Chapter One

INTRODUCTION

Advances in information technology (IT) are affecting most segments of business, society, and government in many if not most regions of the world. The changes that IT is bringing about in various aspects of life are often collectively called the "information revolution."[1] Many of these changes could over time prove to be profound; some may have already done so. A wide range of national and international political, economic, and societal issues arise from these changes, both now and in the future.

Understanding the various impacts that advances in IT will have and the likely nature of future changes that IT will bring about, in different societies all around the world, and the issues (i.e., problems and opportunities) that will arise from these impacts and changes is very important—and also quite difficult. It is important because IT is likely to change the 21st-century world just as much as the steam engine, railroad, and telegraph changed the 19th-century world, and just as much as electricity, the internal combustion engine, automobile and airplane, and the telephone, radio, and television changed the 20th-century world.[2] It is difficult because, while the technology developments that enable and drive the information revolution are more or less the same throughout the world, a large number of factors—social and cultural, political and governmental, business and financial—shape each society's approach to those technology developments. These factors interact in a variety of ways, both straightforward and subtle, and are subject to numerous variations in nations throughout the world, leading to many different national or regional manifestations of the information revolution.

RAND has conducted a multiyear effort, sponsored by the National Intelligence Council (NIC), to explore this important, difficult subject: the likely future of the information revolution throughout the world—in this case, over the next one to two decades.[3] This was a multidisciplinary effort with a broad range of participants from both inside and outside RAND. This report summarizes what was learned in this effort.

WE ADDRESSED A WIDE RANGE OF QUESTIONS

In charting the likely future of the information revolution, we addressed a wide range of questions, such as the following.

In the Technology Arena

- What advances in information technology will the world see in the next 10 to 20 years?
- How broad and deep will IT penetration be in various regions of the world?
- What are the main factors driving advances in IT?

In the Business and Financial Arena

- How will IT affect business and financial developments over the next 10 to 20 years (e.g., new methods of work, e-commerce, new business models, new paradigms for financial services)?
- What are the sources of financing for IT and for new IT-enabled businesses and services? How do these vary from one nation to another?
- How open are various countries to foreign investment and foreign roles in IT-related business?
- Who are the major players in these business and financial developments? Are they predominantly national, regional, or global?
- What characteristics of the business environment in various countries facilitate or inhibit growth in the use of IT and in new

IT-enabled businesses? What are the driving forces of change? What are the main obstacles?

- How are issues of intellectual property, encryption, standards, commercial and contract law, and the like being dealt with in businesses created or transformed by IT? What are the main differences across countries?
- Ultimately, what can be said about the impact of IT on the conduct of business and economic advance in various nations and regions?

In the Governmental and Political Arena

- How different are the approaches of various governments in fostering, channeling, regulating, or inhibiting the spread of IT?
- How may governance change in the information age (e.g., changes in the role of the nation-state, rise of new political actors)?
- Will IT facilitate the creation of nongovernmental organizations?
- How may politics be affected by IT? What is the future for "digital democracy"?
- Is information technology likely to spur political integration, disintegration, or both?

In the Social and Cultural Arena

- What social and cultural changes may the information revolution bring about (e.g., social impacts of increasing disparities and the "digital divide," impact of the information revolution on national or regional social and cultural values, e-learning)?
- Is the information revolution increasing economic inequalities within or between nations? Is it increasing social inequalities in this or other ways—for instance, by accentuating rural-urban cleavages?
- How will IT affect the delivery of human service over the next decade? How will it change health care, education, and other

social services? How, if at all, will it change the balance between public and private providers? What will be the implications of these changes?

- What social or cultural factors prominent in one nation/region or another facilitate or inhibit the diffusion of IT and advances in IT-related industries? How common are these factors in various areas of the world?

With Regard to Regional Variations

- How do all of the above vary from one nation to another, from one part of the world to another?
- Which countries are leading, which lagging in IT developments? What are the predominant differences across countries (and within them)?
- Broadly speaking, how do the projections of IT patterns vary from one region of the world to another? Where do various regions fall on the spectrum of private-sector-dominated, bottom-up versus public-sector-driven, top-down IT-related development?
- What are the key factors in or determinants of how the information revolution plays out in each major region of the world?

GLOBALIZATION AND THE INFORMATION REVOLUTION ARE CLOSELY LINKED

In addressing these and similar questions, the effects of the information revolution are commingled with those of globalization—the rapid advance in cross-border integration in many areas of economic and other human activities that has been ongoing for some time, facilitated by advances in transportation systems and communications systems and by the elimination of regulatory barriers to the movement of money, goods, services, and people. Globalization and the information revolution are closely linked. Indeed, advances in IT are one of the principal enablers of globalization. Conversely, globalization is shaping the world in which the information revolution is playing out.

In most cases it is difficult, and in some cases impossible, to separate the effects of the information revolution from those of globalization. In almost all cases, it serves little useful purpose to do so. Accordingly, in what follows we treat the information revolution and globalization as intimately commingled phenomena, the effects of which we do not attempt to separate.

SOME TOPICS WE DID NOT ADDRESS—DELIBERATELY

There were some aspects of the information revolution that we did not address, at least not in any detail. The two most important are

- The security issues raised by advances in IT, or more precisely, by the ever-increasing fraction of human economic, political, social, and other societal activity that is carried out via information systems and networks. This subject is sometimes referred to as "security in cyberspace."
- The impact of advances in information technology on military operations, sometimes referred to as the "revolution in military affairs."

