The Information Age

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May 2003

e-ASEAN Task Force

UNDP-APDIP

PREFACE

One the many challenges facing the countries in the Asia-Pacific today is preparing their societies and governments for globalization and the information and communication revolution. Policy-makers, business executives, NGO activists, academics, and ordinary citizens are increasingly concerned with the need to make their societies competitive in the emergent information economy.

The e-ASEAN Task Force and the UNDP Asia Pacific Development Information Programme (UNDP-APDIP) share the belief that with enabling information and communication technologies (ICTs), countries can face the challenge of the information age. With ICTs they can leap forth to higher levels of social, economic and political development. We hope that in making this leap, policy and decision-makers, planners, researchers, development practitioners, opinion-makers, and others will find this series of e-primers on the information economy, society, and polity useful.

The e-primers aim to provide readers with a clear understanding of the various terminologies, definitions, trends, and issues associated with the information age. The primers are written in simple, easy-to-understand language. They provide examples, case studies, lessons learned, and best practices that will help planners and decision makers in addressing pertinent issues and crafting policies and strategies appropriate for the information economy.

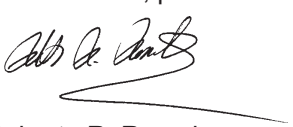
The present series of e-primers includes the following titles:

- The Information Age
- Nets, Webs and the Information Infrastructure
- e-Commerce and e-Business
- Legal and Regulatory Issues for the Information Economy
- e-Government;
- ICT and Education
- Genes, Technology and Policy: An Introduction to Biotechnology

These e-primers are also available online at www.eprimers.org. and www.apdip.net.

The primers are brought to you by UNDP- APDIP, which seeks to create an ICT enabling environment through advocacy and policy reform in the Asia-Pacific region, and the e-ASEAN Task Force, an ICT for development initiative of the 10-member Association of Southeast Asian Nations. We welcome your views on new topics and issues on which the e-primers may be useful.

Finally, we thank all who have been involved with this series of e-primers-writers, researchers, peer reviewers and the production team.



Roberto R. Romulo
Chairman (2000-2002)
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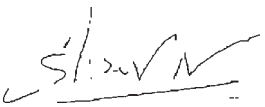

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INTRODUCTION

Imagining the future is always a chancy proposition. For the future almost always turns out differently from how it was imagined. Just think of all the movies made about the present 20 or even 10 years ago. They hardly got it right.

The reason we fail to anticipate the future is simple enough—the many variables that affect the unfolding of history are never fully captured by analysts, activists, artists and scientists.

Yet, we persist in imagining the future. We persist because we are motivated by what could be as much as by what has been. We persist because we have a stake in the future—we intend to live in it.

Imagining a future is affirming a particular account of it. We imagine a future we want to live in. In looking at trends, in extrapolating, we make choices. Even when we take into account all variables, we give some variables more weight than others. Even when all outcomes are anticipated, we deem some outcomes more likely than others. This is not intellectual dishonesty. It is simply how things are. (To say otherwise *is* to be dishonest.)

This primer on the information age, as well as the other primers in this series on the Information Economy, Society and Polity, is an act of imagination and affirmation of a future that is being shaped by information and communication technologies (ICTs).

This particular primer begins with a review of the digital and the ICT revolutions and how these profound technological transformations are changing the economy, business, and the workplace. The primer also outlines the impact of the pervasiveness of ICTs on the individual, the family and society. The effects of technological change on the global order—the nation-state system and governance—are likewise considered. Finally, the primer charts the challenges arising from the widening divide between those who have access to ICT and those who do not.

Ultimately, we imagine the information age in order that we can affect its becoming.

I. THE DIGITAL AND ICT REVOLUTIONS

What is the digital revolution?

Technological breakthroughs have revolutionized communications and the spread of information. In 1875, for example, the invention of the telephone breached distance through sound. Between 1910 and 1920, the first AM radio stations began to broadcast sound. By the 1940s television was broadcasting both sound and visuals to a vast public. In 1943, the world's first electronic computer was created. However,

it was only with the invention of the microprocessor in the 1970s that computers became accessible to the public. In the 1990s, the Internet migrated from universities and research institutions to corporate headquarters and homes.

All of these technologies deal with information storage and transmission. However, the one characteristic of computer technology that sets it apart from earlier analog technologies is that it is **digital**. Analog technologies incorporate a combination of light and sound waves to get messages across, while digital technology, with its system of discontinuous data or events, creates a "universal model" to represent information that is expressed by almost anything using light and sound waves.[1]

To use an analogy, a digital world is a world united by one language, a world where people from across continents share ideas with one another and work together to build projects and ideas. More voluminous and accurate information is accumulated and generated, and distributed in a twinkling to an audience that understands exactly what is said. This in turn allows the recipients of the information to use it for their own purposes, to create ideas and to redistribute more ideas. The result is progress. Take this scenario to a technological level—all kinds of computers, equipment and appliances interconnected and functioning as one unit. Even today, we see telephones exchanging information with computers, and computers playing compressed audio data files or live audio data streams that play music over the Internet like radios. Computers can play movies and tune in to television. Some modern homes allow a person to control central lighting and air-conditioning through computers. These are just some of the features of a digital world.

Box 1. Wearable Computer Systems

Wearable computers are entire systems that are carried by the user, from the CPU and hard drive, to the power supply and all input/output devices. Such systems are under development here at the (MIT) Media Lab, where we are also working to create prototypes of uniquely affective wearable systems. The size and weight of these wearable hardware systems are dropping, even as [their] durability…is increasing. We are also designing clothing and accessories (such as watches, jewelry, etc.) into which these devices may be embedded to make them not only unobtrusive and comfortable to the user, but also invisible to others.

Wearable computers allow us to create systems that go where the user goes, whether at the office, at home, or in line at the bank. More importantly, they provide a platform that can maintain constant contact with the user in the variety of ways that the system may require; they provide computing power for the all affective computing needs, from affect sensing to the applications that can interpret, understand and use the data; and they can store the applications and user input data in on-board memory. Finally, such systems can link to personal computers and to the Internet, providing the same versatility of communications and applications as most desktop computers.

Source: MIT Media Lab Affective Computing Research Group, "Wearable Computer Systems for Affective Computing" [home page on-line]; available from http://affect.media.mit.edu/AC_research/wearables.html; accessed 28 August 2002.

What is ICT?

ICT is short for information and communications technology. It refers to a broad field encompassing computers, communications equipment and the services associated with them. It includes the telephone, cellular networks, satellite communication, broadcasting media and other forms of communication.

What is the relationship between the digital revolution and the ICT revolution?

The digital and ICT revolutions are twin revolutions. To understand their relationship, let us look at the history of voice telephony. According to Robert W. Lucky, "The crux of [Alexander Graham] Bell's invention of the telephone in 1875 was the use of analog transmission—the voltage impressed on the line was proportional to the sound pressure at the microphone."[2] The growth of the telephone was relatively slow; it was not until the 1920s that a national telephone network was established in the US. In the late 1940s, an alternative to analog transmission of voice was considered with pulse-code modulation (an encoded signal of pulses). This marked the start of digitization in telecommunications.

However, it was only in 1961 that the first digital carrier system was installed. Digitization meant the widespread replacement of telephone operators with digital switches. In 1971 the first fiber optic cables suitable for communications were made, leading to efforts to send communications signals via light waves. (Light wave transmission systems are inherently digital.) By about 1989, "ones and zeros" had become the language of telephone networks in the US. Digitization was a critical development because with digital transmission "noise and distortion were not allowed to accumulate, since the ones and zeros could be regularly restored (i.e., regenerated) by a succession of repeater sites along the transmission line."[3] The outcome was clearer communications over longer distances at lower costs.

Today, voice is translated into data packets, sent over networks to remote locations, sometimes thousands of kilometers away, and, upon receipt, translated back to voice. Even television is not immune to digitization. In the near future, television signals and television sets will be digital. It will also be possible to use the television to surf the Internet. The digital TV will allow people from different locations to chat with each other while watching a program. With everything becoming digital, television, voice telephony, and the Internet can use similar networks. The transmission of hitherto different services (telephony, television, internet) via the same digital network is also known as **convergence**.

Cairncross observes that once the infrastructure and the hardware, be it a computer or a telephone or another device, have been set in place, the cost of communications and information exchange will be virtually zero. Distance will no longer decide the cost of communicating electronically.[4] This explains why, for example, a three-minute transatlantic call that costs $0.84 today would probably have cost nearly $800 in today's money 50 years ago!

Box 2. Enter the Communication Satellite

In the late 1970s and early 1980s, just as [Michael] Jordan appeared on the scene, commercial television began to jump over national boundaries. A decade later, NBA games, especially those of the Chicago Bulls, could be seen in ninety-three countries. This exposure was made possible by the direct broadcast satellite (DBS). .. DBS was to have a much greater impact on the day-to-day lives of people around the world than did the moon landing. Launched into orbit so it would float in space over the west coast of South America, the first broadcast satellite relayed information from specialists on health and education into previously isolated areas…. The experiment was so successful that private companies stepped in to launch their own satellites. The companies, as usual, made their profits by selling advertising.

Thus new technology led the world's people into a new era of globalization, paid for by new advertising….

The potential profit of [TV] markets skyrocketed in the 1980s when fiber optic cable carried information in light waves along a silicon wire that had the thinness of human hair. Compared with the copper wire it replaced, the silicon wire could transmit dozens of television programs at once instead of one or two … Digital compression technologies meanwhile increased the possible number of channels on a television set from dozens to 150 and even 500. A British firm developed the first round-the-world fiber optic system in 1991.

Now the possibilities were breathtaking. A single direct-to-broadcast satellite could transmit to earth all of the Encyclopedia Britannica in less than a minute. The contents could even be picked up and placed before the viewer by a cable relay station whose cost in 1975 had been $125,000, but in 1980 was less than $4,000 because of the quick technological advances. Profits promised to have no limit. As cable and satellites created international television in the 1980s, so did advertising, whose profits for cable companies shot up more than ten times.

