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Towards Knowledge Societies

UNESCO World Report

UNESCO Publishing

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UNESCO WORLD REPORT

Towards Knowledge Societies

UNESCO Publishing

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Preface

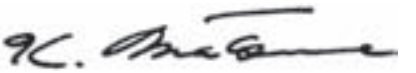
Education, science, culture and communication: the scope of UNESCO's field of competence ensures the relevance of its mission, while pointing to its increasing complexity. The upheavals stemming from the Third Industrial Revolution – that of the new technologies – have produced a new dynamic as the training of individuals and groups, scientific and technical advances and modes of cultural expression have been constantly evolving since the mid-twentieth century, notably in the direction of growing interdependence. This can be viewed positively. For one thing, can we today imagine any use of biotechnologies that disregards the cultural conditions of how they are applied? Or a science heedless of scientific education or local knowledge? Or a culture neglectful of educational transmission and the new forms of knowledge? The notion of knowledge is central to these changes. Knowledge is today recognized as the object of huge economic, political and cultural stakes, to the point of justifiably qualifying the societies currently emerging.

As for knowledge societies, while there is general agreement on the appropriateness of the expression, the same cannot be said of the content. Which types of knowledge are we talking about? Do we have to endorse the hegemony of the techno-scientific model in defining legitimate and productive knowledge? And what of the imbalances that mark access to knowledge and the obstacles confronting it, both locally and globally? These are some of the issues for which this first *UNESCO World Report* attempts to offer some ethical and practical pointers, guided by a strong conviction that emerging societies cannot make do with being mere components of a global information society. To remain human and liveable, knowledge societies will have to be societies of shared knowledge. The plural here sanctions the need for an accepted diversity. The time seems ripe to take up this matter afresh since the burgeoning of a number of studies on the new status of knowledge and the growing reflection of these questions in development initiatives now afford the necessary detachment for an initial assessment and the drawing of conclusions such as to prompt a wealth of proposals in this field – all of which fully justifies the title and the lines of emphasis of this report.

As the report proceeds, a panorama will open up that paints the future in both promising and disquieting tones, promising because the potential offered by a rational and purposeful use of the new technologies offers real prospects for human and sustainable development and the building of more democratic societies; disquieting, for the obstacles and snares along the way are all too real. There has been much reference to the digital divide, which is a reality. But a still more disturbing factor is that the knowledge divide between the most favoured and the developing countries, particularly the least developed countries (LDCs), is liable to widen while, within societies themselves, equally profound cleavages appear or are exacerbated. How could the future knowledge societies settle for being dissociated societies?

It is the task of foresight not to minimize future tensions and dangers beneath a ready-made cloak of optimism. But anticipation is also meant to be a prompting to action, which by definition must avoid pessimism as well. It is on this condition that future-oriented reflection can, both legitimately and advisedly, be prescriptive. As a forum and a crossroads, a place at once for meeting, exchange and debate, UNESCO is committed to devising paths that, while directing us to shared horizons, maintain the diversity of pace and method and, I may add, paths that, rather than just maintaining such diversity, draw upon it and treat it as an asset and not a drawback. There can be no quest here for simple unilateral solutions. What must be sought, by contrast, are lines of reflection and action for making communication and information serve the transmission of knowledge, a diffusion one would want set fast in time and wide in space, operating between generations and between cultures.

To meet such a challenge, UNESCO, given its fields of competence, commands valuable expertise and experience. The technological and knowledge revolution bequeathed us from the twentieth century has lent the Organization's mandate a fresh dimension, for the now more strategic and complex challenges we face are all the more stimulating as a result. The premises and projects we offer here in the first *UNESCO World Report* all emphasize the need to renew an ethic for the guidance of emerging knowledge societies, an ethic of freedom and of responsibility. An ethic that, let us repeat, will rest upon the sharing of knowledge.



Koïchiro Matsuura
Director-General of UNESCO

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Boxes

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List of abbreviations and acronyms

