries for their guests and the service provider has first-hand, reliable data on what visitors value. Some small hoteliers that have upgraded their IT systems, such as CocoLaPalm in Jamaica, have seen a 30 per cent increase in return visitors as a result of using technology to streamline key business processes such as inventory, cash control and room allocation and thus provide a more seamless service. A scaled-up marketing and promotional effort to allow booking and vacation planning through the Internet and more responsive customer contact has also enhanced their visibility and bottom line.

Traders, a Blue Mountain coffee distributor in Jamaica, has also been able to use the Internet successfully as a sales channel. Previously selling bulk green beans to overseas buyers who then roasted and branded the beans, it captured very little value. By selling branded, finished products through a simple online ordering service and using a local courier, the company has found new markets, reduced the number of intermediaries and increased sales. Similar small-scale ventures are emerging throughout the region in commodities such as hot sauces and crafts; these businesses are utilising ICT to expand markets, customise products, and more effectively communicate with customers.

Improving Logistics and Efficiency

When used both inside the organisation and along the value chain ICT can improve efficiency dramatically, for example by reducing delivery times and coordinating stock levels through improved coordination of supply and demand, which in turn enhances customer service. Given the large amount of intra-Caribbean business and the dispersed nature of the Caribbean islands, the efficient use of ICT could be a key competitive strategy for regional companies. Companies such as insurers Sagicor can now reply to claims from all over the Caribbean in two days instead of two weeks, the average turnaround time before their regional offices were digitally connected. Even in agriculture where many of the producers are small and fragmented, there is an important benefit to eliminating information asymmetries: a recent pilot project sending voice messages to convey market prices to farmers in Jamaica has been very popular, given the high penetration of mobile phones in the island.

Making Distance Irrelevant

ICT can create significant value by bridging the distance between the islands of the Caribbean as it allows the free and instant

transport of digitised knowledge and products. Some Caribbean companies are using ICT to expand their market base and overcome geographic distance.

Telemedicine in Action

Telemedicine offers an attractive solution to address the lack of medical specialists in the Caribbean and as a source of opinion and specialised diagnosis. Telemedicine is medicine offered at a distance. This entails the use of audio, video and computer technology to investigate, monitor and manage patients who are geographically separated from a medical specialist. Companies such as the Caribbean Medical Imaging Centre (CMIC) can send X-rays, CT scans and ultrasound imaging to specialists around the world to provide a more reliable diagnosis. Although the costs of wireless Internet access and buying and maintaining equipment have kept CMIC from making a profit, the increasing availability and affordability of the technology infrastructure and the expansion of wellness centres in the Caribbean create the right conditions to leverage telemedicine in a more cost-effective manner.

Understanding and Improving Competitive Positioning

Globalisation has reduced significantly the physical barriers between markets and competitors. Previously, large firms with significant financial resources were not only able to make the most informed decisions but also to maintain certain levels of control over suppliers and buyers within their industries. ICT, however, has levelled the playing field to a large extent, allowing firms of all sizes improved access to market intelligence and reducing entry barriers.

Jamaica Music Production – Jamaica Signature Beats

Jamaica Signature Beats (JSB) is a non-profit company of music producers, studios and professionals who have joined forces to provide technical and creative expertise to the international music industry. The company used ICT to access information and online surveys to reposition itself and find customers around the world who would be interested in recording in Jamaica. Jamaica remains an attractive location because of lower costs, a wide range of services and its unique talents and culture. The company then created an interactive website (www.jamaicasignaturebeats.com) to market its booking and logistical services to overseas customers. The website also allows international labels and bands to browse individual member pages which include bios, digital sound files, history, genre of expertise and track record, and to customise a package of the wide range of services (studio time, engineers, mixers, producers and musicians) they would need to record in Jamaica. JSB also used the Internet to conduct a public relations campaign by electronically distributing its press release to over 100 U.S. print publications at marginal cost. This campaign resulted in a dramatic increase in hits and enquiries. The website also displays JSB's strict membership criteria, helping to assure the client of the quality of the service provided. JSB has an operational arm in charge of checking that members comply with standards and quality, service and security. They provide randomised surveys to track customer satisfaction and ensure that producers and studios are on time, fulfil their contracts and produce great music for their clients. It is important to note that the collaboration around the website also addressed the perennial problem of low levels of trust, communication and collaboration within the industry which had made interaction with the global music industry difficult.

Despite the examples above, between 1975 and 2002 Jamaica's GDP has been less than satisfactory when compared with its neighbours and the rest of the world. What this means is that the deployment of ICT in SMEs to make them more competitive is not taking place on a sufficient scale and scope to affect the economic growth and fortunes of Jamaica.

Competitiveness in the Caribbean

According to the World Bank report entitled *A Time to Choose, Caribbean Development in the 21st Century*,[6] several indicators suggest that the Caribbean has seen a reduction in its competitiveness over the last decade. Shares in world markets have fallen, trade has fallen as a share of GDP and the current account has deteriorated. The growth in merchandise as well as service exports has fallen, and the growth in the all-important tourism sector has also declined as a percentage of GDP from 22 per cent in 1990 to 18 per cent in 2001. Even in sectors that receive export preferences such as banana, quotas have not been filled.

According to the report, there has been a steady decline in CARICOM's market share in goods in the region's most important market, NAFTA, from 0.71 per cent in 1985 to .27 per cent in 2002. The report shows that export growth rates have also declined. While overall export growth rates have fallen by half over the last two decades, exports in services have declined relatively faster, even though export growth in services remains much higher than that of goods. According to the report, in the 1980s export of goods grew at 3.7 per cent while services grew at 10.7 per cent. However, in the period 1991 to 2002 export growth in goods declined to 2.9 per cent, while services declined to 5.3 per cent.

While there are examples of ICT being used to make business in Jamaica and the wider Caribbean more globally competitive,

the World Bank report clearly suggests that the scale and scope is limited in its impact on the overall economic growth in the region. There is no doubt that Jamaica's future economic development is dependent on the society transforming itself into an Information Society to allow trade with its most important neighbours whose societies and economies are driven by information and knowledge. It is therefore necessary to determine the factors which are preventing the transformation process and take immediate steps to fix them.

Measuring the Information Society

In early 2007, the International Telecommunications Union (ITU) developed a new measurement framework and measurement indicators to assist policy makers and those responsible for the development and implementation of ICT strategies that will ultimately lead to developing an Information Society.[7] The ITU has defined two key products that will contribute to the measuring of the Information Society: (1) The World Telecommunications/ ICT Indicators (WTI) which provides statistical information up to the end of 2005 on monitoring telephone network growth, mobile communications, pricing, revenues and investments from around 200 economies worldwide, and (2) the ITU's 2007 Opportunity Index (ICT-OI) which, based on ten carefully selected indicators, combines multiple factors into a single overall value. The ICT-OI, which is a useful statistical tool to compare ICT development in different countries over time, was acknowledged by the World Summit on the Information Society (WSIS).

The ICT Opportunity Index is the result of the merger of two well known projects, ITU's Digital Access Index (DAI) and the Orbicom's Digital Divide Index. The ITU developed the DAI in 2003 to measure the overall ability of individuals in a country to access and use ICT. The Index captured availability of infrastructure, affordability, educational level and quality. The

indicators covered fixed and mobile subscribers, Internet access price, literacy and school enrollment, as well as quality parameters such as broadband subscribers and international bandwidth. The combination of the two indicators measure access to, and use of, ICT for the large majority of the world economies. The Orbicom's Digital Divide Index is presented in *From the Digital Divide to Digital Opportunities: Measuring Infostates for Development*. The framework of the ICT Opportunity Index is based on the dual nature of ICT: ICT as a productive asset and ICT as a consumable.

> In that setting the conceptual framework developed the notions of a country's infodensity and info-use. Infodensity refers to a slice of a country's overall capital and labour stocks, which are ICT capital and ICT labour stocks and indicative of productive capacity. Info-use refers to the consumption flow of ICT. Technically, it is possible to aggregate the two and arrive at the degree of a country's ICT-ization or infostate.[8]

Infodensity and Info-use

Infodensity symbolises the productive capabilities and capacity of the economy in terms of ICT labour stocks and ICT capital. ICT capital is made up of information and communication technology network infrastructure as well as ICT networked machinery and equipment. ICT labour is the total stock of ICT skills of an economy's labour force.

Info-use refers to an economy's ICT consumption (or use) within a given period. Since ICT goods are a necessary prerequisite for the use of ICT services, a distinction has been made between ICT uptake and ICT intensity of use.

The ICT-OI Conceptual Framework

The ITU has developed the ICT-OI conceptual framework adopted from Orbicom, which is set within the socioeconomic, geopolitical

and cultural environment of every economy. They have developed ten indicators to be used to measure the ICT opportunity of a country.

The indicators chosen include the four ICT-related indicators identified to track the Millennium Development Goals. Six indicators are part of the core list of indicators identified by the Partnership on Measuring ICT for Development.[9]

Through a mathematically derived formula, the ICT Opportunity Index was derived to be:

ICT Opportunity Index = the square root of (infodensity x infouse)

Table 2.1 shows the Opportunity Index of a selected group of countries chosen from the data provided by the ITU in *Measuring the Information Society* (2007).