These new systems seemed to resemble magic cash registers as they churned out the money. They also resembled dynamite as they blew apart governmental regulation and geographical boundaries. They did nothing less than change some of the fundamental ways nations' officials behaved toward their citizens.

Source: Walter LaFeber, *Michael Jordan and the New Global Capitalism* (New York: Norton & Company, 1999), 69-71.

What are the main characteristics of digital technology?

Media Integrity. Data stored in analog formats cannot be reproduced without degradation. The more copies made, the worse the copies get. Digital data, on the other hand, do not suffer such deterioration with reproduction.[5] For instance, movies, videos, music and audio files in digital format can be copied and distributed with a quality that is as good as the original.

Media Integration. One of the major limitations of many conventional technologies is their inability to combine media types. Telephones, for example, can send and receive only sound. Similarly, you can't watch television and expect a character to answer a question you pose. However, with digital data, it is easy to combine media.[6] Thus, phones with video, or interactive sound with pictures, become possible. Hence the term **multimedia**.

Flexible Interaction. The digital domain supports a great variety of interactions, including one-on-one conferences, one-to-many broadcasts, and everything in between. In addition, these interactions can be synchronous and in real time.[7]

Transactions. The ability to combine the transactional capability of computers and computer networks with digital media is another interactive advantage of the digital domain. Placing an order and finalizing a transaction becomes as easy as filling in an electronic form and clicking a button. Movies-on-demand (where you pay for movies that you choose to watch on your TV screen) is just around the corner.

Tailoring. Software developed for digital communications and interaction is designed so that users may tailor their use of the tool and the media in a manner not possible with conventional analog technologies.[8]

Editing. The conventional alternatives for manipulating text, sound, images, and video are almost always more cumbersome or limited than the new digital tools. Years ago, Francis Ford Coppola said that the day would come when his young daughter will take a home video camera and make films that would win film awards. Coppola's prediction is fast becoming a reality. Computers with the right software and minimal hardware can do today what thousands of dollars worth of film and video editing equipment did in the past decades.

What is the Internet?

The Internet is a network of networks. It is a global set of connections of computers that enables the exchange of data, news and opinion. Aside from being a communications medium, the Internet has become a platform for new ways of doing business, a better way for governments to deliver public services and an enabler of lifelong learning.

Unlike the telephone, radio or television, the Internet is a many-to-many communication medium. John Gage argues that—

> The Internet is not a thing, a place, a single technology, or a mode of governance: it is an agreement. In the language of those who build it, it is a protocol, a way of behaving. What is startling the world is the dramatic spread of this agreement, sweeping across all arenas—commerce, communications, governance—that rely on the exchange of symbols.[9]

The Internet has become the fastest growing mass medium. In only four years the number of Internet users has reached 50 million. In contrast, it took radio 38 years, television 13 years and the PC 16 years to reach the same milestone. Despite its explosive growth, however, less than 10% of the global population is online.

Why is the Internet important?

The Internet, according to Lawrence Lessig, is an "innovation commons", a shared resource that enables the creation of new and/or innovative goods and services.[10]

The Internet can be likened to designer clay; its use is limited only by the imagination and skill of the designer. This unique characteristic is due to the fact that the Internet is designed using the end-to-end (e2e) principle. That is, the intelligence in the network is at the ends, and the main task of the network is to transmit data efficiently and flexibly between these ends.

Lessig identifies at least three important consequences of an e2e network on innovation. First, because applications run on computers at the edge of the network, innovators with new applications need only to connect their computers to the network to let their applications run. Second, because the design is not optimized for any particular existing application, the network is open to innovation not originally imagined. Third, because the design has a neutral platform—in the sense that the network owner can't discriminate against some packets and favor others—the network *can't* discriminate against a new innovator's design.

The Internet as an "innovation commons" has made the transformation to the information age possible. As Christopher Coward notes,

> Because of end-to-end, the Internet acts as a force for individual empowerment. It fosters entrepreneurship. And, as long as end-to-end is not violated, it is democratizing in the sense that it redistributes power from central authorities (governments and companies) to individuals. In the Internet Age, everyone can be a producer of content, create a new software application, or engage in global activities without the permission of a higher authority.[11]

Box 3. The Earth Will Don an Electronic Skin

In the [21st] century, planet earth will don an electronic skin. It will use the Internet as a scaffold to support and transmit its sensations. This skin is already being stitched together. It consists of millions of embedded electronic measuring devices: thermostats, pressure gauges, pollution detectors, cameras, microphones, glucose sensors, EKGs, electroencephalographs. These will probe and monitor cities and endangered species, the atmosphere, our ships, highways and fleets of trucks, our conversations, our bodies—even our dreams.

Ten years from now, there will be trillions of such telemetric systems, each with a microprocessor brain and a radio. Consultant Ernst & Young predicts that by 2010, there will be 10,000 telemetric devices for every human being on the planet. They'll be in constant contact with one another. But the communication won't be at our plodding verbal pace. ''Fifty kilobits per second is slow,'' huffs Horst L. Stormer, a Nobel prize-winning physicist employed by Lucent Technologies Inc.'s Bell Laboratories and Columbia University. Machines will prefer to talk at gigabit speeds and higher—so fast that humans will catch only scattered snippets of the discussion.

What will the earth's new skin permit us to feel? How will we use its surges of sensation? For several years—maybe for a decade—there will be no central nervous system to manage this vast signaling network. Certainly there will be no central intelligence. But many scientists believe that some qualities of self-awareness will emerge once the Net is sensually enhanced and emulates the complexity of the human brain.

Source: Neil Gross, "The Earth Will Don an Electronic Skin," in *Businessweek Online* (August 30, 1999); available from http://www.businessweek.com/1999/99_35/b3644024.htm; accessed 28 August 2002.

What is Moore's Law? Metcalfe's Law? Internet time?

Moore's Law and Metcalfe's Law are insightful observations into the power of the personal computer and the Internet.

Gordon Moore, co-founder of Intel, the chip making company, postulated that the computing power of a microchip doubles every 24 months. This means that the power of the computer chip keeps growing as its size shrinks. As the chip becomes smaller and more powerful without significant price increases, so does the personal computer. Many associate Moore's Law with the widespread availability of powerful PCs at constant (if not lower) prices. It was used as an explanation for the rapid changes in the PC industry, which in turn affected the whole economy.

Robert Metcalfe, co-inventor of the Ethernet, the local area networking (LAN) technology, observed that a network's value grows proportionately with the number of users.

Internet time refers to the fact that with the Internet, more intensive activities are possible. Indeed, in business Internet time can be the source of competitiveness.

Moore's Law, Metcalfe's Law and Internet time are pithy ways of expressing the dynamism that characterizes developments in the ICT sector and in the areas being transformed by ICT. Ed Lozowska best puts the rapid changes in the ICT sector in perspective:

> If, over the past 30 years, transportation technology had improved at the same rate as information technology with respect to size, cost, performance, and energy efficiency, then an automobile would be the size of a toaster, cost $200, go 100,000 miles per hour, travel 150,000 miles on a gallon of fuel.[12]

Why are these technological revolutions important?

New technologies transform our lives "by inventing new, undreamed of things and making them in new, undreamed of ways", says the economist Richard Lipsey.[13]

Imagine what will happen when the cost of a long distance telephone call becomes as low as the cost of a local call? Or, when you can get a driving license at a time and place of your own choosing? Or, when you can bank from the comfort of your own living room? In some countries, ICT is already making these happen. Many believe that the current technological revolution may in time exceed the Industrial Revolution in terms of social significance.[14]

Lipsey, who studies the relationship between technological change and economic development, suggests that the introduction of new technologies can have the following effects on society[15]:

- Initial productivity slowdown and delayed productivity payoff from the new technologies
- Destruction of human capital (as many old skills are no longer wanted)
- Technological unemployment (temporary but serious)
- Widening disparities in the distribution of income, which tends to be temporary until the supply of labor catches up to the new mix of skill requirements
- Big changes in regional patterns of industrial location (globalization)
- Big changes in required education
- Big changes in infrastructure (e.g., the information highway)
- Big changes in rules and regulations (intellectual property, antimonopoly, etc.)
- Big changes in the way we live and interact with each other

What are some of the consequences of the digital and ICT revolutions?

First, let us look at the effects of the digital revolution. James Beniger explains:

> The progressive digitization of mass media and telecommunications content begins to blur earlier distinctions between the communication of information and its processing…, as well as between people and machines. Digitization makes communications from persons to machines, between machines, and even from machines to persons as easy as it is between persons. Also blurred are the distinctions among information types: numbers, words, pictures, and sounds, and eventually tastes, odors, and possibly even sensations, all might one day be stored, processed, and communicated in the same digital format.[16]

On a societal level, the digital and ICT revolutions make possible better and cheaper access to knowledge and information. This speeds up transactions and processes and reduces their cost, which in turn benefit citizens and consumers.

The ability of ICTs to traverse time and distance allows human beings to interact with each other in new ways. Distance is no longer a consideration. As Giddens observes,

> With the advent of the communications revolution, distance has a different relationship to self-immediacy and experience than it used to have. Distance isn't simply wiped out, but when you have a world where the value of the money in your pocket is affected immediately by ongoing electronic transactions happening many miles away it's simply a different situation from how the world was in the past.[17]

Put another way, so what if two people are located in different time zones? They can still talk, negotiate, and make deals as though they were face to face. As the sociologist Manuel Castells has noted, "Technological revolutions are all characterized by their *pervasiveness*, that is by their penetration of all domains of human activity, not as an exogenous source of impact, but as the fabric in which such activity is woven."[18]

Will all countries and peoples be swept up in the technological revolution?