We did not address these topics primarily because they already have been covered by other investigators at considerable breadth and great depth.[4] To cover them again in our study would have duplicated previous work; we judged that our resources could be better spent elsewhere.

THE COURSE OF THIS EFFORT

This effort included a series of international conferences on specific aspects of the information revolution, involving experts in various relevant areas, as well as selected in-depth studies. The first step in this effort was a conference held in November 1999 on the political, economic, social, and cultural trends driven by the information revolution as they manifest themselves globally; the proceedings of this conference were published in Hundley et al. (2000). The second step was a conference held in May 2000 to explore the technological drivers of the revolution in more detail; the proceedings of that conference were published in Anderson et al. (2000). The third step was a

conference on the information revolution in Latin America, conducted in November 2000; the proceedings of that conference were published in Treverton and Mizell (2001). The fourth step was a conference on the future of the information revolution in Europe, held in Belgium in April 2001; the proceedings of that conference were published in Hundley et al. (2001).

In addition to these conferences conducted by RAND under NIC sponsorship, this effort has also benefited from an international conference on the information revolution in Africa conducted by the NIC and the State Department Bureau of Intelligence and Research in October 2001.[5]

To complement these international conferences, separate studies were conducted on the course of the information revolution in the Asia-Pacific region and in the Middle East and North Africa.[6] The results of these studies are reported in Hachigian and Wu (2003) and in Burkhart and Older (2003), respectively.

These international conferences and in-depth studies are the primary body of information on which this report is based and are supplemented by the many source documents listed in the References.

THIS REPORT

This report represents a final integration and summing up of all the findings of RAND's multiyear effort to chart the worldwide course of the information revolution.[7] It is organized in three parts:

- **Part I** sets out common themes that recur throughout the world—with separate chapters on the technology dimension of the information revolution (Chapter Two); the business/financial dimension (Chapter Three); the government/political dimension (Chapter Four); and the social/cultural dimension (Chapter Five), as well as a chapter on the factors that distinguish one region or nation from another insofar as their approach to the information revolution is concerned (Chapter Six).
- **Part II** discusses regional variations in these themes, as the information revolution proceeds differently in different regions of the world—with separate chapters on the future course of the information revolution in North America[8] (Chapter Seven); the

future course of the information revolution in Europe (Chapter Eight); the information revolution in the Asia-Pacific region (Chapter Nine); the information revolution in Latin America (Chapter Ten); the information revolution in the Middle East and North Africa (Chapter Eleven); and the information revolution in sub-Saharan Africa (Chapter Twelve).

- **Part III** takes a brief look at some additional topics emerging during the course of our work: Chapter Thirteen outlines geopolitical trends furthered by the information revolution that could pose continuing challenges to the United States. Chapter Fourteen addresses the question of what future events could change the projections we make here. And Chapter Fifteen mentions the broader technology revolution of which the information revolution is but one part; this broader revolution should over time have even profounder consequences than those of the information revolution taken by itself.[9]

Insofar as format is concerned, each of the chapters of this report is written (as much as possible) as a stand-alone piece that can be read on its own, without reference to the other chapters. Notes are placed at the end of each chapter, rather than at the bottom of each page, so as not to break up the reading process (for those who do not want to get into the details presented in the notes).

MUCH HAS HAPPENED SINCE WE BEGAN THIS EFFORT

This effort began in mid-1999, before the worst of the dot-com crash and the telecom implosion. All of the international conferences that were a major part of the effort, and on which we base many of the findings of our study, were conducted before the events of September 11, 2001. These events—the dot-com and telecom crashes and September 11—clearly changed the world. The question is, How will this changed world affect the future course of the information revolution?

In the chapters that follow, we comment on what impact we feel these events will have on the future development of the information revolution—on either the character or pace of that development, over either the short or long term.

NOTES

[1]This is not the first "information revolution" that humans have experienced. The invention of moveable-type printing, in the 15th century in Europe and earlier in China, was one. The invention of writing several millennia ago was another. (This may have been the greatest information revolution of them all.) And there have been other inventions classified by some as information revolutions as well (e.g., the invention of the telegraph, the telephone). While recognizing these earlier revolutions, this report concentrates on the current one. (See Dewar, 1998, for a discussion of possible parallels between the invention of the printing press and the current information revolution.)

[2]Information technology is not the only technology that will change the 21st-century world. Biotechnology, nanotechnology, materials sciences, and their synergies with IT should also transform the world greatly (see Antón, Silberglitt, and Schneider, 2001). We come back to this issue in Chapter Fifteen.

[3]This effort was carried out in support of the Information Revolution initiative of the Director of Central Intelligence's Strategic Estimates Program.

[4]PCIPB (2002) provides an overview of the present state of security (and insecurity) in cyberspace. Hundley (1999) discusses the current "revolution in military affairs," placing it in the historical context of past military revolutions.

[5]The results of this conference on the information revolution in Africa are reported on in NIC/State Department (2002).

[6]RAND originally planned to hold an international conference in Asia on the course of the information revolution in the Asia-Pacific region. In the post–September 11, 2001 environment, this was no longer advisable.

[7]This report is a *summary*. As such, it cannot include all the supporting detail contained in the various conference proceedings and other supplementary materials cited in the References (at the end of this report), which should be consulted for additional justification and discussion of points made in this summary.

[8]By *North America,* we mean here the United States and Canada. Mexico is discussed as part of Latin America.

[9]Part III is definitely a *brief* look at these issues, meant merely to introduce the subjects.