Table 2.1 • Opportunity Index of a selected group of countries

	Indicator used
Info Density	
Networks	a) Main telephone lines per 100 inhabitants b) Mobile cellular subscribers per 100 inhabitants c) International internet bandwidth (kbps per inhabitant)
Skills	a) Adult literacy rates b) Gross enrolment rates - primary - secondary - tertiary (*Source:* UNESCO)
Info use	
Uptake	a) Internet users per 100 inhabitants b) Proportion of households with a TV c) Computers per 100 inhabitants
Intensity	a) Total broadband internet subscribers per 100 inhabitants b) International outgoing telephone traffic (minutes) per capita

Source: ITU

The global ICT-Opportunity Index for 2005 shows Jamaica with a ranking of 47 in the world of 183 countries. This is the fourth highest ranking in the Caribbean behind Barbados which is ranked 25 and Antigua and Barbuda (31), the Bahamas (43), with Sweden and Luxemburg ranking numbers 1 and 2 respectively. A closer analysis of the elements making up the Opportunity Index is quite revealing. Table 2.2 below refers:

Table 2.2

Economy	**Network Index**	**Skills Index**	**Info density Index**	**Uptake Index**	**Intensity Index**	**Infouse Index**	**ICT-OI Values**
Sweden	605.1	153.8	**305.1**	464.5	470.59	**467.56**	**377.69**
Singapore	437.6	136.3	**244.2**	395.9	611.56	**492.08**	**346.68**
USA	346.7	143.3	**222.8**	443.6	499.37	**470.64**	**323.85**
Ireland	440.4	137.5	**246.1**	308.8	359.46	**333.15**	**286.32**
Barbados	303.7	130.4	**199**	239.7	518.63	**352.57**	**264.85**
Antigua & Barbuda	444.00	123.8	**234.4**	236.1	277.26	**255.86**	**244.92**
Bahamas	195.4	116.4	**150.8**	183.2	275.83	**224.77**	**184.13**
Jamaica	***363.9***	***94.1***	**185**	***154.5***	***140.65***	**147.41**	**165.16**
Chile	176.00	122.4	**146.8**	157.00	182.68	**169.33**	**157.65**
Grenada	164.3	130.4	**146.3**	168.1	167.94	**168.00**	**156.79**
Malaysia	133.3	104.7	**118.1**	244.3	149.28	**190.96**	**150.19**
St. Vincent	122.2	120.2	**121.2**	115.6	179.83	**144.18**	**132.19**
Trinidad & Tobago	156.4	108.1	**130.0**	122.0	127.02	**124.50**	**127.22**
Guyana	97.4	112.1	**104.5**	108.6	86.71	**97.03**	**100.69**

Jamaica's network index, which is a measure of the information and communication infrastructure and ICT machinery, is higher than that of Barbados and Chile and not very far behind Singapore

and Ireland. What is very noticeable is that Jamaica's skill index is the lowest in the Caribbean and significantly behind Barbados and Ireland. This has resulted in a lower ICT uptake than Barbados and the country is amongst the lowest in the Caribbean. The cumulative effect of the low skill index is that Jamaica has an overall low ICT-IO index compared to Barbados, the Bahamas, Antigua and Barbuda and significantly behind Ireland and Singapore. This clearly points to the fact that if Jamaica is to improve its ICT-OI index and consequently create an Information Society that will facilitate new business opportunities to contribute to economic growth, the country must take some radical steps to improve its skills index.

Appendix A provides details of the telecommunications infrastructure elements used in measuring the Information Society. As is evident, Jamaica is ahead of most of the Caribbean countries including Barbados and compares favourably with countries such as Chile. What is abundantly clear is that compared to its neighbours and other similar countries, Jamaica's efforts in becoming an Information Society are not based on the lack of telecommunications infrastructure creating a digital divide; instead, Jamaica is suffering from an education and skills divide when compared with other countries. The most important consideration therefore for Jamaica in using ICT to shape the future is to fix its education system and improve its skills and competencies.

Notes

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CHAPTER 3

Using ICT to Promote Global Competitiveness

There should be little expectation in the short to medium term that Jamaica will develop an ICT sector producing ICT goods and services through new innovations that will create a meaningful revenue stream and make a noticeable contribution to the Gross Domestic Product. Jamaica was unsuccessful in participating at the lower end of the ICT sector that required no more than high school graduates. Jamaica was also unable to make a breakthrough in the software development end of the sector which required developing a surplus of specific technical skills in areas such as programming, database and systems analysis. The strategic intent of the Caribbean Institute of Technology that was established in partnership with the Government of Jamaica in the Montego Bay Free Zone in the late 1990s to produce a cadre of appropriate skills for software development has not delivered on expectations. The new and emerging opportunities for participating in the ICT sector in the production of goods and services requires even higher levels of skills and competencies. New opportunities such as business process outsourcing are truly knowledge-based and require skills in the area of enterprise resource processing systems and global business skills.

According to the World Summit on the Information Society (WSIS) (2003), the development of an Information Society holds promises and possibilities for developing countries such as Jamaica to leverage the use of ICT in making a significant indirect impact on their economies.[1] An Information Society holds the promise to transform business and, in the case of small economies

like Jamaica, enables small and medium enterprises to become more globally competitive. Jamaica's challenge, therefore, must be to (1) fill the skills gap which is one of the key determinants in developing an Information Society and (2) apply ICT within an enabling framework that will improve the efficiency of SMEs, facilitating the development of new goods and services that are globally competitive and extending the market reach of the SMEs to be global.

Use of ICT in Transforming Education in Jamaica

To determine how best ICT can be used in transforming education in Jamaica which can ultimately lead to developing an Information Society and improving the competitiveness of the country, it is necessary to examine Jamaica's educational achievements in relation to the rest of the region and its trading partners, identify the gaps and then figure out what needs to be done and how best to do it.

Jamaica's Education and Skills Gap Challenge

According to Barrow and Lee (cited in World Bank 2005), one measure of national education attainment is the average number of years of schooling adults possess.[2] In 2002, Jamaica was below the average years of schooling of the adult population in the Caribbean and the rest of the world. Table 3.1 refers. What this means is that education transformation must make provision so that the average number of years of schooling for adults is extended.

Table 3.1 • Average years of schooling of the adult population in the Caribbean

	1980	2000
Barbados	6.8	8.7
Jamaica	4.1	5.3
Dom Republic	3.7	4.9
Trinidad and Tobago	7.3	7.8
Guyana	5.2	6.3
Caribbean Average	4.8	6.0
Latin America Average	4.9	6.3
Korea	7.9	10.8
USA	11.9	12.0
World Average	5.1	6.5

Source: The World Bank: *A Time to Choose* (2005)

According to the World Bank Report, most Caribbean countries have achieved near universal primary enrollment (Table 3.2). However, at the secondary level there are disparities across the region with Jamaica achieving 83.6 per cent.

Table 3.2 • Secondary education enrollment

	1980	1990	2000
Belize	37.9	41.3	70.7
Barbados	88.1	87.3	100.3
Dominican Republic	41.5	40.2	67.4
Grenada	76.6	83.4	90.5
Guyana	76.6	83.4	90.5
Haiti	13.5	20.9	29.3
Jamaica	66.7	65.3	83.6
Trinidad & Tobago	68.8	80.4	82.0
Caribbean Average	56.2	57.8	70.3
World Average	52.2	57.8	70.3

Source: (di Gropello, 2003) and (WDI, 2004)

Enrollment in Tertiary Education

The percentage of high school graduates having access to tertiary education in 2000 was below the world average and Latin America and less than half that of Barbados. Table 3.3 below refers. In addition to the low percentage of tertiary graduates, the World Bank reports that over 75 per cent of Jamaican graduates leave the country. Statistics have shown that tertiary graduates, especially those in the areas of science, engineering, business management and marketing are the more appropriate skills in the use and development of ICT and contribute more to the development of an Information Society.

Table 3.3 • Enrollment in tertiary education

	1980	1990	2000
Barbados	14.8	27.2	41.2
Belize		1.1	.9
Dominican Republic		19.9	28.8
Guyana	2.7	5.8	11.6
Haiti	.9	1.2	1.2
Jamaica	6.7	6.8	16.9
Trinidad and Tobago	4.4	6.6	7.0
St. Kitts			12
St. Lucia			14
St. Vincent & the Grenadines			8.3
Suriname			9.2
Caribbean Average	5.9	9.5	15.1
Latin America Average	15.3	19.2	23.9
World Average	13.3	17.4	25.7

Source: (WDI, 2004)

Quality of Education in the Caribbean

Quality of education matters both for individual and social returns. Economic studies indicate that the salary of an individual in the

Caribbean depends on the quality of education attained. For example, di Gropello (2003) examines the wages of individuals in St. Lucia with the same number of years of schooling. A high quality secondary education degree earns a graduate a salary that is 23 per cent higher than that earned by a graduate with a low secondary degree. Further, in the CXC examinations in 2003 the pass rate in English varied from a little over 35 per cent amongst Guyanese students to more than 65 per cent amongst students from Dominica. This low pass rate is cause for concern for several reasons. The failure of more than 50 per cent in this key subject is either the result of an overly ambitious examination or a failing education system; post-secondary education institutions in the Caribbean generally require three to four CXC passes including English and mathematics as a condition for entry, hence less than half of the graduates of secondary education qualify for further studies, and future job training requires a fundamental ability to learn.

Agenda for Improving the Quantity and Quality of Education in Jamaica

The World Bank (2005) has articulated some clear policy guidelines for improving education outcomes in the Caribbean. These, clearly, must apply to the Jamaican education environment.[3]

The following summarises the World Bank's guidelines.

First priority: Improving quality of education. This is the first priority because quality primary and secondary education is the foundation upon which all future skills-building takes place. It would not be rational for firms or individuals to invest in further upgrading of skills if the population does not possess adequate prior skills.

Second Priority: Increased access to tertiary education through greater private investments. Expanding the pool of knowledge workers with general problem-solving competencies as is developed through tertiary education is critical for improving the skills base of the Caribbean economies. Caribbean enterprise will not be able to increasingly apply scientific, technological and managerial know-how to strengthen competitiveness of existing sectors or develop new competitive sectors without these knowledge workers.