The revolution will affect some countries earlier than it will others. For ICT to weave its magic, it must find a hospitable social and political environment. New technologies threaten existing power and economic relationships, and those that benefit from these old relationships put up barriers to the spread of the new technologies. Note, for example, how the music industry has resisted digital audio tapes and Napster. Moreover, laws can deter (or encourage) the spread of new technologies. For example, the lack of legal recognition for digital contracts and digital signatures is holding back electronic commerce.

Debora Spar states that "life along the technological frontier moves through four distinct phases: innovation, commercialization, creative anarchy, and rules."[19] While individualism and the absence of government are characteristics of the first three stages, government—with its rule making and enforcing capability—is a key player in the fourth stage. This is because

> The establishment of property rights is one of the most crucial events along the technological frontier. It allows the market to unfold in a predictable way, and gives pioneers a hefty dose of ownership and security. Most important, perhaps, the creation of property rights also marks the difference between pioneers and pirates, between those whose claim on the new technology is legitimate and those whose claim is not.[20]

It is important to remember that technology is shaped by society as much as it shapes society. Thus, those interested in harnessing the power of new technologies should help create the right environment for it to flourish.

II. INFORMATION, KNOWLEDGE AND THE NEW ECONOMY

What is the information economy?

An information economy is where the productivity and competitiveness of units or agents in the economy (be they firms, regions or nations) depend mainly on their capacity to generate, process, and apply efficiently knowledge-based information.[21] It is also described as an economy where information is both the currency and the product.

While we have always relied on information exchange to do our jobs and run our lives, the information economy is different in that it can collect more relevant information at the appropriate time. Consequently, production in the information economy can be fine tuned in ways heretofore undreamed of. What makes information plentiful in this economy is the pervasive use of information and communications technology.

Box 4. Banking Without Boundaries

> For the first time in 300 years, the very nature of banking has changed. We still handle money, but information, not money, is now the lifeblood of our industry. From what was essentially a transaction-based business, where customers came to you (or didn't), banking has to make the leap into what is essentially a sale-and-marketing culture. In the new culture, a bank is defined almost solely by its ability to add value to the customer relationship, which breaks down into acquiring, analyzing, integrating, and leveraging of information about, from, and for the benefit of each individual customer.
>
> The last (but obviously not the least) of our fundamental changes goes to the very heart of how banking is done. What used to happen only in branches (and only during 'bankers hours') can now happen not just anywhere in the world at any time of the day or night, but also through just about any delivery channel a customer cares to select—the automated banking machine, the telephone, the personal computer, even the television set.

Source: Lloyd Darlington "Banking Without Boundaries: How the banking industry is transforming itself for the digital age" in Don Tapscott, Alex Lowy and David Ticoll (eds.), *Blueprint for the Digital Economy: Creating Wealth in the Era of e-Business* (New York: McGraw Hill), 115.

What are the main features of the information economy?

The information economy is *global*. A historically new reality, the global economy has the capacity to work as a unit in real time on a planetary scale.[22] Corporations and firms now have a worldwide base for skilled labor to tap. Capital flows freely between countries, and countries can utilize this capital in real time.

However, some critics claim that a true global economy has yet to be achieved. Stephen Cohen observes that the mobility of labor is undermined by people's xenophobia and stricter immigration laws. Multinational corporations still maintain their assets and strategic command centers in their home nations, and capital is still limited by banking and finance laws.

Castells, however, argues that even if globalization has not yet been fully realized, it will only be a matter of time before this happens. Globalization will be affected by government regulations and policies, which will affect international boundaries and the structure of the global economy.[23]

A second characteristic of the information economy is that it is *highly productive*. William Nordhaus of the US National Bureau of Economic Research states that:

> Productivity growth in the new economy sectors has made a significant contribution to economy-wide productivity growth. In the business sector (between 1999 and 2001), labor-productivity growth excluding the new economy sectors was 2.24 percent per year as compared to 3.19 percent per year including the new economy. Of the 1.82 percentage point increase in labor-productivity growth in the last three years relative to the earlier period, 0.65 percentage point was due to the new economy sectors. The

contribution of the new economy was slightly larger for well-measured output because that sector is smaller than the business economy.[24]

Some critics argue that there is no relationship between profitability and investment in ICT. Castells looks into the history of productivity growth in advanced market economies and observes a downward trend of productivity growth starting roughly around the time that the information technology revolution was taking shape in the early 1970s. According to him, this decline was particularly marked in all countries for serviced activities, where new information-processing devices could be thought to have increased productivity. However, manufacturing productivity presents a different picture. Manufacturing productivity in the US and Japan increased dramatically in 1988-1989 by an annual average of 3% and 4.1% respectively, and productivity increased at a faster pace than during the 1990s.[25] Castells concludes that economic statistics do not adequately capture the movements of the new information economy, precisely because of the broad scope of transformation under the impact of information technology and related organizational change. There may be a diffusion from information technology, manufacturing, telecommunications, and financial services into manufacturing services at large, and then into business services.

A third characteristic of the information economy is the *change in the manner of obtaining profits*. Robert Reich observes that profits in the old economy came from economies of scale—long runs of more or less identical products. Thus, we had factories, assembly lines, and industries. Now profits come from speed of innovation and the ability to attract and keep customers. Where before the winners were big corporations, now the winners are small, highly flexible groups that devise great ideas, develop trustworthy branding for themselves and their products, and market these effectively.[26] The winning competitors are those who are first at providing lower prices and higher value through intermediaries of trustworthy brands. But the winning is temporary, and the race is never over. Those in the lead cannot stop innovating lest they fall behind the competition.[27]

Is the information economy different from the "knowledge economy", the "new economy", or the "network economy"?

All these terms are used interchangeably, although the various concepts tend to emphasize different aspects of the phenomenon—like "knowledge" instead of "information" or "network" as opposed to "new". Peter Drucker describes the information revolution as a knowledge revolution. The key, he says, is not electronics but cognitive science.[28] The software used for computers merely reorganizes traditional work, which had been based on experience. This is done through the application of knowledge, in particular systematic, logical analysis. Setting up an IT structure is not enough. To maintain leadership in the new economy, the social position of knowledge professionals and the social acceptance of their values should be guaranteed.

The knowledge economy is also a networked economy. The concept stresses the important role of links among individuals, groups and corporations in the new

economy. It has been argued that networks have always been an ideal organizing tool due to their inherent flexibility and adaptability. However, traditional networks were not designed to coordinate functions beyond a certain size and complexity. This early limitation has been overcome with the introduction of ICTs, particularly the Internet, where the flexibility and adaptability of networks are brought to the fore, and their evolutionary nature is asserted.[29]

What is Coase Law? And how is it related to the ICT revolution and the information economy?

Nobel Laureate for Economics Ronald Coase noted that a firm tends to expand until "the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction on the open market."[30] Coase also believed that the law of diminishing returns applies to firm size: Big firms are complicated and they find it hard to manage resources efficiently. Small companies often do things more cheaply than big ones. Therefore, if it's cheaper to perform a transaction within a firm, it usually stays there. However, if it's cheaper to go to the marketplace, then firms go to external suppliers. Thus, a car maker (like Toyota) will buy car batteries from a supplier rather than manufacture batteries in-house if it is easier to do so.

ICT reduces transaction costs significantly. Large and diverse groups of people can now more easily and more cheaply gain near real-time access to the information they need to make sound decisions and to coordinate complex activities.[31] Firms can now downsize to the point of producing their main competence and purchasing everything else they need from outside. Thus, instead of massive corporations, what are emerging are small highly focused corporations that farm out production to their allies. This is also known as **network production**.

Box 5. Furiously Fast Fashions (excerpts)

… Hong Kong is the center of the garment outsourcing industry. Most of the companies located there own and run factories across Asia that weave, cut and sew garments. But Li & Fung is a different kind of outsourcer… the 95-year-old trading house that once sold ceramics and fireworks overseas doesn't own a stitch when it comes to making garments. No factories, no machines, no fabrics. Instead, [Li & Fung[deal only in information, relying on a far-flung network of more than 7,500 suppliers in 37 countries, from Madagascar to China to Guatemala. "There are no secrets in the actual manufacturing. I mean, a shirt is a shirt," says William Fung, the managing director. "We would rather build on something proprietary, like what information it takes to make that shirt faster or more efficiently."

As an order comes in … Li & Fung uses personalized Web sites and e-mail to fine-tune specifications with the customer. It then takes those instructions and feeds them into its intranet to find the right supplier of raw materials and the right factory for assembling the clothes.

… (Li & Fung's) division manager Ada Liu explains how she juggled a pants order for a major American clothing brand. She had the fabric woven in China because the factories there

could dye it the dark green indigo she needed, and she chose fastenings from factories in Hong Kong and Korea because they are the most durable. Then she sent the raw materials to Guatemala for sewing. “For simple things like pants with four seams, Guatemala is great.” says Liu. “They can do things quickly, and it’s close to the U.S. Delivery takes only a few days.” And if production problems arise in Guatemala, Li & Fung can tap into its worldwide network and send the order to another country to avoid delays.

As a garment moves through production, retailers can make last-minute changes to orders on the Web site, which tracks the entire production process. About five years ago, when the company was run by phone and fax, Li & Fung would get an order for 50,000 khaki cargo pants - and deliver the goods five months later. Now, until the material is woven, the customer can cancel the order online. Until the fabric is dyed, the retailer can change the color. Until it is cut, the client can change the design or size. “There are generally fewer mistakes and disputes now when we have to make changes because the communication is clearer. That makes [adjustments] easier to do,” explains Liu.

Source: Joanne Lee-Young and Megan Barnett, “ Furiously Fast Fashions,” in *The Software and Information Industry Association Trends Report 2001* [home page on-line]; available from http://www.trendsreport.net/software/young.html; accessed 28 August 2002.