AGORA	Global Online Research in Agriculture
AISI	African Information Society Initiative
AJOL	African Journals OnLine
ALAS	Latin American Association of Scientists
APPEAL	Asia-Pacific Programme of Education for All
APRM	African Peer Review Mechanism
ARPANET	Advanced Research Projects Agency Network
ASCII	American Standard Code for Information Interchange
ASEA	Association of Surgeons of East Africa
ASEAN	Association of Southeast Asian Nations
ASTA	Arab Scientists and Technologists Abroad
AU	African Union
BNF	Bibliothèque nationale de France
BRAC	Bangladesh Rural Advancement Committee
CBD	Convention on Biological Diversity
CEPES	UNESCO European Centre for Higher Education
CERI	Centre for Educational Research and Innovation
CERN	European Organization for Nuclear Research
CESCR	Committee on Economic, Social and Cultural Rights of ECOSOC
CITRIS	Center for Information Technology Research in the Interest of Society
CLCs	Community Learning Centres
CMC	Community Multimedia Centres
CODATA	Committee on Data for Science and Technology
COMEST	World Commission on the Ethics of Scientific Knowledge and Technology
CRESALC	Regional Centre for Higher Education in Latin America and the Caribbean (now the UNESCO International Institute for Higher Education in Latin America and the Caribbean (IESALC))
DATAD	Database of African Theses and Dissertations
DFID	Department for International Development
DNA	DeoxyriboNucleic Acid
Dot.Force	Digital Opportunity Task Force
DRM	Digital Rights Management
ECLAC	Economic Commission on Latin America and the Caribbean
ECLAC	Economic Commission for Latin America and the Caribbean
ECOSOC	Economic and Social Council
EFA	Education for All
eJDS	electronic Journals Delivery Service
EPA	United States Environmental Protection Agency
EU	European Union

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FAO	Food and Agriculture Organization of the United Nations
G8	Group of Eight (Canada, France, Germany, Italy, Japan, Russian Federation, United Kingdom, United States)
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GEO	Global Ethics Observatory
GMOs	Genetically Modified Organisms
GNP	Gross National Product
GPS	Global Positioning System
GRID	Globalization des ressources informatiques et des données
GURTs	Genetic Restrictive Technologies
HDI	UNDP's human development index
HINARI	Health InterNetwork Access to Research Initiative
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HTML	Hypertext Markup Language
IADB	Inter-American Development Bank
IBSP	International Basic Sciences programme
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific
ICSTI	International Council for Scientific and Technical Information
ICSU	International Council for Science
ICTP	Abdus Salam International Centre for Theoretical Physics
ICTs	information and communications technologies
IFLA	International Federation of Library Associations and Institutions
IIEP	UNESCO International Institute for Educational Planning
ILO	International Labour Organization
INASP	International Network for the Availability of Scientific Publications
INRS	Institut National de Recherche Scientifique
IOC	Intergovernmental Oceanographic Commission
IPA	International Publishers Association
ISCED	International Standard Classification of Education
ITER	International Thermonuclear Experimental Reactor
ITIC	International Tsunami Information Center
ITU	International Telecommunications Union
IUCN	World Conservation Union
LDCs	Least Developed Countries
MAB	Programme on Man and the Biosphere
MDGs	Millennium Development Goals
MIRCEN	Microbial Resource Centres
MIT	Massachusetts Institute of Technology
MONDIACULT	World Conference on Cultural Policies
MSF	Médecins sans frontières
MOST	Management of Social Transformations Programme
MSTI	Main Science and Technology Indicators
NASA	National Aeronautics and Space Administration
NEPAD	New Partnership for Africa's Development
NGO	non-governmental organization
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OPAC	Online Public Access Catalog
OST	Observatoire des sciences et des technologies
PDF	Portable Document Format
PERI	Programme for the Enhancement of Research Information
PLoS	Public Library of Science
R&D	Research and Development

RICYT	Iberoamerican Web of Science and Technology Indicators
SARS	Severe Acute Respiratory Syndrome
SCI	Science Citation Index
Sci Dev. Net	Science and Development Network
SIPRI	Stockholm International Peace Research Institute
SMMEs	Small, Medium-Sized and Micro Enterprises
TOKTEN	Transfer of Knowledge through Expatriate Nationals
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TWAS	Academy of Sciences for the Developing World
UIS	UNESCO Institute for Statistics
UN	United Nations
UN ICT Task Force	United Nations Information and Communication Technologies Task Force
UNAIDS	United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
URL	Uniform Resource Locator
USAID	United States Agency for International Development
VHS	Virtual High School
WCCD	World Commission on Culture and Development
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WSIS	World Summit on the Information Society
WTO	World Trade Organization

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Introduction

Does the aim of building knowledge societies make any sense when history and anthropology teach us that since ancient times, all societies have probably been, each in its own way, knowledge societies?

Today, as in the past, the control of knowledge can go hand in hand with serious inequality, exclusion and social conflict. Knowledge was long the exclusive domain of tight circles of wise men and the initiated few. Secrecy was the organizing principle behind these *exclusive knowledge societies*. In the Age of Enlightenment, the demand for democracy, the concept of openness and the gradual emergence of a public forum for knowledge, fostered the spread of the ideas of universality, liberty and equality. The diffusion of knowledge through books and the printing press, as well as the extension of an education for all through schools and universities, accompanied this historical development. But the ideal of a public knowledge forum, which is the basis of UNESCO and of its Constitution, cannot be taken for granted.

The current spread of new technologies and the emergence of the internet as a public network seem to be carving out fresh opportunities to widen this public knowledge forum. Might we now have the means to achieve equal and universal access to knowledge, and genuine sharing? This should be the cornerstone of true knowledge societies, which are a source of human and sustainable development.