Third Priority: Producing skills demanded by employers: Caribbean firms require specialised skills to be able to diversify into new and emerging sectors. The development of these more relevant skills will demand substantially improved interaction between the training and education institutions and the employers. Further, increased relevance of education will reduce migration of skilled labour by improving the matching of supply and demand.

Improving the Quality of Education

There are several issues to be resolved to address the issue of quality in the education system in Jamaica. One such issue is the cost of providing education to its citizens. A series of recent World Bank public expenditure reviews examined this question and found that the expenditure on education in the Caribbean is not commensurate with outcomes.

The Caribbean governments spend a record share of GDP on education, 6.5 per cent:

Barbados	8.3 %
St. Lucia	7.8
St. Kitts & Nevis	7.7
Dominica	7.0
Grenada	6.7

St. Vincent	6.4
Jamaica	5.6
Latin America/OECD average	4.1

It must be noted that while Jamaica's percentage of GDP spend on education is the lowest in the Caribbean, it is above the average of countries in Latin America. An analysis of the cost elements making up the total expenditure is quite instructive. In most Caribbean countries 94 per cent or more in recurrent expenditure at the primary level is devoted to salaries. This leaves very little resources for learning materials, textbooks and investments in ICT for teaching and learning. There is an urgent need and a compelling case to make the necessary investments in ICT and to reconfigure the teaching, learning and administrative processes which could result in significant savings in operational expenditure, thus making more funds available to extend the reach of education to a larger public and improve the quality of education.

In the Caribbean, a little more than half of the teachers at the primary level have received at least two years of post-secondary training before commencing full time teaching (di Gropello, 2003).[4] In some countries, untrained young students who have just completed secondary education are allowed to teach. In many countries including those of the OECS, teachers receive government paid salaries during their studies and also qualify for excessively generous study leave. For example, a teacher who has served for three years may get study leave with full pay for the first year and half pay for the second year. In St. Lucia, 9 per cent of the teachers were on leave in 2003, which costs the government 4.4 per cent of the annual recurring education budget. Furthermore, the official career path of a teacher involves little monetary incentive

to improve teaching during his or her professional life. In Jamaica, the spread between the entry-level salary and the top salary is 24 per cent, regardless of performance.

There is an urgent requirement to improve and rethink teacher training and management. The use of ICT in providing education at a distance can play a very important role in augmenting teacher training thus increasing the quality and number of teachers available in the profession.

Overall, as a means of further reducing administrative costs, the World Bank report advocates deeper cooperation at the regional level; this will reduce duplication and lead to more innovative education policies. Possibilities for collaboration include: (1) provision of job training, (2) tertiary education, (3) curriculum reform, (4) continued and increased collaboration in evaluation and examinations, building on the CXC experience, standard setting and certification of pre-primary education.

Increasing Access to Tertiary Education through Greater Private Investment

In the previous chapters we showed that if the economy of Jamaica is to grow then Jamaica must become more globally competitive. Competitiveness will have to be strengthened through strategies that emphasise economic diversification and labour mobility. This economic competitiveness will require new literacies (including scientific, mathematical and computer literacy) achieved via curriculum reform and significant improvement in teacher qualifications, higher level professional capacities (engineering, economics, public administration), and new general skills for a significantly larger portion of the population, including entrepreneurship, marketing, time management and teamwork.

Tertiary education institutions are instrumental in providing high-quality training in these fields of study to support

diversification and to stimulate the mobility of human capital. Caribbean countries have agreed to promote regional universities and consolidate small institutions into multifunction colleges to better meet these objectives. A number of challenges arise from the increased demand for higher education, new forms of competition among providers and the need to adapt to the rapidly changing skills needs of the labour market. These require new ways of providing tertiary education including strong, autonomous, accountable and diversified institutions, distance learning and regional partnerships, and also necessitate new ways of financing tertiary education, including student-based financing by the state and increasing cost recovery.

The data has shown that the average percentage of students having access to tertiary education in the region is approximately 9 per cent, with Jamaica achieving approximately 16 per cent. This is below the average of 24 per cent for Latin America and 26 per cent for the rest of the world. According to the World Bank, the shortfall in tertiary education stems largely from a supply constraint. The number of students that completed secondary education in the last decade was much larger than the enrollment in tertiary education. The World Bank statistics show that in 2001, an estimated 57 per cent of a cohort graduated from secondary education but only 15 per cent pursued tertiary education. At the UWI Mona Campus in Jamaica, only one out of every three qualified students gains entry. The bottleneck seems therefore primarily to be an inadequate supply of tertiary education providers. It is only lately that non-governmental providers have emerged as significant players in Jamaica (30 per cent of enrollment in 2002, World Bank 2003). The OECS, Jamaica, Belize, Guyana, Trinidad and Tobago invest around one per cent of GDP in tertiary education, almost exclusively public funds. The exception in the English-speaking Caribbean is Barbados, which invests 2.4 per cent of GDP in tertiary education.

Government of Jamaica Strategy

There is evidence that the assessment and policy prescriptions outlined above have not been lost on the government of Jamaica. Further, it is probably well understood by the private sector, civil society and the academic community that solving the education problem in Jamaica is probably the single most important challenge for the country if it is to break loose of the past and join the new information technology world of possibilities. The Jamaican government understands that strategies and solutions that bring about incremental improvement in the education system in Jamaica are no longer appropriate in solving its education problems and that what is required is a transformation that will break with the past.

Amongst other strategic options and prescriptions, the government of Jamaica has embraced the use of ICT in order to close the skills gap in Jamaica. Specifically, the government has:

- Established the Education Transformation Unit in the Ministry of Education which is committed to leveraging the use of ICT to improve efficiency in the educational, administrative, operational and management processes

- Established the E-Learning Company of Jamaica charged with the responsibility of providing connectivity of schools to the Internet and the use of e-learning tools and platforms in the classroom for teaching and learning

- Embraced the Caribbean Knowledge and Learning Network (CKLN), a regional organisation charged to work with all tertiary education institutions in the Caribbean to strengthen their capacity to use ICT in the development and delivery of distance education programmes. The project will also

provide a regional fibre-optic broadband network connecting all tertiary education institutions in the Caribbean so they can collaborate in the development and delivery of distance teaching and learning. The strategic intent is to radically improve access to tertiary education for Caribbean nationals no matter where they live. (See Appendix B for an overview of the project.)

Why Education Must Change to Prepare the Workforce of the Future

The current education system has failed to complete its most vital and strategic mandate, that of preparing the workforce for the future. Education must therefore change to prepare the future workforce for a world driven by information and knowledge. By and large, the educational leadership does not have the guts or the vision to reinvent itself and most schools, primary through to college, are not in sync with changes in the marketplace; there is a need to become more competitive, more complex, more global and more innovation driven. Without educational change, overseas companies will not outsource their business to the Caribbean and the region will not attract needed direct foreign investment. Whilst there is a teacher shortage in Jamaica, this is not the real problem. Pay teachers double and we would be able to retain them for the innovation economy. Measure their performance, hire the best and fire the non-performers. Over the years political leaders have lacked the courage to create a future-ready national innovation curriculum, made up of more science, more innovation, more high-tech, a more global outlook and more entrepreneurial skills. This must change. We are teaching our children about the past. We need to teach them about the future.

Education Prescription for Jamaica

The prescription for the future of Jamaica in the new Information Society is to upgrade and advance science programmes in high schools and colleges, create new incentive programmes to encourage youth to become scientists, engineers and tech-savvy entrepreneurs; teach innovation and entrepreneurship to everyone; seed venture capital investments in new innovations; bring on the Internet and give it to everyone and reward individuals for being innovative.

ICT in Small and Medium Enterprise (SMEs)

As the largest source of employment, especially in developing countries such as Jamaica, particular attention should be given to SMEs with regard to how ICT may be applied to improve their efficiency, extend their reach and make them more globally competitive. SMEs face particular difficulties in exploiting the benefits of new technologies. Commercial considerations and returns on investment continue to be the main drivers of adoption of new technologies. Results from developed country studies evaluating the impact of ICT on the productivity of firms have demonstrated that complimentary investments in human capital (i.e. skills), new business strategies and processes, and new organisational structures are necessary in order for companies to reap higher benefits from the adoption of ICT.

There is a minimum threshold of costs that must be incurred in procuring ICT infrastructure and available specialised skill sets in areas such as business process engineering, systems development and networking in order to implement systems that not only automate processes but create opportunities for transforming them. In Jamaica and the Caribbean most companies would be considered to be SMEs. These companies are unable to operate at

a level of economies of scale in their business activities to support the minimum threshold of costs of infrastructure and skills required to derive the benefits of using them.

The potential impact of ICT on SMEs was addressed at the WSIS Thematic Meeting on the Economic and Social Implications of ICTs which took place on the 17-19 January, 2005 in Antigua, Guatemala. Over 300 participants from 39 countries attended the meeting, including representatives from governments, NGOs, the business community, academia and international organisations. The meeting addressed the impact of ICT on the economic performance and trade competitiveness of developing countries, explored policies and best practices to enable enterprises – and in particular SMEs – to raise their productivity and competitiveness through the use of ICT. The meeting also reviewed strategies to integrate SMEs into national and international supply chains using modern communication technologies, and examined the impact of the enterprises' structural changes on local, national and international labour markets, identifying strategies to ease the transition.[5]

The WSIS Thematic Meeting articulated some specific policies and practices that will assist SMEs in using ICT to improve their efficiency and make them more globally competitive. The recommendations are comprehensive and form an encompassing blueprint for developing countries based on experience. It is strongly recommended that the political leadership of Jamaica should be made aware of these recommendations and the Ministry of Industry, Technology, Energy and Commerce should include these recommendations in Jamaica's national ICT strategic plans and follow through with their implementation.

The Recommendations

The WSIS meeting suggested that the adoption of ICT is but one component of general economic and social development strategies and has identified the roles and responsibilities of key players and actors engaged in the economic development process of developing countries. These players include government, social partners, international organisations, statistical offices, research organisations and universities.