What is e-commerce?

The ICT revolution has transformed not only how (and where) goods are produced but also how commodities are exchanged. E-commerce is buying and selling over the Internet or any transaction concluded through an information network involving the transfer of ownership or rights to use goods or services. More precisely, it includes all business transactions that use electronic communications and digital information processing technology to create, transform and redefine relationships for value creation between organizations, and between organizations and individuals.

The different types of e-commerce are: business-to-business (B2B); business-to-consumer (B2C); business-to-government (B2G); consumer-to-consumer (C2C); and mobile commerce (m-commerce).

What will happen to agriculture in the information economy?

Like the production and exchange of commodities, agriculture will also be transformed by ICT. ICTs will allow farmers to have more accurate information on the factors that are needed to increase crop yield. “Precision farming” or farm management using ICTs will become the norm rather than the exception.

We can also expect better crops and livestock as a result of agricultural biotechnology. The term “biotechnology” broadly includes “any technique that uses living organisms, or parts of such organisms, to make or modify products, to improve plants or animals, or to develop microorganisms for specific use.”[32]

The potential applications of modern biotechnology in agriculture are varied and promising. These include: (a) improved yield from crops; (b) reduced vulnerability of crops

to environmental stresses; (c) increased nutritional qualities of food crops; (d) improved taste, texture or appearance of food; (e) reduced dependence on fertilizers, pesticides and other agrochemicals; and (f) production of novel substances in crop plants.

Box 6. Farming Goes Into Space

For most of the twentieth century, farming has been somewhat of an inexact science, more a matter of a farmer developing an innate understanding of the nuances of his land and thereby planting and harvesting his fields accordingly. Now, at the beginning of the twenty-first century, sophisticated technological advancements offer today's farmers a variety of methods to increase crop yields, selectively apply pesticides, and lower associated costs. The technology that is enabling this revolution in farming processes is on the ground, in the tractors, but it is also up in the sky, circling the globe in a geo-synchronous orbit 12,000 miles above the planet's surface.

Twenty-four satellites orbit the Earth, making up the Global Positioning System (GPS) System. These satellites have the ability to pinpoint the location of an object on the ground within a few centimeters. Developed by the Department of Defense for military purposes, GPS has now been opened up for civilian use. In fact, civilian applications have come to outnumber military one almost 10 to 1. Among the former, precision farming seems poised to become the next great application area for GPS.

How, specifically, are these new technologies helping farmers to improve farming efficiencies? At this point, precision farming can be broken down into three major areas: crop, soil, and positioning sensors — including remote and vehicle-mounted, on-the-go tools that detect moisture levels, protein, water stress, and disease or weed infestations; machine controls that guide field equipment and can vary the rate, mix, and location of water, seeds, nutrients, or chemical sprays; and computerized GIS maps and databases that process the data produced by the first category of tools and generates the "prescriptions" that drive the second category.

Although improvements can and are being made in the first and second categories, their capabilities are well developed, well defined, increasingly integrated, user-friendly, and ever more affordable. The critical component, and the one that can realize the greatest benefits for farmers, is found in the final category: GIS-based, decision-support software that can guide management practices. It is in this third area where more work remains to be done: building the databases, refining the analytical tools, and increasing the site-specific agronomic knowledge and expertise of the community.

Source: Craig Sutton and John Deere, "Farming Goes Into Space," in *The Software and Information Industry Association Trends Report 2001* [home page on-line]; available from http://www.trendsreport.net/software/deere.html; accessed 28 August 2002.

Did the information economy end with the dot-com crash?

Not at all. If we look at the history of technology and development, we will see that the dot-com bust is part of the normal pattern of events in any technological revolution.

The economist Joseph Schumpeter suggests that a technology revolution starts with the introduction of one or more technologies that enables the new cluster.

The new technology cluster, at first little noticed, achieves successes in early demonstrations. Technical people start small companies based on the new ideas. These new companies compete intensely in this early turbulent phase, when government regulation is largely absent, and as successes mount in a technical free-for-all environment. The promise of extraordinary profit looms. The public begins to speculate.

The middle phase sees a sustained build out or golden age of the technology, during which the technology becomes the engine of growth for the economy. Large companies and oligopolies reign, and the period is one of confidence and prosperity.

In the last phase, the technology matures. Technological possibilities are saturated, production moves to places on the periphery, and complacency sets in. Profits at home are low, and entrepreneurs start scouting for new opportunities. The economy becomes ripe for the next revolution.[33]

It was not the information economy that died with the dot-com crash. Only the hype died. The downturn in ICTs and the dot-com crash simply ended the first phase. We are now just entering the middle phase, the "sustained build out or golden age of the technology".

III. NEW WORK

Will the widespread introduction of ICT lead to mass unemployment?

Jeremy Rifkin suggests that the rise of productivity as a consequence of ICT deployment affects the amount of time worked in two ways.[34] First, labor and time saving technologies have allowed companies to eliminate and dismiss workers en masse. Second, those who manage to hold their jobs are made to work longer hours. For firms a smaller workforce means saving on the cost of providing benefits such as health care.

But the history of the industrial revolution suggests that workers will not disappear; only particular kinds of workers will. Peter Drucker gives us a clue on what kinds of work will disappear. According to Drucker, "the Information Revolution has routinized traditional processes in an untold number of areas." [35] Just as the industrial revolution mechanized weaving, the information revolution will replace what has been automated by robots. The scenario is not much different from what transpired in previous eras and technology revolutions.

There will always be room for workers, but the areas or fields of demand will change.

What kind of workers will be needed?

The breadth of new work in the information age is immense. New workers can be seen in traditional industries (old workers renewed), in new ICT-related services and content provision (the information workers), in infrastructure development and mainte-

nance of the information economy (information managers and entrepreneurs) and in a host of related areas.

Among the most in demand and sought after workers are information technology (IT) professionals. According to a 1999 US Commerce Department study: "For more than 15 years, employment in the core IT occupations—computer scientists, computer engineers, system analysts and computer programmers—has grown at an astounding pace. The growth rate for computer scientists and system analysts has even accelerated in recent years."[36] The recent downturn has not changed this trend; it has only slowed down the demand.

But it is not only IT professionals who will thrive. What Robert Reich calls "symbolic analysts"—engineers, attorneys, scientists, professors, executives, journalists, consultants and other "mind workers" who engage in processing information and symbols for a living—will occupy a privileged position in that they can sell their services in the global economy. In an economy where information is critical, symbolic analysts or "knowledge workers" will constitute an elite group.

Box 7. The New Workforce (excerpts)

...[T]he knowledge workers, collectively, are the new capitalists. Knowledge has become the key resource, and the only scarce one. This means that knowledge workers collectively own the means of production….

Effective knowledge is specialized. That means knowledge workers need access to an organization—a collective that brings together an array of knowledge workers and applies their specialism to a common end-product. …

Knowledge workers… see themselves as equal to those who retain their services, as 'professionals' rather than 'employees'. The knowledge society is a society of seniors and juniors rather than bosses and subordinates.

… although women have always worked, since time immemorial the jobs they have done have been different from men's. There was men's work and there was women's work. … Knowledge work, on the other hand, is 'unisex', not because of feminist pressure but because it can be done equally well by both sexes.

Such workers have two main needs: formal education that enables them to enter knowledge work in the first place, and continuing education throughout their working lives to keep their knowledge up to date.

Although the emergence of knowledge as an important resource increasingly means specialization, knowledge workers are highly mobile within their specialism. They think nothing of moving from one university, one company or one country to another, as long as they stay within the same field of knowledge.

The knowledge society is the first human society where upward mobility is potentially unlimited. Knowledge differs from all other means of production in that it cannot be inherited or bequeathed. It has to be acquired anew by every individual, and everyone starts out with the same total ignorance.

> The upward mobility of the knowledge society, however, comes at a high price: the psychological pressures and emotional traumas of the rat race. There can be winners only if there are losers. This was not true of earlier societies. The son of the landless labourer who becomes a landless labourer himself was not a failure. In the knowledge society, however, he is not only a personal failure but a failure of society as well.

Source: "The Next Society: A Survey of the Near Future," *The Economist* (November 3, 2001), 8-11.

What are attention givers?

Another category of workers that will emerge are attention-*givers*—people who care for, tend to, or oversee children, the elderly, the disabled, the depressed and anxious, as well as more or less healthy adults who want more attention for themselves and are able and willing to pay for it.[37]

Two reasons account for the growth of the attention industry. First is the increasing number of people who work harder and subcontract family responsibilities, many of which involve giving attention. Second, with the growing productivity of machines (computerized machine tools and robots inside factories, and, in the service economy, automated bank tellers, automated gas pumps, voice activated telephone answering systems, and digital devices), they will soon be capable of doing just about everything. Everything, that is, except personal attention. So those with jobs that have been replaced by highly productive machines sell personal attention instead, and this trend will continue as the years pass.[38]

Will there still be farmers in the future?

The information revolution will not eliminate farmers, just as the industrial revolution did not eliminate them. But farming methods will change yet again. More information will help farmers to irrigate only those areas that need water and provide for more effective use of fertilizers, among others. In addition, agricultural biotechnology genetically modifies plants and food sources to maximize their reproduction and nutritional value.

Aside from increased yield, faster communications and transactions and lower transportation costs also ensure more efficient delivery of farm inputs that lead to lower prices and better inventory.

What about entrepreneurs? What role do they have in the new economy?

It has been suggested that the Internet is a natural environment for entrepreneurs. Entrepreneurs are innovators who implement change within markets through the introduction of new goods, new methods of production or new markets. Gregory K. Ericksen believes that enterpreneurs will flourish in the new Internet society:

> …the Internet world calls for a personality portfolio that comes naturally to entrepreneurs. It demands a willingness to take risks, a whole-hearted commitment to the enterprise, a sense of timing, and a readiness to act fast. The challenge of the Internet is not technology, whish is the enabler. The challenges and the opportunities are based on problem solving and innovations that deliver true value. Ideas that make a difference can and must be put into action quickly.[39]

How do we nurture entrepreneurs?