Which knowledge societies?

A knowledge society is a society that is nurtured by its diversity and its capacities

Every society has its own knowledge assets. It is therefore necessary to work towards connecting the forms of knowledge that societies already possess and the new forms of development, acquisition and spread of knowledge valued by the knowledge economy model.

The idea of the information society is based on technological breakthroughs. The concept of knowledge societies encompasses much broader social, ethical and political dimensions. There is a multitude of such dimensions which rules out the idea of any single, ready-made model, for such a model would not take sufficient account of cultural and linguistic diversity, vital if individuals are to feel at home in a changing world. Various forms of knowledge and culture always enter into the building of any society, including those strongly influenced by scientific progress and modern technology. It would be inadmissible to envisage the information and communication revolution leading – through a narrow, fatalistic technological determinism – to a single possible form of society.

The importance of education and critical thinking underscores that, in building real knowledge societies, the new prospects held out by the internet

and multimedia tools must not cause us to lose interest in traditional knowledge sources such as the press, radio, television and, above all, the school. Most of the people in the world need books, school textbooks and teachers before computers and internet access.

It is impossible to separate the issue of contents from that of languages and different forms of knowledge. This does not simply mean we should limit our scope to the debates about the growing importance of English in relation to the other major world languages or to the fate of languages threatened with extinction. What is also at stake is the space we should make for local or indigenous forms of knowledge within knowledge societies whose development models highly value the codification forms specific to scientific knowledge. The increasing importance of cultural and linguistic diversity underscores the extent to which problems of access to knowledge are bound up with the production of knowledge. Fostering diversity also means nurturing the creativity of emerging knowledge societies. Such a prospect fulfils not only an abstract ethical imperative, it above all aims to raise in each society an awareness of the wealth of the forms of knowledge and capacities it possesses, in order to increase their value and take advantage of what they have to offer. That done, each society will probably be better armed to cope with the ever-increasing pace of change that characterizes today's world.

A knowledge society must foster knowledge-sharing

A knowledge society should be able to integrate all its members and to promote new forms of solidarity involving both present and future generations. Nobody should be excluded from knowledge societies, where knowledge is a public good, available to each and every individual.

Young people are bound to play a major role because they are often among the first to use new technologies and to help establish them as familiar features of everyday life. But older people also have an important part to play. They possess the experience required to offset the relative superficiality of "real-time" communication and remind us that knowledge is but a road to wisdom. Every society possesses a huge knowledge potential that should be turned to good account.

Moreover, since the "information age" knowledge societies differ from older knowledge societies because of the focus on human rights and the inclusive participatory character they inherited from the Enlightenment, the importance of basic rights translates into the particular emphasis on:

- freedom of opinion and expression (Article 19 of the Universal Declaration of Human Rights) as well as freedom of information, media pluralism and academic freedom;
- the right to education and its corollary, free basic education and progress towards free access to other levels of education (Article 26 of the Universal Declaration of Human Rights and Article 13 of the International Covenant on Economic, Social and Cultural Rights); and,
- the right "freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits" (Article 27, paragraph 1, of the Universal Declaration of Human Rights).

The diffusion of information and communication technologies creates new opportunities for development

The simultaneous growth of the internet, mobile telephony and digital technologies with the Third Industrial Revolution – which, at first in the developed countries, has seen much of the working population migrate to the service sector – has revolutionized the role of knowledge in our societies.

These technologies play an important role[1] not only in economic development (through the spread of innovation and the productivity gains they bring about), but also in human development.[2] For some stagnating developed economies, in the late 1970s, the growth of new technologies seemed like a panacea for many nagging domestic problems, such as education and health care for the most underprivileged in the United States, the recurring industrial and monetary crises in Japan and structural unemployment in Europe. For the developing countries, the promise of "technological leapfrogging", of being able to skip the

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stages of industrial development by adopting the most advanced technologies directly and to capitalize on their tremendous potential, held out special appeal.

In emerging knowledge societies, there is also a virtuous circle in which the progress of knowledge and technological innovation produces more knowledge in the long term. We are witnessing an acceleration of knowledge production. The new technology revolution marks the entrance of information and knowledge in a cumulative logic, which Manuel Castells describes as *"the application of such knowledge to knowledge generation and information processing/communication devices, in a cumulative feedback loop between innovation and the uses of innovation."* [3]

The values and practices of creativity and innovation will play a major part in knowledge societies, if only through their ability to challenge existing models in order to better meet societies" new needs. Creativity and innovation also lead to promoting new types of collaborative processes that have already proven themselves to be particularly fruitful.

Knowledge societies are not limited to the information society

The rise of a global information society spawned by the new technology revolution must not overshadow the fact that it is valuable only as a means to achieve genuine knowledge societies. The growth of networks alone will not be able to lay the groundwork for the knowledge society.