Government

The government of Jamaica's national development strategy should include the creation of a healthy business environment for SMEs to strive and benefit from ICT. It should include an open, transparent and competitive business framework; clear independent rules for all firms; easy setup and dissolution of businesses; transparent, simple and accessible corporate regulations and equal and stable treatment for national and cross-border transactions. In addition, the availability of transaction facilities, trust mechanisms and logistics and transportation and access to energy and communication facilities must also be included. Access to skills, know-how and innovation support systems in creating an enabling environment for the adoption of ICT is also paramount.

The report further recommends that the potential of ICT to facilitate and increase trade should be included in national and multilateral trade policies and negotiations. It notes that the introduction of ICT requires training and retraining of the labour force and suggests a profound review of education and training systems to ensure that the workforce will be able to adapt to increasingly more frequent changes in work practices and that education in the use of ICT as a powerful information

source should be expanded to enhance the position of citizens as participative members of society and as intelligent consumers. The report also suggested that governments can use ICT as a tool to encourage and facilitate the involvement of their diasporas, and therefore to harness the skills and resources available amongst nationals living abroad for development purposes.

Given the importance of SMEs as sources of employment, particular effort should be deployed to facilitate their access to ICT. Such effort should include the provision of business development services that assist in the design of business models, redefinition of business processes and the assessment of the most cost effective means of implementing ICT solutions, exploring effective ways of providing inexpensive access to ICT, integrating SMEs into supply chains by adopting industrial and trade policies that seek to expand both exports and local value added and by encouraging commercial access to reliable, low-cost connections and boosting local content.

Social Partners

Experience has shown that the effective implementation of ICT requires full participation of the labour force. To avoid active and passive rejection of new production processes associated with ICT, the report stresses the importance of establishing full dialogue with workers so that they understand and adopt new production processes and that policies are adopted that promote labour flexibility in a concerted manner. Experience has also shown that the favourable effects ICT can bring to the labour force can be negated by the race to the bottom-line strategies that lower labour standards rather than improve productivity. Social partners are encouraged to adopt win-win strategies that strengthen the competitiveness of enterprises and at the same time enhance the conditions of work, thus contributing to the sustainable alleviation of poverty.

International Organisations

International organisations should develop their policy analysis and capacity building programmes based on practical and replicable experiences of ICT policies and actions that have led to poverty alleviation through improved competitiveness of enterprises, resulting in greater trade and better employment. Such programmes should result from policy development dialogues that seek to render international and national development strategies coherent.

Statistical Offices and Research Organisations

There is a clear need to develop mechanisms to measure the implementation of ICT, to identify the factors that obstruct their adoption and to assess their impact on the economy. Although the Thematic Meeting has shown that evidence is now being accumulated that information and communication technologies can make a tangible and widely shared contribution to economic growth and social welfare, much remains to be understood about how it happens and under what conditions, and how we can encourage that process. This means that attention should be paid to the development of new statistical data, both through the official statistical mechanisms and from other sources.

Because of the importance of gathering statistical data to establish baseline positions in measuring an Information Society, to be able to benchmark with other countries and identify gaps which will inform future strategies in developing the Information Society, the report suggests that the capacity of national statistical offices should be strengthened to gather the following data that should be made widely available:

- Longitudinal data at the enterprise level on investment in, and use of, ICT, the enabling resources that have led to the effective use of ICT and finally, the performance of these enterprises

- Best practices – in enterprises and in business development services – of enabling policies that have led to improved competitiveness through ICT and of entrepreneurship strategies that have used ICT to gain a competitive edge

- Firm level data on changes in the patterns of occupation and skills requirements demanded of the labour force and general data on the shifts of employment patterns related to changes in production processes

Universities

Universities and research centres should be encouraged to expand their research on the relationship between investment, employment, productivity and the competitiveness of firms.

Economies of Scale

All the studies on the use of ICT suggest that the investment in both infrastructure and skills require a degree of scale of use in order to realise a reasonable return on investment. The challenge for Jamaica and other Caribbean countries is dealing with the issue of small market size, which has only been partially overcome by the very open nature of these economies. It is in Jamaica's economic interest to seek to be part of a larger regional market that can act as its domestic base from which to launch onto the international market. Accelerating trade integration in the CSME will help to increase domestic market size and moving as quickly as possible towards free movement of labour within the region will

ease labour and skills shortage. The InfoDev report has identified some key areas of collaboration amongst Caribbean countries for creating an enabling environment for leveraging ICT within a framework of economies of scale. These are the harmonisation of business regulations to lower transaction costs and uncertainty for investors and single visas and work permits for foreign nationals valid in all Caribbean countries to improve incentives for multi-country investments. Joint promotion by a regional investment promotion centre to engage in image building, provide information and standardise procedures across the region could help attract investment.

Accelerate Regional Harmonisation in Key Policy Areas Related to ICT

One of the important areas in which Jamaica and the Caribbean can accelerate activities towards an Information Society is in the area of policy harmonisation relating to ICT. The legal enforcement of electronic documents, protection of intellectual property and privacy, development of a framework to support electronic transactions and enforcement of electronic documents and contracts are amongst the priorities in this realm. Laws on intellectual property as they relate to the Internet, in code, data, music or other content have important implications for businesses selling into a multi-jurisdictional world. Keeping abreast of these changes and providing up-to-date, enforceable legislation is an expensive proposition and will affect the region's ability to transact with and attract foreign businesses.

A regional approach to these reforms would be useful. A regional approach would, first, constitute an immediate step towards regional harmonisation of practice and legislation, which will help international compatibility in e-practices and attempts at replicating best practices. Second, it would allow individual

governments to move more swiftly in the reform process as each country focuses on facilitation and execution rather than drafting country-specific legislation. Third, a regional approach would help maximise the use of scarce expertise in a fast-evolving area. So far, however, issues such as intellectual property and e-enabling legislation (e-commerce regulation, electronic signatures, Internet banking and transactions and Internet crime) have not been tackled regionally.

Jamaica must encourage the establishment of a regional body or strengthen the capacity of an existing regional body, appropriately resourced and charged with the responsibility to identify key policy areas relating to ICT that can be facilitated through regional harmonisation.

Notes

1. World Summit on the Information Society (WSIS) Geneva, Switzerland, 2003.

2, 3. World Bank, *A Time to Choose: Caribbean Development in the 21st Century* (Washington, DC: World Bank, 2005).

4. di Gropello, 2003.

5. WSIS Thematic Meeting on the Economic and Social Implications of ICTs www.itu.int/wsis/docs2/thematic/ilo/final-report.pdf

CHAPTER 4

Beyond the Information Society: The Future

In the last decade the Internet provided a platform for rapid changes in innovations at a speed that we have never experienced in our history. Innovations such as the Netscape browser, Google, YouTube and blogging empowered individuals to break loose of the constraints that space and time had hitherto imposed. A transformed world has been created where relationships are no longer defined by geography but by communities of interest; individuals are no longer constrained to be recipients of published information but can themselves become publishers of information. In this transformed world termed the Information Society, businesses have experienced a step function increase in efficiency gains through innovations in the use of broadband technologies which have broken down borders, creating global markets and giving access to the use of the best and most cost-effective resources anywhere in the world. Teaching and learning has been transformed from being teacher-centred to being student-centred, facilitating the student's learning in his or her own time and at a place of his or her choosing, and governments have become closer to their citizens, offering more transparency and ease of access to government services.

On the one hand, advances in technology have brought new opportunities to individuals and have contributed to their social and economic development. It has leveled the playing field for communications, information access and skills, bringing the opportunity to all to learn, develop and grow. On the other hand, these technologies can have a negative impact on our lives

especially with regard to democracy, security and individual freedoms and rights. James Canton, Chairman and CEO of the Institute of Global Futures, has identified some of the risks as follows:[1]

- More than forty million people in the United States yearly are victims of identity theft and more than one hundred million people worldwide. This number is rising

- Personal identity is a valuable criminal commodity with a global value and a willing market of buyers

- Hackers steal billions of dollars from personal bank accounts

- Invasive governments can watch and listen to their citizens via a global communications network called Echeon that evades the laws of ten democracies including the United States

- Global positioning satellites calibrate overhead, watching our every move every three minutes. They have the capacity to take pictures of every face, every license plate, every bedroom and every one of our children

- Wiretapping enables governments to listen to citizens' conversations

- Every e-mail worldwide is electronically scanned, analysed and stored, ostensibly to allow government officials to search for threatening messages sent or received by everyone in more than one hundred countries, including the United States

- Every cell-phone conversation is listened to by a battery of supercomputers that mine the text for keywords and then report back to their human monitors who are responsible for threat assessment

- An army of hackers competes to damage or destroy your computer with viruses

- Every newborn in the U. S. has blood taken that goes to federal authorities for analysis and storage. And few know why

- Every car has a black box that registers the driver's actions for on-demand government access

- In some countries video surveillance cameras, often hidden from view, follow individuals around every day in 70 per cent of public spaces, everywhere from work to shopping to driving their car

- Global direct-marketing companies amass consumer databases with the ability to predict your behaviour

- Every insurance company and employer insists on knowing your total health status

- Insurance companies trade confidential consumer information daily

The convergence of supercomputing power, the advanced intelligence of computers, the increased integration of computer chips and the pervasive networking capabilities of wireless communication continue to transform our world at speeds that are

incomprehensible. New technologies currently in the laboratory stages are suggesting that the time is fast approaching when our entire lives will be managed and controlled by computers that have the ability to think, to be aware of their existence and which are choice makers without intervention from humans. The rapid pace of Internet-based innovation and functionality is suggesting that the Internet can become the universal mind of our planet, controlling all aspects of human behaviour. The Internet today already exhibits self-healing skills; like humans, it can diagnose problems and reason out solutions to keep working, even optimising itself all on its own.