Entrepreneurs flourish in an environment that allows the free flow of ideas, encourages risk taking and accepts failure as a necessary part of doing business. Creating entrepreneurs is also linked to an environment of lifelong learning. The European Commission defines lifelong learning as "all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal, civic, social and/or employment-related perspective."[40] Lifelong learning involves acquiring and updating all kinds of abilities, interests, knowledge and qualifications to enable citizens to adapt to the information age. If designed and implemented properly, ICT use in education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning in the 21st century.

Box 9. Educating Entrepreneurs

The Consortium for Entrepreneurship Education supports the concept that entrepreneurship is a lifelong learning process that has at least five distinct stages of development. This lifelong learning model assumes that everyone in our educational system should have opportunities to learn at the beginning stages, but the later stages are targeted to those who choose to become entrepreneurs.

Each of the following five stages may be taught with activities that are infused in other classes or as a separate course.

Stage 1 - BASICS: In primary grades, junior high and high school, students should experience various facets of business ownership. At this first stage the focus is on understanding the basics of our economy, career opportunities that result, and the need to master basic skills to be successful in a free market economy. Motivation to learn and a sense of individual opportunity are the special outcomes at this stage of the lifelong learning model.

Stage 2 - COMPETENCY AWARENESS: The students will learn to speak the language of business, and see the problems from the small business owner's point of view. This is particularly needed in vocational education. The emphasis is on beginning competencies that may be taught as an entire entrepreneurship class or included as part of other courses related to entrepreneurship. For example, cash flow problems could be used in a math class and sales demonstrations could be part of a communications class.

Stage 3 - CREATIVE APPLICATIONS: There is so much to learn about starting a business it is not surprising that so many businesses have trouble. We teach future doctors for many years, but we have expected a small business owner to learn everything by attending several Saturday seminars.

This stage may take place in advanced high school vocational programs, two-year colleges where there are special courses and/or associate degree programs, and some colleges and universities. The outcome is for students to learn how it might be possible to become an entrepreneur.

Stage 4 - STARTUP: After adults have had time to gain job experience and/or further education, many are in need of special assistance in putting a business idea together. Community education programs are widely available in the vocational schools, community colleges, 4-year colleges and universities to provide startup help.

Stage 5 - GROWTH: Often business owners do not seek help until it is almost too late. A series of continuing seminars or support groups can help the entrepreneur recognize potential problems and deal with them in time.

Source: Cathy Ashmore, "Five Stages of Lifelong Learning," in The Consortium for Entrepreneurship Education [home page on-line]; available from http://www.entre-ed.org/_entre/5-stages.htm; accessed 29 August 2002.

IV. THE INFORMATION SOCIETY

How will the Internet affect the individual?

The Internet and the ICT revolution have created "sovereign individuals"— individuals who are empowered because they have access to new learning opportunities; are able to sell their own ideas, services or products directly to others; and can access medical information to make their own choices about health care. These sovereign individuals also have reliable and up-to-date information about government policies and programs that allows them to become better citizens.

Moreover, the convenience and the anonymity provided by the Internet have led some people to turn to the Internet for emotional and psychological needs. The Net has become a means and method not only for doing business, but also for reaching people on a social and personal level. The latter has elicited some concern in the field of psychiatry. The Addiction Research Foundation in Toronto now accepts Internet Addiction Disorder (IAD) as a real problem. Internet junkies, as those with IAD are called, interact more with their PCs than with real people. Psychiatrists consider this not just addiction but dependence, which is characterized by obsessiveness, a loss of control, and an inability to stop even if the person wants to and understands the dangers.[41]

Given its negative effects on individuals, shouldn't the Internet simply be banned?

Technology is not sole the culprit. Robert Putnam has documented a decline in civic engagement and social participation in the US in the past 35 years, resulting in major consequences on both the societal and the individual level. This is a major concern. As Putnam writes,

> the quality of governance [is] determined by longstanding traditions of civic engagement (or its absence). Voter turnout, newspaper readership, membership in choral societies and football clubs… [are] the hallmarks of a successful region. In fact, historical analysis suggested that these networks of organized reciprocity and civic solidarity, far from being an epiphenomenon of socioeconomic modernization, were a precondition for it.[42]

Technology, particularly the Internet, is definitely helping change social relations, but not in ways that its critics suggest. Castells describes the impact of the Internet as people organize themselves into a social network. "Networked individualism," as he describes it, "is a social pattern, not a collection of isolated individuals." Individuals will build networks, both on-line and off-line, based on their interests, values, affinities, and projects. Because of the capabilities of the Internet for communication, people will build virtual communities that are different from physical communities. These communities, however, are not necessarily less intense or less effective in binding and mobilizing people. Furthermore, a communication hybrid is now developing in our societies, bringing together both the physical and the virtual space as the material support of networked individualism.[43]

How will the Internet affect the family?

Technology allows families living in different locations to stay in touch with each other. Filipinos are now able to send text (SMS) messages to their relatives in the United States and Europe. Singaporeans who are working overseas are able to keep in touch with their families back home via the Internet. Children of expatriate Lao are able to learn more about their parents' home country via the Internet.

But it also cannot be denied that in recent years people have been spending less time with their families because of information and work overload. Work takes more and more time, and even when a family member is physically present, work is intrusive, preoccupying and unpredictable. Reich believes that the new family now requires a complex set of logistical arrangements for the various members to respond to the economy's new demands.[44]

Changes in family structure and family attitudes are directly parallel to changes in the economic system that began in the 1970s. In the old system of large-scale production, most men had steady jobs and solid wages, while women had fewer job opportunities. However, in the new system of continuous innovation, we see less predictable earnings and wider disparities in earnings. This induces harder work in terms of time and emotional energy.[45]

Nevertheless, although the emerging economy is more stressful, it generates more opportunities to earn more money for talented men and women alike. Almost all women now have the option of having a job and need not be entirely dependent on a male breadwinner.[46] Gender and racial issues in employment may soon be a thing of the past. Talent is what matters most.

What is the impact of ICTs on communities?

ICTs make possible communities not bound by space. In these "communities of choice" proximity is not a factor for intimacy. Examples of communities of choice are Web forums, newsgroups and mailing lists, which are generally organized topically. Strangers who have similar interests are encouraged to read each other's messages and communicate, giving each other advice, information and updates. Forums for all fields of interest or concerns and issues exist online, and a person can find others similarly situated with whom to form possible friendships based on common interests, or support groups if suffering from afflictions rare or otherwise.

For this reason, Castells tends to disagree that Internet use lowers social interaction and causes greater social isolation. He does agree that in certain circumstances, perhaps for individuals suffering from addiction or dependence, Internet use tends to become a substitute for other social activities.[47]

Box 10. Asháninka@the Peruvian Amazon (excerpts)

In an open grass hut on the edge of the Peruvian Andes and the Amazon jungle, an unlikely sight heralds a revolution: a computer on a rough plank table, displaying Internet web pages. The anachronistic beige box, owned by a village of indigenous Asháninka, called Marankiari Bajo, is connected to the Internet by high-powered radio. The tiny community, located more than 500 metres above sea level and 400 kilometres from Lima (a journey that includes many changes in elevation), is remote — yet in touch with the world. Perhaps more importantly to the villagers, it's also networked with other Asháninka communities nearby. Until recently, they didn't even have telephones.

The Asháninka do not see the Internet as the beachhead of a cultural invasion from the North. Rather, they have seized it as a tool to reinforce and perpetuate their own culture, to build a larger sense of community purpose among the 400-odd Asháninka villages scattered across South America, and to tell their own story to the world. In the process, they bypass outside news media and governments, which they think tend to marginalize them.

…

In the course of embracing the Internet, the Asháninka are moving from an oral to a written culture. Parents hope their children will be able to learn new things that the Asháninka have not known before. But the community also still believes that elders have something to teach their youth about succeeding on Asháninka terms, even while they prepare to enter a world larger than Marankiari Bajo. In the meantime, the Internet gives villagers the chance to set up strategic alliances, not just with other Asháninka communities nearby, but with First Nations around the world, says Castro.

"It's difficult for me to synthesize the experience sometimes, but on the way we've found friends, we've learned to dialogue and to agree. This has permitted us to strengthen our local capacities," he concludes. "This whole experience has shown us that we're not alone — we have friends who are in the same circumstances as we are."

Source: Keane Shore, "Asháninka@the Peruvian Amazon," in *Reports: Science from the Developing World*, International Development Research Centre [home page on-line]; available from http://www.idrc.ca/reports/read_article_english.cfm?article_num=837; accessed 28 August 2002.

Do other communication technologies affect societies the way the Internet does?

A mode of communication that is more prevalent in the developing world than the computer-based Internet is the mobile phone. In most of Asia the mobile phone has become a familiar gadget. Interestingly, mobile phones are not used only for making voice calls but also for short messaging. It is believed that in the developing world more people will access the Internet via mobile phones than computers.

Castells observes that "cell-telephony" also fits a social pattern organized around communities of choice and individualized interaction based on the selection of time, place, and partners of the interaction. In addition, the development of wireless Internet increases the possibility of personalized networking to a broader range of social situations. This enhances the capacity of individuals to rebuild structures of sociability from the bottom up.[48]

Kraut and Lundmark of the Human Interaction Institute of the Carnegie Mellon University issue a cautionary note. Based on their studies, they conclude that the Internet is not a substitute for real human interaction as a means for emotional and social fulfillment. The use of the Internet can be both highly entertaining and useful, but if it causes too much disengagement from real life, it can also be harmful. Until the technology evolves to be more beneficial, people should moderate their use of the Internet and monitor the uses to which they put it.[49] While there are clear benefits to virtual communities formed around infocommunication networks, a balance should be maintained and social isolation minimized.

