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NEW INFORMATION AND COMMUNICATION TECHNOLOGIES, SOCIAL DEVELOPMENT AND CULTURAL CHANGE

by Cees J. Hamelink

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Preface

In the late 1990s, we stand on the eve of the total digitalization of all forms of information transmission, except those occurring on a non-mediated, person-to-person level. Sound, text, voice and image will soon be relayed across vast distances in the binary language used by computers; and this will open possibilities for the high-quality transmission of information, in a volume and at a speed almost unimaginable a few years ago. The cost of doing so is also likely to decline dramatically.

Digital technologies are already bringing about profound changes in the economies and societies of countries around the world — speeding the automation of work, facilitating borderless financial transactions, delivering global news and entertainment to vast new audiences. As these technologies permit the fusion of the telecommunications, computer and entertainment industries, they encourage a titanic struggle among some of the largest corporations in the world for control of a consolidated information industry.

The potential of digital technologies to improve the livelihood of people is great. In remote regions, the disadvantage that comes with isolation can be significantly lessened through access to rapid and inexpensive communications. Like-minded people can co-operate across great distance to defend human rights or promote other projects of common interest. Remote sensing can be used to protect the natural environment. The list of possible contributions to human development is long indeed.

Yet there are also obvious dangers in the current highly charged competition to gain control over digital technologies. Already existing trends toward polarization in the world economy can clearly be worsened. Digital advantage can reinforce the possibility that ever smaller groups of people will determine the future use of an ever larger proportion of global resources. Development can be concentrated in regions where the information infrastructure is most developed, to the detriment of areas that are not endowed with the most modern capabilities. And within societies, a growing "knowledge gap" can separate individuals who have access to the latest equipment, and have been trained to use it, from those less well endowed.

In the following pages, Cees Hamelink reviews the background of the current "information revolution", explains its principal technical features and explores possible scenarios for the future. He challenges the frequently held disposition to accept the current direction of change without question. The course of technological development, he reminds us, is always shaped by human beings with particular interests and goals, and a certain (sometimes implicit) view of the future. The latter should be examined openly, not taken for granted.

We have the obligation to think first of the kind of society we want to see in future, and then to influence the design and deployment of new technologies in ways that are most likely to further our goals. In this regard, institutional

innovations are as important as scientific or technological breakthroughs in creating new opportunities for human development.

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Dharam Ghai
Director

CONTENTS

Summary

A particularly important aspect of contemporary technological innovation is the quest for new ways to capture, store, process, transport and display information. Although the prevailing expectation is that progress in this field will have a profound impact on societies, expert opinions differ about whether this impact will be positive or negative. In fact it is difficult, if not impossible, to foresee the future social and economic implications of the adoption and proliferation of new information and communication technologies, and this creates a serious problem for policy makers. In the following pages, a case is made for accepting the ambiguities inherent in the current process of technological change and giving concerted attention to specification of the social and institutional changes that will be required to strengthen its potential for social development.

The Development of Information and Communication Technologies

Four stages in the development of technologies to capture, store, process, transport and display information can be identified throughout human history. From the first stage to the fourth, constraints upon the distance, speed, volume and reliability of information handling have progressively been reduced.

In the **first**, and longest, phase (from approximately 35,000 BC to Samuel Morse's first telegraphic transmission in 1838) information was handled through recourse to physical and mechanical power. Media for the transmission of information included fast-running couriers, carrier pigeons, smoke signals, talking drums and semaphores.

In the **second** phase, following the invention of electricity, electro-mechanical power permitted the development of the telegraph, telephone, radio and television.

In the **third** phase, the possibilities of electronics were explored, with the invention of the electronic computer, transistors, semi-conductors (such as silicium) and integrated circuits (or "chips"). The integration of telecommunication and computer technologies began.

Initially, these two technologies were developed and utilized in distinct ways. For almost 80 years, telecommunication technology generated and upgraded techniques for transmission between people-centred artifacts such as telephones, facsimile machines and television systems. Eventually, switching techniques began to make networking possible.

Meanwhile, computer technology evolved from the first electro-mechanical calculator in 1939 to the first — huge — electronic computer (the ENIAC), developed during the Second World War. During the 1950s, the invention of the transistor made it possible to design computers of smaller size, operating at higher speeds, and permitting more versatile programming and reduced energy consumption.

Over the course of the 1950s, computer and telecommunications technologies were integrated, and computer-communications networks were created that linked computers among each other and to terminals. These networks found wide application as a number of technological advances increased the capacity, accessibility and compatibility of both computing and telecommunication facilities. For example, research in the field of telecommunications yielded innovations such as satellites, modems, optical fibres and packet switching. New computer technology permitted the integration of electronic circuits on very small surfaces of silicon (the "chip"), and then created the capacity to place the complete central processing unit of a computer on one chip (the microprocessor).

The first microprocessor was manufactured by Intel in 1971, and only four years later the first computer based upon the microprocessor (the microcomputer) was marketed. This has often been identified as the beginning of the "information age". It certainly announced the sophisticated, inexpensive and flexible personal computer (PC), which began to make the capacity to handle electronic information available to growing numbers of businesses and individuals.

The 1970s and 1980s were largely characterized by further miniaturization of electronic components, exploration of new conducting materials, new techniques for faster electronic switching, expansion of memory capacity and improvements in computer software. New programming languages were developed in order to improve machine-user interaction and to render the problem-solving capacity of computers more sophisticated. The speed of peripheral equipment (all kinds of input and output devices, such as interfaces and printers) was also increased to match the performance of the central processing unit.

The **fourth** phase in the development of information and communication technologies is marked by still further reduction of constraints. Earlier analog modes of information handling are being replaced by more powerful, reliable and flexible digital systems. "The technical foundations of this process lie in the early post-war era, in the innovation of a common language of microelectronics for both computing and, somewhat later, telecommunications" (Schiller and Fregoso, 1991:195). With the development of digital switches and digital transmission facilities in the 1960s, the transition from analog to digital networks began. During the 1980s the process accelerated, and by the late 1980s between one fourth and one half of all central office telephone switches in the advanced industrial market economies had been digitized. It was also in the 1980s that the international