Computer Development in the 21st Century

If Moore's Law continues to apply, whereby the power of computer chips doubles every eighteen months, by 2025, cheap personal computing power will exceed the power of the supercomputers sold today to governments and large corporations. Future computer chips will not only be made from silicon but will include the use of nanotech, photonics, quantum, biotech or DNA. What we have on our desktop today is what we will be wearing by the year 2015.

Software is currently being built that can self-organise, self-assemble and make decisions about its own rules, standards, protocols and objectives; such software is being used in cars, homes and businesses. Already these types of software advise us and take action to optimise network communications, transactions and fundamental tasks in areas such as security, traffic, health, energy and finance.

According to the forecast by Canton,[2] computers of the twenty-first century will have the following characteristics:

1. Computers will become powerful extensions of human beings designed to augment intelligence, learning, communication and productivity.
2. Computers will become intuitive – they will "learn", "recognize" and "know" what we want, who we are, and even what we desire.
3. Computer chips will be everywhere and they will become invisible – embedded in everything, from brains to hearts to clothing and toys.
4. Computers will manage essential global systems such as transportation and food production, better than humans.
5. Online computer resources will enable us to download applications on demand via wireless access anywhere and anytime.
6. Computers will become voice activated, networked, video-enabled and connected together over the Internet, linked with each other and humans.
7. Computers will have digital senses – speech, sight, hearing, smell – enabling them to communicate with humans and with other machines.
8. Neural networks and other forms of artificial intelligence will make computers both as smart as humans and smarter for certain jobs.
9. Human and computer evolution will converge. Synthetic intelligence will greatly enhance the next generations of humans.
10. As computers evolve a new form of intelligence, a new digital species and a new culture will emerge that is parallel to ours.

The Internet and the Web in the 21st Century

The Pew Internet and American Life Project surveyed more than 1,200 professionals in 2004, asking them to predict the 'net's

next decade.[3] One scenario earned agreement from two-thirds of the respondents: "As computing devices become embedded in everything from clothes to appliances to cars to phones, these networked devices will allow greater surveillance by governments and businesses." Another scenario was affirmed by one-third: "By 2014, use of the Internet will increase the size of people's social networks far beyond what has traditionally been the case." These predictions are fast becoming reality.

To most future watchers, the real transformation of the Internet and the Web underway is more in line with what Sun's John Gage had in mind in 1988 when he famously said, "The network *is* the computer." He was talking about the company's vision of the thin-client desktop, but his phrase neatly sums up the destiny of the Web: as the operating system for a megacomputer that encompasses the Internet, all its services, all peripheral chips and affiliated devices from scanners to satellites, and the billions of human minds entangled in this global network. The Internet today, operating in collaboration with Google, Internet Explorer, blogs and other tools, is already exhibiting these characteristics.

A Wikipedia article entitled "We are the Web" speaks of the power and the future of the Internet and the Web:

> Today, the Machine acts like a very large computer with top-level functions that operate at approximately the clock speed of an early PC. …This planet-sized computer is comparable in complexity to a human brain. Both the brain and the Web have hundreds of billions of neurons (or Web pages). Each biological neuron sprouts synaptic links to thousands of other neurons, while each Web page branches into dozens of hyperlinks, that adds up to a trillion "synapses" between the static pages on the Web. The human brain has about 100 times that number – but brains are not doubling in size every few years. The Machine is.
>
> Since each of its "transistors" is itself a personal computer with a billion transistors running lower functions, the Machine is

fractal. In total, it harnesses a quintillion transistors, expanding its complexity beyond that of a biological brain….

By 2015, desktop operating systems will be largely irrelevant. The Web will be the only OS worth coding for. It won't matter what device you use, as long as it runs on the Web OS. You will reach the same distributed computer whether you log on via phone, PDA, laptop, or HDTV. …

What will most surprise us is how dependent we will be on what the Machine knows – about us and about what we want to know. We already find it easier to Google something a second or third time rather than remember it ourselves. The more we teach this megacomputer, the more it will assume responsibility for our knowing. It will become our memory. Then it will become our identity. In 2015 many people, when divorced from the Machine, won't feel like themselves – as if they'd had a lobotomy.

Canton has provided this forecast for the Internet:[4]

The Future Internet Trends 2020

1. The 'net will be wireless and pervasive, with access anytime, anywhere
2. Every manufactured product, object and material will be online
3. The telephone and TV will be fully integrated into the Internet
4. The Internet will develop a type of "personal awareness" of itself
5. Real-time access to 80 per cent of all information in the world will be provided free
6. All e-mail will be multimedia, audio and video streaming-enabled
7. Real-time videoconferencing will be widely available

8. "Telepresence": The 'net will be an immersive experience
9. All merchants, banks and consumers will be linked
10. The 'net will be a vibrant trading market with more than 3 billion people
11. Collaboration will drive trade and entrepreneurship will drive demand
12. Personal privacy will be recognised as a major national security issue

Impact on Our Lives

The creation of the Information Society provided the opportunity for transforming our lives by the choices it gives us to access people, services and information technology in radically new ways. The emerging society of the twenty-first century, beyond the Information Society, which will be characterised by super-fast quantum computers and an Internet that acts as a universal mind that has "awareness and can self-organize", connecting all citizens together, will transform our lives in radically new ways, not by choice but by design.

The Future Surveillance Society

Futurists have forecasted that by 2015, the United States will have more than ten million closed-circuit televisions and cameras, more than half operated by government agencies, the rest by private security and corporations, and the average citizen in New York City will be photographed 500 time a day. Every object will have an Internet address and will be online, connected, watching and being watched. All television sets will be two-way interactive; they will watch us as we watch them and biometrics will be used to capture facial, iris, fingerprint, voice or breath scans before you can leave or enter a room or building. Genomic personal identity

cards will be required to enter or leave areas in a city or town. They will have unique DNA markers for each individual. Global Positioning Systems (GPS) will signal satellites, authenticating our true identity and registering who we are, where we are going – and perhaps wondering why – and every chip in every product will be online, linked to GPS satellites that can track every human on the planet. Security chips could be embedded in our skin and used to buy, sell and authenticate our identity.

Health

Each of us will soon carry a personal health record "smart card" that contains the relevant data about our health history on a tiny chip. These cards will include our entire health record, including the drugs we have taken, surgery we have had, medicines we are allergic to, and diseases or conditions we have suffered. The next stage is for these health chips to be embedded in our skins. Upgrades via the wireless Web will keep our personal health history current. Our health card will act as a tiny computer, another gateway to the 'net, searching out information for our specific needs and alerting the hospital or specialist when we need their service. It will watch our health statistics and know what we need and when.

Education

Knowledge will not be based on information that has been acquired over time. Instead, "knowledge objects" will exist on any conceivable subject and will be hosted on the 'net. These knowledge objects will be automatically downloaded from the 'net to embedded chips that are stored in humans and used in a "just-in-time" manner.

Convergence: The Economy

The economy of the future, beyond the information economy, has been defined as the innovation economy. This future economy has been defined as a fusion of technology and economics that promises to change the nature of work, jobs, capital, competitors, markets and customers. It promises the individual opportunities to create wealth on a scale never seen before. This new economy is being created by the convergence of four very important core technologies, referred to as "power tools" by Canton:

- Nanotechnology: The manipulation of matter at the atomic scale, producing new drugs, fuels, materials and machines

- Biotechnology: The unlocking of DNA, life sciences, and the impact of genomics on health care, life extension, and medicines

- Neurotechnology: The use of devices, drugs and materials to heal, manage and enhance mental performance and functioning

- Infotechnology: Products and services related to computing, telecommunications and networks

For example, advances in biotech to build the next generation of drugs – based on genomics and leveraging DNA – can only be achieved by computing and Internet innovations. The sequencing of DNA and the resulting new drugs and personalised medicine could not be undertaken without fast, powerful computers. Network outsourcing and Internet collaborations are also drivers of nanotechnology. The building of devices and materials at the nano scale could not happen without access to smart, cheap, fast computing and cheap bandwidth networking power.

In the United States, the marketplace is already being defined by companies that are gaining a competitive advantage through the manipulation, production, analysis and intellectual property associated with these power tools. Work being done in genetic programming at Intel for the next generation of microprocessors and IBM's work on nano drives for data storage are two such examples.

According to Canton,[5] signs of the innovation economy are as follows:

- One-third of the U.S.'s GDP is already based on innovation industries. By 2015 more than two-thirds of U.S. GDP and more than one-third of the world's GDP will be based on innovation industries

- Information technology drives more than two-thirds of labour productivity today. By 2015 innovation industries will dominate labour productivity worldwide

- More than one billion people are connected to the Internet today; by 2015, three billion people will be online

- Total information technology and communications spending worldwide is about $2 trillion today. By 2015, it will exceed $5 trillion

- The nanotech industry generates more than $10 billion today. By 2015, nanotech will generate more than $1 trillion and employ one million workers

- Where there is high-tech penetration of computers, wireless, and Internet access societies thrive and economic productivity is robust

- The U.S. medical device marketplace in 2005 is estimated at about US$80.3 billion with projected growth by 2010 reaching US$100 billion

- The global market for microelectronic medical implants was US$11.9 billion in 2004, and is expected to rise at an adjusted annual growth rate of 22.1 per cent to $32.3 billion in 2009

Present Trends in the Innovation Economy

Nanotech Market Forecast

Nanoscience represents a radical change in material science, drugs, devices and manufacturing. Nano-based products could change everything, reducing functions down to 100,000 times smaller than a human hair. Total Nanotech investment worldwide was $10 billion in 2005 and is forecast to be more than $30 billion by 2008.