V. GLOBALIZATION

What is globalization and how is it related to the ICT revolution?

Technological development, from better transportation and carrier services to the telephone and mass media, has created a smaller, more integrated world. Now, the ICT revolution is making the world even smaller and more integrated. Communications, trade and employment, personal and political transactions are now occurring on a global scale, in real time, ignoring boundaries between states.

Nobel Laureate Joseph Stiglitz defines globalization as

> …the closer integration of the countries and peoples of the world which has been brought about by the enormous reduction of costs of transportation and communication, and the breaking down of artificial barriers to the flows of goods, services, capital, knowledge, and (to a lesser extent) people across borders.[50]

It is important to underscore that globalization is not just an economic phenomenon. It affects all aspects of life.

At least four factors have contributed to globalization: (1) technological change, particularly the ICT revolution; (2) the spread of market-based systems; (3) domestic politics—pro-globalization forces are more politically significant; and (4) inter-state rivalries.[51]

How will globalization affect the nation-state?

Anthony Giddens suggests that globalization affects the nation-state in three ways.[52] First, globalization, especially the global marketplace, takes certain powers away from the nation-state. Nation-states are not as in command of their economic futures as they used to be. The best example of this is the increasing inability of governments to control their currencies. Exchange rates are now determined by other people's assessment of a country's economic well-being.

At the same time, says Giddens, globalization creates new possibilities and motivations for local cultural autonomy and identities. This "push down effect" of globalization is the reason for the revival of local nationalism and local forms of cultural identity in all parts of the world. It may seem strange but the more we globalize, the more we localize.

The third effect of globalization is that it also pushes sideways. This is best seen in the emergence of regional groupings, which Keniche Ohmae calls "regional states".[53] Both Giddens and Ohmae give as an example the area of Catalonia around Barcelona in northern Spain: Catalonia overlaps with southern France, but it is linked to the Spanish economy.

Clearly globalization is a complex set of partly contradictory forces. It is not, as globalization critics suggest, a single force pulling in a single direction.

How do the Internet and the ICT revolution affect governance?

Governance can be simply defined as "organizing collective action".[54] It implies the organization of rules that allows, prescribes and prohibits certain actions. A narrower definition of governance relates it to government or the decision-making processes in the administration of a state. ICT has a major effect on governance in both its broad and narrow sense. The Institute of Governance (Canada) believes that ICTs:

> … create new expectations among citizens about how governments should interact with them, and how services should be delivered. Internet technology and recent advances in applied genetics are significantly redefining the boundaries of personal choice and private influence, and of collective decision-making on matters of public importance.[55]

At one level, governments that use ICT will be better able to govern. E-government, or the use of ICT to enhance the access and delivery of government services to benefit

citizens, is a necessary element in the government's drive for good governance. E-government promises not only a more efficient and effective government but a more transparent one as well.

How does ICT transform international politics?

Robert Keohane and Joseph Nye, Jr reject the view that the information age will radically transform relations between nations. Their position is based on their belief that countries are already embedded in patterns of complex interdependence where "security and force matter less and countries are connected by multiple social and political relationships."[56] However, they judge that

> The information revolution alters patterns of complex interdependence by exponentially increasing the number of channels of communications in world politics—between individuals in networks, not just individuals within bureaucracies. But it exists in the context of an existing political structure, and its effects on the flows of different types of information vary vastly.[57]

They also agree that in the 21st century, "information technology, broadly defined, is likely to be the most important power resource."

Other scholars have proposed the concept of *noopolitik*, which refers to a dimension of international relations that is related to the formation of a 'noosphere' or a global information environment. Noopolitik is projected as an alternative to realpolitik, the latter being the traditional approach to fostering the power of the state in the international arena, by negotiation, force, or the potential use of force. In a world characterized by globalization and shaped by information and communication, the ability to act on information flows, and on media messages, becomes an essential tool for fostering a political agenda.[58]

With noopolitik, diplomacy will now include not only governments but also the societies they represent. This new diplomacy may prevent confrontation, increase the opportunity for alliances, and foster cultural and political hegemony. Embedded in this new diplomacy is the capacity to intervene in the process of mental representation underlying public opinion and collective political behavior at the national level.[59]

What is cyberwar? Is it the same as information war and cyberterrorism?

Cyberwar, according to James Dunnigan, is the use of "electronic networks, and information, …as part of a weapon system".[60] It includes warplanes using electronic devices to jam enemy radars to elude their missiles as well as hacking into the enemies' bank accounts and/or their servers and information networks. He distinguishes cyberwar from "information war", which is using information and news as weapon. Information war or propaganda war, claims Dunnigan, has been around for thousands of years. Cyberterrorism is a narrower concept, and is defined as

"the premeditated, politically motivated attack against information, computer systems, computer programs, and data which result in violence against noncombatant targets by sub national groups or clandestine agents."[61]

The emergence of these terms is related to the fact that more and more governments and businesses are becoming dependent on computers and information systems. Databases of highly sensitive and confidential information are stored on computer systems. Air traffic control, banking and finance accounts, water utilities and other public utilities are assisted by computer programs and networks as well. Thus, these systems become targets of those who wish to threaten the government or the economy.

What is cybersecurity?

Cybersecurity is about combating threats and crimes in cyberspace. It includes passing appropriate laws and policies, as well as developing capabilities and institutions to prevent fraud and fight threats.

At the national level, government cybersecurity efforts have focused on creating the appropriate policy and legal environment, protecting critical infrastructure against cyber attacks and improving the security of the national information system. At the global level, various efforts are now underway to create a harmonized policy infrastructure to enable a robust and globally integrated system capable of responding to cyber threats in a coordinated and timely manner. In December 2002, the UNGA adopted resolution 57/239 calling for a "global culture of security".[62] In the Asia-Pacific, APEC Leaders have issued a "Statement on Fighting Terrorism and Promoting Growth" which includes an APEC Cybersecurity Strategy to protect communications and information systems.[63] In their statement APEC leaders have announced their intention to: (1) enact cybersecurity laws that are consistent with international norms; (2) identify national cybercrime units; and (3) establish institutions that exchange threats and vulnerabilities (such as computer emergency response teams or CERTs).

While a focus on cybersecurity is important, analysts believe that cyber terrorist threats to computer structures are implausible. This is because terrorism is like lightning, taking the path of least resistance. Moreover, currently it is easier to blow something up than to figure out how to damage it by hacking into and manipulating a computer system.[64]

VI. THE DIGITAL DIVIDE

What is the digital divide and why is it important?

The digital divide separates the information rich and the information poor. The Organization for Economic Co-operation and Development defines the digital divide as the difference between individuals, households, businesses and geographic

areas with regard to (a) their opportunities to access ICTs and (b) their use of the Internet for a wide variety of activities. It is the gap between those who have real access to information and communications technology and who are able to use it effectively, and those who don't have such access.[65]

Lack of access to ICT goods and services poses social and economic disadvantages. More and more, developing countries are recognizing that they cannot compete in the new global market unless they take advantage of the ICT revolution. Countries that do not undertake measures to enhance their ICT infrastructure risk not just being marginalized but also being completely bypassed in the new global order. The experience of a number of countries, like Singapore, Malaysia and Korea, demonstrate that bold actions in bringing their countries into the digital age pay off.

Box 11. Internet Access Under African Skies by Noah Elkin

In absolute terms, the number of internet users in Africa is abysmally low. The entire continent has a user population that is approximately half that of Canada, even though its population is nearly 20 times as large. Penetration rates are likewise miniscule—currently, less than 1% of Africa's population uses the internet, while penetration rates top 50% in North America. As a result, Africa, with the exception of South Africa and some of the more developed North African countries, barely appears on the radar in most global internet studies.

This may not be the case in the future. According to a recent report by Mike Jensen, an independent monitor of information and communication technology development in Africa, internet usage has progressed considerably throughout the continent in recent years and shows no sign of slowing down. All countries there enjoy internet access, at least in the capital city, while few countries could make that claim just five years ago. By mid-2002, Jensen had tallied 560 internet service providers (ISPs) across Africa, noting that competition for dial-up subscribers exists in most countries.

However, high fees, a recurring problem in developing countries, keep the subscriber rolls from growing. Jensen's analysis indicates that the average monthly cost for 20 hours of dial-up account usage (a standard measure used by the Organization for Economic Cooperation and Development [OECD]), which includes ISP charges and local call fees but not the cost of a renting the telephone line itself, is an astronomical $60 per month. This figure is nearly three times the average monthly rate recorded by the OECD in the US, and, as Jensen notes, exceeds the average per capita income in many African countries.

Those Africans who cannot afford a phone or a computer—in other words, most of the continent's population—have responded by sharing paid subscriptions (a popular strategy in developing areas), with an estimated three to five people using a single subscription. Residents of urban areas, where the telecommunications infrastructure is typically the most highly developed in any given country, have flocked to public access points such as cybercafés, internet kiosks and community telecenters, where equipment and costs can be shared by a large number of users.

However, these arrangements often leave out the majority of the population, given that the population of most African countries remains overwhelmingly rural. The extant challenge lies in extending the communications infrastructure throughout each country in such a way that the build-out does not make installation and usage costs too onerous for consumers and

small businesses to take advantage of it. And entrepreneurs must develop creative business models that are based on shared internet usage, such as community internet centers offering connectivity plus international money transfer, small business assistance and educational services. This is one way of creating a self-sustaining technology base in Africa.

Source: Noah Elkin, "Internet Access Under African Skies," *eMarketer Daily* Issue 162 (2002); available from http://www.emarketer.com/news/article.php?1001522&ref=ed; accessed 21 August 2002.

How do we measure the digital divide?