Biotech Market Forecast

The size of the U.S. biotechnology market in 2004 was estimated at $311 billion, divided between 1,473 companies with 189,300 employees. Worldwide it is close to $1trillion. Biotech is the key driver for health care, a $2 trillion industry in the U.S. and more than $10 trillion worldwide, numbers only rivaled by the defense industry. This market is set to grow to $25 trillion by 2030. Biotech promises to revolutionise our lives in the future, particularly with regard to quality of life and life expectancy. According to some futurists, this technology will support genetic vaccines, gene replacement therapy, human enhancement genetic testing, genomic disease prevention, genetic restoration therapy, bio-engineered organs, memory and personality bio-restoration and the production of longevity medicines.

Neurotech Market Forecast

This is the market for drugs, devices and materials that correct and augment human mental capacities. This market stands at about $100 billion today and is forecast to grow to more than $180 billion by 2015. According to some futurists, this technology will support stem-cell therapy for restoring memory; brain-machine implant into the cerebral cortex to activate mobility after paralysis; silicon nano-retinas to provide sight; age reversal on cancerous cells using neuro-pharmacology, genomic neurotherapy to reprogram disease-causing genes; enabling neurons that control robotic arms and legs (human cybernetics) and neural engineering to rewire the brain to combat mental illness and depression.

Infotech Market Forecast

This market, the most mature of the four, is comprised of products and services related to computing, telecommunications and networks. It stands at more than $2.5 trillion today and is forecasted to grow to more than $7 trillion by 2020.

Shaping Our Lives: Jamaica and the Caribbean

The Desired Future

The process of using ICT in shaping our lives involves a clear definition of the state we wish to achieve and consciously making strategic decisions and choices as to how we can and will use ICT in achieving this state. Necessarily, such choices must be informed by our current state of social and economic development. For Jamaica and the Caribbean our reality would suggest that we would want to use ICT to shape our future to be: an economy that is globally competitive and growing, a citizenry that is fully literate and can continuously learn and grow, where poverty and diseases such as HIV/AIDS have been brought under control; a society that feels secure and free from the scourge of crime and

where justice is seen to be applied; a leadership that exercises good governance, encourages democracy and protects the individual rights and the creation of an environment that encourages trust between government and citizens.

We can achieve this desired state by making choices and adjusting our priorities such that:

Education

1. Every child has access to a computer in the classroom with Internet access so that each child has the opportunity to learn at his or her own pace
2. Near to 100 per cent of citizens including those in the inner cities and remote villages achieve a measured degree of literacy and be computer literate and able to use this acquired skill to use ICT and have unlimited access to the Internet
3. Any individual, no matter what age, gender, race, social status or address is presented with the choice to use ICT to access higher education and pursue a course of study of their choice
4. ICT is leveraged to reinvent the teaching and learning process and curriculum reform where the teacher is no longer seen as the repository of information and knowledge, where the emphasis is on teaching children how to learn, manage information, do research, develop written and oral communication skills and are taught about possibilities in the future and not labour too much on the past
5. Teachers are highly paid and they are continuously recertified, are given targets to achieve and are held accountable for results or lack thereof
6. Private companies be given tax incentives to assist all employees in becoming computer literate and further incentives for each employee acquiring certification in new skills-based activities

7. Students in Jamaica can access degrees from the most reputable university in the world in their preferred subject area and conduct research in any area of interest without having to relocate to another country
8. A professor in Jamaica develops the most sought after course in Reggae Studies or a world class programme in Hospitality Management in the tropics that is accessed globally and that provides special benefits for children in the Diaspora

Democracy, Security, Governance and Justice

1. ICT can be used to ensure clean enumeration and to allows citizens the opportunity to vote freely without fear and intimidation, knowing that their vote is in the strictest of confidence
2. ICT can monitor conversations of criminals and track their movements to assist the law in bringing them to justice, to track the movement of illicit funds and reduce money laundering and reduce white-collar crime
3. ICT can make it easy for citizens to interface with government and be trusting of government processes when interfacing with the public, so they are assured of transparency, consistency and fair play
4. ICT is leveraged to provide transparency in revenue collection and give government the assurance and trust that it is collecting revenue from citizens that is due to the government

Personal, Economic and Social Well-being

1. An environment is created so that individuals feel empowered and can make choices and participate in innovative activities. Such an environment will seek to create special innovation centres and business incubators. It will foster and encourage

behaviours where new ideas are valued, where knowledge is appreciated and rewarded and tinkering is encouraged without fear of failure

2. Small and Medium Enterprises (SME) are encouraged to form industry clusters and work towards becoming globally competitive through collaboration, use of ICT and greater economies of scale
3. The skills, competencies and know-how of Caribbean people in the Diaspora is captured and retained as a valuable resource and create an enabling environment and encourage collaboration amongst Jamaica and Caribbean people in the region as well as those in the Diaspora to compete for global businesses
4. Through the use of telemedicine, our health practitioners in the Diaspora are able bring their expertise to the country to assist in diagnoses of illnesses and offering advice and guidance to local practitioners in difficult operation.

Notes

1,3,4,5. James Canton, *Extreme Future: The Top Trends That Will Reshape the World for the Next 5, 10, and 20 Years* (New York: Penguin Group, 2006).

2. James Canton, *Technofutures: How Leading Edge Innovations Will Transform Business in the 21st Century* (San Francisco: Next Millennium Press, 2004).

APPENDIX A*
Measuring the Information Society 2007

Table 1: Evolution of Network

Country	2001	2002	2003	2004	2005
Luxembourg	368.77	389.71	400.44	420.20	675.52
Denmark	377.17	435.75	524.79	529.19	616.47
Sweden	393.77	455.16	558.99	571.50	605.13
UK	354.59	411.15	501.32	517.36	590.43
Ireland	253.97	341.39	397.70	433.94	440.43
Singapore	221.87	267.48	351.09	413.76	437.64
Malaysia	99.91	106.06	13.33	123.12	133.26
Chile	111.52	121.94	138.15	168.17	176.03
Indonesia	25.62	31.60	37.00	45.86	57.52
India	15.32	19.48	24.67	30.35	38.94
Niger	1.80	4.46	5.20	7.13	8.33
Myanmar	3.42	4.55	5.10	5.95	7.84
Chad	3.97	4.67	5.78	6.83	7.65
D. R. Congo	2.07	3.16	4.01	4.71	5.15
Antigua & Barbuda	156.64	179.81	311.37	356.49	444.02
Bahamas	115.65	145.73	152.65	180.20	195.74
Barbados	190.80	235.23	265.68	299.23	303.66
Grenada	81.78	87.00	152.96	153.87	164.26
Guyana	55.59	56.61	72.17	80.77	97.39
Jamaica	90.08	140.30	153.68	160.35	363.93
St. Vincent & the Grenadines	62.17	68.67	115.20	114.93	122.15
Trinidad & Tobago	93.85	95.21	103.37	132.96	154.42
Suriname	82.26	89.43	107.54	116.62	119.31

* All tables based on data from *Measuring the Information Society ICT Opportunity Index and World Telecommunications/ICT Indicators* 2007.www.itu.int/ITU-D/publications/ict_oi/2007/index.html

Table 2: Evolution of Info Density

Country	2001	2002	2003	2004	2005
Luxembourg	202.40	208.99	211.91	216.97	275.10
Denmark	233.17	251.08	276.94	277.74	299.77
Sweden	256.03	265.46	294.48	296.50	305.10
UK	231.08	254.31	278.97	284.91	304.37
Ireland	184.93	214.86	233.34	244.24	246.06
Singapore	171.13	191.85	217.96	237.83	244.24
Malaysia	101.50	105.34	109.04	113.60	118.12
Chile	116.11	121.46	130.18	143.63	146.77
Indonesia	49.53	55.41	60.62	68.22	76.83
India	33.02	37.60	43.12	48.56	55.34
Niger	5.65	9.14	10.14	13.71	16.73
Myanmar	16.60	19.22	20.45	22.43	26.07
Chad	12.60	14.14	15.88	14.80	13.20
D. R. Congo	10.50	13.03	14.77	16.11	16.95
Antigua & Barbuda	138.83	149.48	196.64	210.06	23.44
Bahamas	117.91	132.4	135.47	144.83	150.83
Barbados	156.42	173.86	185.37	197.50	198.96
Grenada	102.40	105.74	140.65	141.63	146.33
Guyana	78.99	79.63	89.60	95.13	104.48
Jamaica	96.69	120.95	126.41	125.83	185.04
St. Vincent & the Grenadines	85.55	89.61	116.78	117.55	121.19
Trinidad & Tobago	98.76	95.95	104.38	119.84	130.01
Suriname	82.26	89.43	107.54	116.62	119.31

Table 3: Evolution of Info Use

Country	2001	2002	2003	2004	2005
Luxembourg	216.69	261.63	316.75	415.33	500.61
Denmark	276.57	321.95	363.64	399.12	434.22
Sweden	281.49	337.62	356.29	413.44	467.56
UK	188.55	240.35	286.36	349.14	394.17
Ireland	177.44	195.02	212.82	276.84	333.15
Singapore	313.03	377.03	439.13	480.76	492.08
Malaysia	114.08	126.40	143.41	164.90	190.96
Chile	115.45	136.11	154.30	165.41	169.33
Indonesia	44.06	45.32	51.55	55.29	59.62
India	30.08	35.96	37.87	44.39	51.81
Niger	11.04	11.62	12.37	13.42	13.00
Myanmar	4.92	5.68	11.39	11.51	14.01
Chad	10.13	12.75	14.04	14.14	14.47
D. R. Congo	4.86	7.25	8.20	8.86	8.79
Antigua & Barbuda	116.30	116.69	127.30	176.53	255.86
Bahamas	167.31	174.48	197.62	211.57	224.77
Barbados	102.74	109.95	264.69	316.27	352.57
Grenada	103.8	146.98	158.37	163.45	168.00
Guyana	79.40	85.50	87.06	88.12	97.03
Jamaica	70.93	103.80	109.95	131.45	147.41
St. Vincent & the Grenadines	90.68	108.13	111.50	115.90	144.18
Trinidad & Tobago	88.94	92.52	98.42	109.33	124.50
Suriname	66.69	71.31	74.72	79.43	43.46