The digital divide is usually measured in terms of citizen/population access to ICT. Among the indicators for measuring access are (1) telephone density (teledensity); (2) personal computer (PC) deployment and penetration; and (3) number of Internet users.

Teledensity is the ratio of population to telephones (traditionally defined as fixed or wired telephone lines). This indicator of the divide must be redefined to include cellular/mobile phone use since in a number of developing countries there are more mobile phones than wired phones. Taylor Nelson Sofres Interactive (TNS) estimates that 57% of the adult population (defined as those between ages 15 and 65) in the Asia-Pacific region have a mobile phone.[66]
Personal computer penetration and deployment has also been used to measure access, since the PC is the most common way of accessing the Internet. However, recently more and more ways of accessing the Internet have been devised. In Japan, people can access the Internet through their mobile phones. Those from developing countries share PCs, usually in an Internet café or in school.

The number of Internet users is also a way of looking at the digital divide. Statistics show that only about 10% of the world's population is online. Furthermore, most of these Internet users are in the developed Western countries: the US, Canada and Europe account for about 63% of the world's Internet users. The Asia-Pacific's share is about 30%. Africa and the Middle East combined account for less than 2% of the universe of Internet users.

Equally disturbing is the fact that the global Internet population is predominantly male. Again, there are marked regional differences in the gender digital divide. In the Asia Pacific, the ratio of Internet users is about 60% men and 40% women. In the US and Canada the gender distribution is more balanced.

Box 12. Asian Women Love E-mail

More and more Asian women are discovering the joys of getting in touch over the internet.

The number of them who used e-mail and internet chat leapt towards the end of last year, according to recent figures by the net measurement company NetValue.

"Towards the end of 2001, women were definitely interested in keeping in touch with people over the internet," said NetValue President Jack Loo in a statement.

"We saw more female users sending e-cards, sending and receiving e-mail, joining chat rooms, and posting up messages in forums."

The figures reinforce the commonly held belief that women are better communicators than men, using new technology to share experiences.

Chat takes off

The highest growth was in Hong Kong, where women flocked to use webmail and send electronic greetings cards during the holiday season.
Between October and December 2001, the number of Hong Kong women using webmail jumped 104.7%. There was also an increase of just under 80% in those sending e-cards.

There was also considerable growth in Korea, Singapore and Taiwan.

The study also showed that more women were attracted by chatting over the internet, especially in Korea where more than half of all female internet users headed to chat sites.

But Singaporean women are fast catching up, with more than a fourfold jump in number of female chat users at the end of last year.

Women's voices

…Experts say the internet is tailor-made to help women find their voices, citing the rise of women's organisations across Asia.

The figures from NetValue also reflect the increasing numbers of women who are going online in Asia.

They now account for more than 40% of internet population in the Asia-Pacific region.

Source: "Asian women love e-mail" (26 February, 2002) in *BBC News* [home page on-line]; available from http://news.bbc.co.uk/1/hi/sci/tech/1840279.stm; accessed 28 August 2002.

Is lack of access the only problem?

It is already received wisdom among those who are working to bridge the digital divide that providing access to technology is only one of many obstacles that must be addressed. Internet access is not enough. The Children's Partnership argues that content is one aspect of the digital divide that has been neglected. The four content-related barriers to greater Internet uptake across society are: (1) local information barriers; (2) literacy barriers; (3) language barriers; (4) cultural diversity barriers.

Local content is determined by the commercialized nature of the Web. Commercial content providers tend to focus on content that delivers returns to their investments. Thus, Internet users from developing countries, such as farmers, for example, rarely discover information that is relevant to them. Compounding the problem is that non-profit, community-based initiatives to create content face sustainability problems.

Literacy is another concern. Literacy includes not only basic and functional literacy but also technological literacy. Older people who may be literate may find using a computer and accessing the Internet an intimidating experience. A related concern is creating inexpensive content that is accessible to all, including illiterate people. Perhaps this aim will be achieved through voice recognition technologies.

The language barrier compounds the literacy issue. Over 68% of Internet content worldwide is in English. In e-commerce, English is even more dominant, with over 94% of links to pages on secure servers in English. However, although there are currently fewer sites for non-English speakers, the trend is expected to change soon.

How can we bridge the digital divide?

Studies have shown that technology diffusion is slow and costly and developing countries "cannot assume that relevant new technologies will flow easily to them across international borders".[67]

Governments play a vital role in bridging the digital divide. This is particularly true in developing national information infrastructures that will increase Internet access among the population. Specifically, governments should develop a policy and legal regulatory environment conducive to the creation of a robust national information infrastructure, including a regulatory environment that would increase competition and keep prices down. Government should also consider lowering or removing import duties and/or sales taxes on IT goods and services. This would contribute towards increasing PC penetration rates. Finally, governments' own use of technology to enhance efficiency, effectiveness and transparency (e-government) could stimulate growth in the private ICT sector.

Governments should also encourage alternative access to the Internet. If in the developed world the PC through the telephone or cable networks is the main mode of accessing the Internet, developing countries should seriously consider the use of wireless technologies and devices to connect to the Internet.

Box 13. Mobile Internet for Developing Countries

Mobile communications has exploded in many developing nations. Mobile has often been the first competitor to sluggish government-owned fixed line telephone systems. Instead of waiting for years for a fixed line, and sometimes paying high line installation fees, citizens in many developing countries can now get a mobile connection on demand and need only to pay for the card that activates their handset. Furthermore, because wires do not need to be laid, mobile networks can be installed relatively quickly and are appearing in formerly 'unwired' places such as 'up-country' Uganda. Another big driver of mobile in developing countries has been the pre-paid card which turns the mobile handset into a portable, personal pay phone. Pre-paid service has allowed millions of users who would not normally financially qualify for subscription-based service to become mobile users.

One of the reasons that wireless Internet seems logical for developing countries is that mobile phones outnumber PCs. In addition, mobile phones are beginning to exceed fixed lines in a growing number of developing countries. Of course, many of those handsets cannot access the Internet but most could be used for SMS (short messaging service), a precursor of Internet use. SMS is exploding in many developing countries. Take the Philippines for example where one of the leading mobile operators is Globe Telecom. At the end of 2000, it had 2.6 million subscribers (of which 86% were pre-paid) generating 25 million SMS messages a month. Revenues from SMS increased almost 500% in 2000 and accounted for 17% of Globe's wireless revenue.

Is it realistic to expect that the latest mobile Internet applications will also be launched in developing countries? The Congo, one of the poorest countries in the world, was one of the first nations in Africa to get WAP in June 2000. It was introduced by Celtel Congo, which launched its mobile service only in December 1999. A year and half later, Celtel had grown to be the largest telecom operator in the Congo with 14,000 subscribers. Celtel's WAP users can access content such as local news, exchange rates, travel schedules and overseas WAP sites.

Source: Michael Minges, "Mobile Internet for Developing Countries" in *INET 2001 Proceedings*; The Internet Society [home page on-line]; available from http://www.isoc.org/inet2001/CD_proceedings/G53/mobilepaper2.htm; accessed 28 August 2002.

Is government's role limited to developing the physical infrastructure?

The problem with focusing too much on providing the infrastructure to enhance access is that the public may have Internet access but will not find anything useful or relevant on the Net anyway. Since governments are the biggest repository of information that is important to citizens, and since information is a public good, governments' role as a content provider is also critical.

Some governments address the issue of content directly. For instance, the Information Stores (Boutiques d'information), which is operated by the government of Burkina Faso, provides agricultural production and marketing information to rural farmers. The Information Boutiques collect and provide information about judicial matters, facilitate courses and mediate between the local population and services. It was designed to meet the information needs of the rural population of Burkina, who do not have sufficient access to information supporting basic economic, social and political activities.

Is there a role for the private sector in bridging the digital divide?

The private sector, through investments and economic activities, plays an important role in bridging the digital divide. The numerous Internet cafes in the developing world are a testament to fact that the drive for profit does not preclude doing social good (in this case making the Internet more accessible). Moreover, the development of new IT businesses contributes to employment and economic growth in general.

A number of global IT companies are also keen on helping to provide people with the necessary skills to succeed in the information age. Oracle's Oracle Academic Initiative, Sun Microsystems' Java Competency Center, Cisco Systems' Cisco Network-

ing Academy, and other similar efforts not only help make their graduates more employable but also upgrade skills in the community. That they also ensure a steady supply of workers for these corporations certainly makes it a win-win-win situation for individuals, communities and corporations.

Corporate social responsibility efforts are also useful in ensuring broader access to ICT goods and services. Microsoft's international community affairs program aims to bring the benefits of ICT to disadvantaged people in countries where it does business. In China, Microsoft is sponsoring Project Hope, a non-governmental organization (NGO) that aims to create five computer labs or cyberschools. The project will involve teaching computer skills to disadvantaged youth, who will have Internet access and the highest quality teachers and curricula in China. The same is being done in Indonesia, where Microsoft is working with Pact Indonesia to create six computer centers and offer IT skills development for disadvantaged youth.

In the Philippines, Coca-Cola Export Corporation has entered into a joint project with the Foundation for IT Education and Development, a non-profit organization, to operate the ed.venture project, which provides computers and Internet connectivity, training and post-training support services to high schools in the Philippines. By using schools as an entry point to the community, ed.venture and similar projects are laying the foundation for greater community participation in the digital universe.

Box 14. Tuning In to The Village Voice

Under the name Radyo Natin, or Our Radio, MBC has launched more than 400 low-power FM stations since late (2001), with another 400 in the pipeline. This network of tiny radio stations represents an effort by MBC to convince national advertisers that they can reach virtually every consumer in the Philippines at the local level. For the stations' operators, the money they make will depend on convincing small local businesses to advertise, while also selling blocks of the stations' airtime to local politicians, religious institutions and others with a desire to reach the community.

Using a combination of low-cost transmitters and satellite-programming muscle developed in Manila as part of its traditional radio network, MBC, the oldest broadcaster in the Philippines, stands poised to revolutionize local radio. For the first time, tiny local stations are able to deliver the latest music and news from Manila in tandem with local-language news and information about the village or the neighborhood.

…

The network is so new that it is difficult to say if the local stations will generate consistent profit for the operations. One thing is certain, however: Never before in Asia has a company come up with a formula for such widespread low-power broadcasting. Traditional so-called 'community' radio has relied on foundations and funding agencies like the United Nations to set up small stations in remote communities in the developing world. But frequently, when the money from the agency dries up, the stations go off the air. With Radyo Natin, MBC is betting that operators will develop sufficient local-revenue streams to keep the network going and that national advertisers will give the home networks a steady flow of advertising pesos to make the venture profitable.

…

> If all goes as planned, by the end of (2002) MBC will have 1,174 stations in its network, including its 74 traditional big stations, the 100 larger Radyo Natin properties and the 1,000 tiny local stations currently being established.

Source: A. Lin Neumann, "Tuning In to The Village Voice" in *Far Eastern Economic Review* (August 29, 2002).

What is the role of nongovernment organizations?

Nongovernment organizations (NGOs) play a number of roles in bridging the digital divide. NGOs help define the issue and mobilize resources to bridge the digital divide. The work of the Benton Foundation is an example. This non-profit organization produces and coordinates the Digital Divide Network (DDN), which serves as "a catalyst for developing new, innovative, digital divide strategies and for making current initiatives more strategic, more partner-based, and more outcome-oriented, with less duplication of effort, and more learning from each other's activities."[68]

NGOs are also engaged in policy work, helping develop proposals for global action on the digital divide. This is seen in the role of the non-profit organizations in the Digital Opportunity Task Force (DOT Force), a body created by the G8 Summit in July 2000. The DOT Force report, presented at the 2001 Genoa Summit, proposed a nine-point action plan to resolve the digital divide.[69]

NGOs also act as technology providers (in some instances acting as Internet service providers and/or application services providers). An interesting effort along this line is that of Jhai Foundation's Remote IT Village Project in Laos.[70] Faced with no electricity or telephone wires and harsh conditions, Jhai Foundation is developing the following:

- A rugged computer and printer that draws less than 20 watts in normal use (less than 70 watts when the printer is operating) and that can survive dirt, heat and immersion in water;
- A wireless local area network with relay stations based on the 802.11b protocol, that will transmit signals between the villages and a server located at the Phon Hong Hospital for switching to the Internet or the Lao telephone system; and
- A Lao-language version of the free, Linux-based KDE graphical desktop and Lao-language office tools.

It is expected that Lao villagers in the five pilot areas will use these facilities to make telephone calls within Lao PDR and internationally (using voice-over-Internet technologies), and for the activities that are so important for their start-up enterprises, such as accounting, letter writing and email.

NGOS also play a significant role in bridging the digital divide particularly as content providers and trainers. The Community Learning Centers in Ghana are a case in point.

Box 15. High Tech/Grassroots Education: Community Learning Centers (CLCs) for Skill Building (excerpts) by Mary Fontaine

Since November 1998, three Ghanaian NGOs have been managing and running CLCs in Accra, Kumasi, and Cape Coast. The purpose of the centers is to empower individuals and organizations for local development by providing public access—particularly for low-income populations—to the Internet and other ICTs. In just a little over two years, the centers grew from small, relatively obscure offices to popular establishments with their waiting rooms filled. They served nearly 14,000 clients during the first quarter of 2000 alone, 77 percent of whom took advantage of the training opportunities in typing, word processing, spreadsheets, computer literacy, and Internet orientation that are offered in addition to simple access to computer equipment. That's over 10,000 individuals who gained increasingly important computer-related skills. Trainees include students, teachers, and researchers as well as business people, staff from NGOs, medical practitioners, artisans, merchants, local officials, and telecommunications workers. Ranging in age from eight to sixty-seven, with 85 percent between 18 and 40, the vast majority of clients are males. However, female enrollment has been growing steadily, in part due to the CLCs' creative outreach campaigns.

…

The CLCs in Ghana and Benin are providing practical, hands-on, and affordable training to thousands of people from all walks of life, who are developing skills that simply cannot be acquired anywhere else—even at some of the major universities. Individuals participating in the training perceive it to be highly empowering, due not only to the employment opportunities it opens up but also to the ready access to global information and networking it provides. In the long term, it may have the same empowering effect on low-income communities as a whole. For now, the training programs are clearly meeting a need and helping to satisfy a growing demand that remains otherwise unfulfilled.

Beyond the impact on individuals and communities, the operation of CLCs is having an interesting impact on NGOs as well. Their entry into the telecenter business illustrates a growing trend in the NGO world toward a kind of "social entrepreneurship" that is neither strictly non-profit nor for-profit. Generating revenue to run a business is a relatively new undertaking for most NGOs, especially small, indigenous groups in developing countries. The NGOs in Ghana and Benin deserve credit for their courage in taking the risk on behalf of their constituents—and congratulations for making it work.

Source: Mary Fontaine, "High Tech/Grassroots Education: Community Learning Centers (CLCs) for Skill Building" in *TechKnowLogia* (July/August 2000), Knowledge Enterpise Inc.; available from http://ict.aed.org/infocenter/pdfs/hightech.pdf; accessed 28 August 2002.

What about international organizations?

The digital divide has reached the top of the agenda of numerous international and regional organizations.

The United Nations' ICT Task Force, for one, aims to find new, creative and quick-acting means for spreading the benefits of the digital revolution and averting the prospect of a two-tiered world information society.[71] The United Nations Development Programme (UNDP) has projects to boost Internet connectivity and access in some of the poorest countries in the world. These include the United Nations Information Technology Service (UNITeS), a volunteer corps to train groups in developing countries in the uses and opportunities of the Internet and IT, and the Sustainable

Development Networking Program (SDNP), an initiative to kick-start networking in developing countries and help people share information and expertise relevant to sustainable development. The UNDP Asia Pacific Development Information Program (APDIP) aims to promote and establish information technology for social and economic development throughout the region.

The World Bank's Global Information and Communication Technologies Department (GICT) seeks to accelerate the participation of client countries in the global information economy; to promote private sector investment in developing countries, which will reduce poverty and improve people's lives; and to promote innovative projects on the use of ICTs for economic and social development, with special emphasis on the needs of the poor in developing countries. The World Bank's Information for Development Program (infoDev) is a global grant program that promotes innovative projects in the use of ICTs for economic and social development in developing countries. The Development Gateway is a development portal that provides access to information and knowledge on development activities.[72] Through this initiative, the World Bank hopes to make it easier to share experience and knowledge in development, and offers up-to-date information on projects, resources, best practices and expertise on such subjects as poverty, governance, gender, IT, development and environment.

At the regional level, the Asia Pacific Economic Cooperation (APEC) forum has adopted an e-APEC strategy, which has three pillars: to create an environment for strengthening market structures and institutions; to provide an environment for infrastructure investment and technology development; and to enhance human capacity building and promote entrepreneurship. The e-ASEAN initiative is an effort of the 10 Southeast East Asian states to develop a broad and comprehensive action plan to develop competencies within ASEAN to enable it to flourish in the global information economy.

VII. THE CHALLENGE AHEAD

Developing countries recognize the need to harness ICTs for development. However, the ICT uptake has been largely unequal. The digital divide is a problem that both government and the private sector must work together to address. Without doubt, the ICT revolution is changing the course of history, and developing countries must equip themselves with better information and policies that would enable them to join the digital revolution.

The aim of this primer and the series on the Information Economy, Society and Polity is to provide policy makers and opinion leaders in developing countries of the Asia-Pacific with a clear understanding of the various terminologies, definitions, trends and issues surrounding the information age. The other primers in the series are:

- Nets, Webs and Information Infrastructure
- E-commerce and E-business
- Legal and Regulatory Issues in the Information Economy

- E-Government
- ICT and Education
- Genes, Technology and Policy: An Introduction to Biotechnology

It is our hope that these primers will spur the continuing efforts of developing countries to prepare for the information age.

Much has been written about the information revolution. Many initiatives have been undertaken and some are to be applauded for their success while others need further support and guidance. The signs of the times—digitization, convergence, globalization, as well as their various impacts on politics, economics, social structures and culture—all foreshadow a future in which information is the key component. We must heed these signs if the future, the new era of information and progress, is to be ours.

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ACKNOWLEDGMENT

Shahid Akhtar played a crucial role in making this series a reality. He mooted the idea during our first meeting and provided funding for it. He not only gave important inputs during the writing and publishing phases, but was also very understanding when deadlines were not met.

Mr. Roberto R. Romulo, generous mentor, provided the “enabling environment” that made writing and publishing this series on the Information Economy, Society and Polity a lot easier.

Janet Pearce, Fellow at the Center for Telecoms Management, University of Southern California, and Chris Coward, Director of the Center for Internet Studies, University of Washington, read and critiqued this primer on the information age.

Rudy, Patricia, Joey, Zorah, Edwin and Vicky/Bibi were game enough to undertake the project with me. Margaret Uy readily agreed to be drafted when I needed help.

Patricia Pascual made leading this project less demanding. Katch Nakpil and Shelah Lardizabal provided the critical administrative support during the lifetime of the project. So did Yenny, Nannie, Mel, Evelyn, Kitty, Claire, Myra, Rhiza, Macki, Ruel and Len.

Pat Arinto skillfully copyedited the primers. Jenny Pascual gave the series its look. Reynaldo Lane made sure that we have an online version of the series. Ruth Pison and Veni Ilowa helped fine tune the layout.

The UNDP-APDIP team not only facilitated the project but also provided critical inputs that made the primers better.

Jose Estrella provided the inspiration and the motivation to see this (and other projects) through.

I dedicate this work to my parents.