Measuring the Information Society 2007
Basic Indicators

	Population		**GDP**	**Total Tel. Subscribers**		**Effective tele-Density**
	Total (M)	Density (per KM2)	per capita (US$)	Total	per 100 inhabitants	
	2005	*2005*	*2005*		*2005*	*2005*
Country						
Luxembourg	0.47	180	76'442	964	207.41	154.83
Denmark	5.43	126	47'733	8'798	162	100.34
Sweden	9.04	20	39'527	14'551	158.73	100.34
United Kingdom	59.67	244	37'319	97'296	163.06	109.77
Ireland	4.75	60	38'249	6'322	152.41	102.94
Singapore	4.35	6'374	26'883	6'299	143.15	100.76
Malaysia	26	78	5'030	23'911	91.96	75.17
Chile	15.59	21	7'391	14'005	89.82	67.79
Indonesia	22.78	116	1'263	59'682	26.79	21.06
India	1'103.37	348	726	139'750	12.67	8.16
Niger	13.96	11	217	324	2.32	2.15
Myanmar	54	80	0	687	1.27	0
Chad	9.75	8.7	544	223	2.29	2.15
D.R. Congo	51.55	25	118	27.57	4.79	4.77
Antigua	0.08	184	0	121	149.09	105.55
Bahamas	0.32	23	0	336	102.25	58.35
Barbados	0.27	626	10'379	341	126.79	76.65
Grenada	0.1	298	4'274	76	74.34	42.36
Guyana	0.75	3	1'051	392	52.12	37.45
Jamaica	2.65	232	3'664	3'123	117.82	105.78
St.Vincent	0.42	306	3'629	93	78.26	59.34
Trinidad & Tobago	1.31	255	8'729	1'123	86.02	61.26
Suriname	0.45	3	2'484	314	69.86	51.82

Main Telephone Lines

	Main Telephone Lines (000's)		**CAGR %**			**CAGR %**
	2000	*2005*	*2005*	*2000*	*2005*	*2000-05*
Country						
Luxembourg	248.9	244.5	-0.4	56.76	52.58	-1.5
Denmark	3'835.0	3'348.5	-2.7	71.95	61.66	-3
Sweden	6'728.0	5,264.00	-4.8	75.76	58.22	-5.1
United Kingdom	35'228.0	31'796.0	-2	58.94	53.29	-2
Ireland	1'832.0	2'052.0	2.3	48.38	49.47	0.4
Singapore	1'946.0	1'844.4	-1.1	48.44	42.39	-2.6
Malaysia	4'634.3	4'365.6	-1.2	19.92	16.79	-3.4
Chile	3'302.5	3'435.9	0.8	21.71	22.04	0.3
Indonesia	6,662.60	12,772.30	13.9	3.23	5.73	12.2
India	32'436.1	49'750.0	8.9	3.18	4.51	7.3
Niger	20	24	3.7	0.19	0.17	2.6
Myanmar	271.4	503.9	13.2	0.54	0.93	11.5
Chad	10.3	13	4.8	0.14	0.13	-0.6
D.R. Congo	9.8	10.6	1.5	0.02	0.02	-1.3
Antigua	38.3	35.4	-1.5	50.07	43.54	-2.8
Bahamas	114.3	139.9	5.2	37.93	43.9	3.7
Barbados	123.8	134.9	1.7	46.29	50.14	1.6
Grenada	31.4	32.7	1.1	30.86	31.98	0.9
Guyana	68.4	110.1	10	9.2	14.66	9.8
Jamaica	49.35	319	-8.4	19	12.03	-8.7
St.Vincent	24.9	22.5	-2	21.96	18.91	-2.9
Trinidad & Tobago	316.8	323.5	0.4	24.47	24.77	0.2
Suriname	75.3	81.1	1.5	17.35	18.04	0.8

Measuring the Information Society 2007

ISDN and DSL

		DSL Subscribers	
	ISDN subscribers (000's)	**Total (000's)**	**As % of subscriber lines**
	2005	*2005*	*2005*
Country			
Luxembourg	80.8	63.9	26.13
Denmark	321.5	826.4	29.55
Sweden	179	1'208.0	26.01
United Kingdom	870	6'97.70	24.44
Ireland	51.6	239	13.68
Singapore	25.2	355.7	21.95
Malaysia	48.9	481.4	11.15
Chile	0	379.9	11.06
Indonesia	0	0	0
India	0	1'000	2.01
Niger	0	0	0
Myanmar	0.2	0.2	0.05
Chad	0	0	0
D.R. Congo	0	0	0
Antigua & Barbuda	0	0.7	1.99
Bahamas	0	12.8	9.15
Barbados	0.7	31.8	23.61
Grenada	0	0.6	1.86
Guyana	0	1.5	1.36
Jamaica	0	41	12.85
St.Vincent & the Grenadines	0	2.6	11.74
Trinidad & Tobago	0.6	10.7	3.3
Suriname	0.1	1	1.22

Measuring the Information Society 2007

Teleaccessability

	Residential Main Lines		Public Telephones		
	Total (000's)	Per 100 HH	Total (000's)	Per 1'000 inhabitants	As % of mainlines
	2005	*2005*	*2005*	*2005*	*2005*
Country					
Luxembourg	168.7	90.7	0.42	0.9	0.17
Denmark	0	0	4.09	0.75	0.12
Sweden	5'060.9	100	0	0	0
United Kingdom	22'638.8	90.2	87.51	1.46	0.28
Ireland	0	0	4.44	1.1	0.22
Singapore	1'086.4	100	10.9	2.5	0.59
Malaysia	2'839.0	50.9	95.21	39.66	2.18
Chile	2'314.6	51.7	68.73	4.51	2.11
Indonesia	0	0	0	0	0
India	0	0	2'006.49	0	4.84
Niger	0	0	0.07	0.01	0.3
Myanmar	188.3	1.8	4.7	0.09	0.93
Chad	0	0	0.1	0.01	0.77
D.R. Congo	3.9	0.1	1.54	0.03	14.59
Antigua & Barbuda	0	0	0	0	0
Bahamas	0	0	1.59	5.06	1.21
Barbados	0	0	0.78	2.86	0.57
Grenada	0	0	0	0	0
Guyana	79.7	39.8	0.7	0.93	0.68
Jamaica	252	32.9	0	0	0
St.Vincent & the Grenadines	17.1	63.5	0	0	0
Trinidad & Tobago	281.3	81.1	2.3	1.76	0.71
Suriname	58.8	62.5	0.34	0.76	0.42

Measuring the Information Society 2007

Main Telephone Lines

	Main Telephone Lines (000's)		**CAGR %**	**Main telephone lines per 100 inhabitants**		**CAGR %**
	2000	*2005*	*2005*	*2000*	*2005*	*2000-05*
Country						
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United Kingdom	35'228.0	31'796.0	-2	58.94	53.29	-2
Ireland	1'832.0	2'052.0	2.3	48.38	49.47	0.4
Singapore	1'946.0	1'844.4	-1.1	48.44	42.39	-2.6
Malaysia	4'634.3	4'365.6	-1.2	19.92	16.79	-3.4
Chile	3'302.5	3'435.9	0.8	21.71	22.04	0.3
Indonesia	6,662.60	12,772.30	13.9	3.23	5.73	12.2
India	32'436.1	49'750.0	8.9	3.18	4.51	7.3
Niger	20	24	3.7	0.19	0.17	2.6
Myanmar	271.4	503.9	13.2	0.54	0.93	11.5
Chad	10.3	13	4.8	0.14	0.13	-0.6
D.R. Congo	9.8	10.6	1.5	0.02	0.02	-1.3
Antigua	38.3	35.4	-1.5	50.07	43.54	-2.8
Bahamas	114.3	139.9	5.2	37.93	43.9	3.7
Barbados	123.8	134.9	1.7	46.29	50.14	1.6
Grenada	31.4	32.7	1.1	30.86	31.98	0.9
Guyana	68.4	110.1	10	9.2	14.66	9.8
Jamaica	49.35	319	-8.4	19	12.03	-8.7
St.Vincent	24.9	22.5	-2	21.96	18.91	-2.9
Trinidad & Tobago	316.8	323.5	0.4	24.47	24.77	0.2
Suriname	75.3	81.1	1.5	17.35	18.04	0.8

Note: An explanation of the methodology used to measure the features of the Information Society can be found in the publication: *Measuring the Information Society 2007:* Technical Notes (The International Telecommunication Union: Geneva: Switzerland 2007).

APPENDIX B
Caribbean Knowledge and Learning Network (CKLN)
(www.ckln.org)

In November of 2002, the Prime Ministers of seven Eastern Caribbean states met with the President of the World Bank in St. Kitts. One of the key issues discussed was the need to diversify the economies of the Caribbean, through the promotion of institutional innovation, new technologies and regional cooperation embodied in the concept of the Centre of Excellence. This project was presented to the Prime Ministers of the OECS and endorsed by the Ministers of Education in their meeting of June 27, 2003. It was also presented at the Ninth Meeting of the Council for Social and Human Development – COHSOD – which took place in Guyana on October 8, 2003.

The overall goal of the project is to enhance the global competitiveness of countries in the region by upgrading and diversifying the skills and knowledge of human resources in the region through greater regional collaboration and connectivity.

There are three specific objectives:

1. to improve the relevance of tertiary education and training by increasing the number of accredited tertiary education programmes recognized internationally for their excellence;
2. to establish a Caribbean Knowledge and Learning Network to strengthen tertiary institutions, foster specialization and knowledge sharing;
3. to ensure the convergence of fragmented regional and international initiatives to maximize results in the area of tertiary and distance education.

The project has been planned with an initial phase for five years and will be available to all public tertiary education institutions in CARICOM countries. In addition, the learning centres of the UWI (distance education centres) will participate in the connectivity network.

Component One: Improving the Efficiency and Relevance of Tertiary Education Institutions

This component intends to assist the Tertiary Education Institutions to (i) develop strategic planning capacity to effectively manage their resources and to provide educational and training services; (ii) define new priorities and new ways of service delivery; (iii) establish disciplines/fields of study in which they are capable of developing and sharing excellence with other members of the network; and (iv) improve the financing of tertiary education institutions through programme budgeting and cost recovery.

Technical assistance provided to the tertiary education institutions will help them to generate the necessary resources, allowing them to finance, in a sustainable way, the operating costs of the knowledge and learning network, the services provided by the accreditation and quality assurance mechanism and other core regional services.

Component Two: Establishing the Knowledge and Learning Network

This component intends to implement the necessary technical infrastructure and enabling environment to allow participating institutions to both offer and receive distance learning courses and other online services for the benefit of students in the region. This will entail the implementation of satellite connectivity between the institutions, suitable network administration and a comprehensive

learning management system. Additionally, technical assistance and supporting partnerships will be put in place to build the necessary capacity among faculty, students and administrators to utilize modern teaching approaches.

This component will also develop an IT Centre of Excellence, to be located on the campus of an existing tertiary education institution and fully integrated into its organizational structure. The Centre will concentrate on building a broad base of highly trained IT professionals in the Caribbean. The Centre will be developed in partnership with private sector IT companies interested in expanding in the region (e.g. Microsoft) and offer certification in related programmes.

Taking advantage of the connectivity and reach provided by the Knowledge and Learning Network, this Centre will offer IT training both face-to-face and via e-learning. The Centre is expected to take a strongly outward focus, and to aim to provide services to undergraduate, postgraduate and professionals in the Caribbean. Besides training, the Centre will be expected to provide an enabling environment for the incubation of micro-enterprise and potential commercial spin-offs, ideally in partnership with the private sector.

The IT Centre will be expected to provide graduates capable of improving the region's ability to both maintain and service computing and network facilities and to support the growth of community telecentres and "Computers for Schools" programmes. Through contracts with governments, the private sector and international agencies, the Centre would be expected to provide support for the growth of high-level ICT applications in the region, notably e-commerce and e-government. By operating with a strong business orientation, the Centre should not only become financially self-sustaining but should also provide a revenue source for its host institution.

As well as connecting the existing tertiary level colleges, the network will be opened up to the distance education centres of the University of the West Indies and provision will be made for all UWIDEC centres to receive infrastructure and bandwidth capacity.

It is envisaged that the connectivity element of the network will be provided on a non-profit basis. Subscription charges and an element of cost recovery will be required to cover local equipment maintenance and core services. In most cases hardware maintenance and operation will be the responsibility of the local institutions or will be carried out via contracts negotiated in the Caribbean.

Component Three: Building Capacity for Delivering Regional Programmes and Services

This component intends to: (i) train teaching staff in curriculum development, pedagogy and delivery via distance learning methods and in the use of e-learning materials and related conversion of traditional courses, (ii) develop and adapt a set of five pilot programmes (courses) which, as well as providing valuable learning opportunities, demonstrate the effectiveness of the network/approach and which highlight organizational and technical challenges which must be overcome; (iii) strengthen the regional accreditation and certification mechanism, (iv) develop a central management function for the Network, and (v) evaluate and scale-up the project.

Selection of the pilot courses will be based on the strategic planning exercise conducted in the first year of the project and course development will be handled through a combination of consultant support and the active participation of faculty.

In addition to the development of content within the Caribbean, efforts will be made to identify and license externally

available content of immediate utility in the Caribbean. Similarly, development of electronic libraries and other online services will be promoted, with training being given to library and resource managers.

The regionally-based organisation ACTI (the Association of Caribbean Tertiary Institutions) will be strengthened to develop advisory services and an accreditation and certification mechanism.

Glossary

Analogue (also **analog**) the proportional relationship between a signal and a voltage or current that represented the signal. (http://en.wikipedia.org/wiki/Analogue_electronics)

Artificial Intelligence "The science and engineering of making intelligent machines." It can also refer to intelligence as exhibited by an artificial (man-made, non-natural, manufactured) entity. (http://en.wikipedia.org/wiki/Artificial_intelligence)

Bandwidth a measure of frequency range typically measured in hertz. Bandwidth is a central concept in many fields, including information theory. (http://en.wikipedia.org/wiki/Bandwidth)

Biometric authentication in information technology, biometric authentication refers to technologies that measure and analyze human physical and behavioural characteristics for authentication purposes. Examples of physical (or physiological or biometric) characteristics include fingerprints, eye retinas and irises, facial patterns and hand measurements.

Biotechnology any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. (Source: The United Nations Convention on Biological Diversity, Rio de Janiero, 1992)

Blog (short for **web log**) a website where entries are made and displayed in a reverse chronological order. Blogs provide commentary or news on a particular subject, such as food, politics, or local news; some function as more personal online diaries.

Deoxyribonucleic acid (DNA) a nucleic acid molecule that contains the genetic instructions used in the development and functioning of all living organisms. The main role of DNA is the long-term storage of information and it is often compared to a set of blueprints.

Dial-up access a form of Internet access through which the client uses a modem connected to a computer and a telephone line to dial into an Internet service provider's (ISP) node to establish a modem-to-modem link, which is then routed to the Internet.

Digital divide the gap between those with regular, effective access to digital and information technology, and those without this access.

DSL a family of technologies that provide digital data transmission over the wires of a local telephone network.

Electronic mail (abbreviated **"e-mail"** or often **"mail"**) a store and forward method of composing, sending, storing, and receiving messages over electronic communication systems. (http://en.wikipedia.org/wiki/Email)

Encryption the process of obscuring information to make it unreadable without special knowledge such as passwords. Encryption is also sometimes referred as scrambling.

File Server a form of disk storage that hosts files within a network; file servers do not need to be high-end but must have enough disk space to incorporate a large amount of data. Many people mistake file servers for a high-end storage system but in reality, file servers do not need to possess great power or super fast computer specifications. (http://en.wikipedia.org/wiki/File_server)

Google a search engine owned by Google, Inc. whose mission statement is to "organize the world's information and make it universally accessible and useful".

Hyperlink (often referred to as simply a **link**) a reference or navigation element in a document to another section of the same document, another document, or a specified section of another document, that automatically brings the referred information to the user when the navigation element is selected by the user. http://en.wikipedia.org/wiki/Hyperlinks)

Instant messaging (IM) a form of real-time communication between two or more people based on typed text. The text is conveyed via computers connected over a network such as the Internet. (http://en.wikipedia.org/wiki/Instant_messaging)

Linux predominantly known for its use in servers, Linux is used as an operating system for a wider variety of computer hardware than any other operating system including desktop computers, supercomputers, mainframes, and embedded devices such as cell phones.

Matrix in computer programming, a two dimensional array. An array is a list of data values.

Millennium Development Goals eight goals that 191 United Nations member states have agreed to try to achieve by the year 2015.

Mobile or cellular telephone (commonly called **"mobile phone"** or **"cell phone"**) a long-range, portable electronic device used for mobile communication.

Nanotechnology a field of applied science and technology covering a broad range of topics. The main unifying theme is the control of matter on a scale smaller than 1 micrometer.

Open Source the term is most commonly applied to the source code of software that is made available to the general public with either relaxed or non-existent intellectual property restrictions.

Photonics the science and technology of generating, controlling, and detecting photons, particularly in the visible light and near infra-red spectrum.

Podcast a digital media file, or a series of such files, that is distributed over the Internet using syndication feeds, for playback on portable media players and personal computers.

Quantum in physics, a quantum (plural: quanta) is an indivisible entity of energy. For instance, a photon, being a unit of light, is a "light quantum". In combinations like "quantum mechanics" and "quantum optics", it distinguishes a more specialized field of study.

Uniform Resource Locator (URL) a technical, Web-related term to demonstrate the idea of a uniform syntax for global identifiers of network-retrievable documents; this was the core idea of the World Wide Web.

Videoconference (also known as a **videoteleconference)** a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously.

Virtual private network (VPN) a private communications network often used by companies or organisations, to communicate confidentially over a public network.

WAP an open international standard for applications that use wireless communication. Its principal application is to enable access to the Internet from a mobile phone or PDA.

Webcasting ("web" plus "broadcast") sending audio and/or video live over the Internet. In essence, webcasting can be thought of as broadcasting over the Internet. (http://en.wikipedia.org/wiki/Web_cast)

Wi-Fi a brand originally licensed by the Wi-Fi Alliance to describe the embedded technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications. Wi-Fi was developed to be used for mobile computing devices such as laptops in LANs, but is now increasingly used for more services, including Internet and VoIP phone access, gaming, and basic connectivity of consumer electronics such as televisions, DVD players, and digital cameras.

World Summit on the Information Society (WSIS) a series of United Nations-sponsored conferences about information, communication and, in broad terms, the information society that took place in 2003 and 2005. One of its chief aims was to bridge the so-called "digital divide" separating rich countries from poor countries by spreading access to the Internet in the developing world.

World Wide Web (or the **"Web"**) a system of interlinked, hypertext documents that run over the Internet. With a Web browser, a user views Web pages that may contain text, images, and other multimedia and navigates between them using hyperlinks.

YouTube a popular video sharing website where users can upload, view, and share video clips.