While information is a knowledge-generating tool, it is not knowledge itself.[4] Emerging from the desire to exchange knowledge by making its transmission more efficient, information remains a fixed stabilized form of knowledge, pegged to time and to the user – news is either fresh or it is not. Thus, information is in many cases a commodity, in which case it is bought or sold, whereas knowledge, despite certain restrictions (defence secrets, intellectual property, traditional forms of esoteric knowledge, for example), belongs of right to any reasonable mind. The excessive focus on information compared with knowledge reveals the extent to which the spread of knowledge economy models has changed our relationship to knowledge.

Today, as we are witnessing the advent of a global information society where technology has increased the amount of information available and the speed of its transmission beyond all expectations, there is still a long way to go before we achieve genuine knowledge societies. A piece of information, "enhanced" though it may be (to eliminate noise or transmission errors, for example), does not necessarily make sense. As long as vast swathes of the global population lack equal opportunity in terms of access to education – in order to master the available information with critical judgement and thinking, and to analyse, sort and incorporate the items they consider most interesting in a knowledge base – information will never be anything but a mass of indistinct data. And instead of controlling it, many people will realize that it is controlling them.

An excess of information is not necessarily the source of additional knowledge. What is more, the tools that can be used to "process" that information are not always up to the task. In knowledge societies, everyone must be able to move easily through the flow of information submerging us, and to develop cognitive and critical thinking skills to distinguish between "useful" and "useless" information. Useful knowledge is not simply knowledge that can be immediately turned into profit in a knowledge economy – "humanist" and "scientific" knowledge each obey different information-use strategies.

Knowledge societies: a new approach to relevant development for the countries of the South

Above all, reflection upon knowledge societies and how to build them makes it possible to rethink development itself. The new value placed on "human capital" suggests that traditional models of development, predicated on the enormous sacrifices deemed necessary for the achievement of long-term growth (at the cost of very great inequalities and possibly a high degree of authoritarianism), are gradually giving way to models centred on mutual help and the role of the public services. Making the most of knowledge leads to imagining a new, collaborative development model based on the guarantee, by government, of

"public property", where growth is no longer viewed as an end in itself, but simply as a means to reach the target. By giving knowledge an unprecedented accessibility, and by engaging in capacity-building for everyone, the technological revolution might help to redefine the end goal of human development. For Amartya Sen, this is to be found in the search for elementary freedoms – so-called "substantial", empirically verifiable freedoms and not simply in the form of rights. These, he argues, are both the end and the main tool for development. They coincide with the elementary ability to gain access to the labour market, to education and health services (particularly for girls and women), and to goods, to take part in political decision-making, and to enjoy equal access to information and the right to collective security.[5] Do those substantial freedoms not coincide with the hallmarks of knowledge societies, based on lifelong education for all and on the promotion of knowledge, all forms of knowledge, taken in their plurality, as values?

Network societies, as knowledge societies, necessarily foster a heightened awareness of global problems. Environmental damage, technological hazards, economic crises and poverty are some of the areas in which cooperation and collaboration may be expected to bring benefits.[6] Knowledge is a potent tool in the fight against poverty, as long as that fight is not limited to building infrastructures, launching micro-projects (whose sustainability largely depends on outside financing on a case-by-case basis) or promoting institutional mechanisms, whose usefulness for the least developed countries might be called into question. Infostructure and capacity-building are just as important, if not more. The successes achieved by a certain number of East and Southeast Asian countries in the fight against poverty is largely explained by the massive investments they made in education and research and development (R&D) over several decades. This is a possible example for many developing countries, that would stand to gain from drawing inspiration from experiences that have helped to slash absolute poverty. In this perspective, the idea of knowledge societies cannot be reduced to a vision of the North – it can also constitute a new, relevant development approach for the countries of the South.

Which context?

The term "knowledge society", which the academic Peter Drucker used for the first time in 1969, came into its own in the 1990s, in particular with the detailed studies by researchers such as Robin Mansell[8] and Nico Stehr.[9] As we shall see, the idea emerged in the late 1960s and early 1970s, at about the same time as the notion of "learning societies" and lifelong education for all, which is surely not a coincidence. UNESCO played its part, if modest, in this change, as is exemplified by the publication of the report of the International Commission on the Development of Education, *Learning to Be* (Faure et al., 1972). In addition, the idea of the knowledge society is inseparable from studies on the information society, whose premises appeared with the growth of cybernetics. From the 1960s to the publication of Manuel Castells "information age" trilogy[10] in the late 1990s, the notion of information society in a way summed up the changes and trends that the earliest trailblazers described or foresaw – technology's penetration of the power structure, the new economy based on scientific knowledge, changes in the workplace, etc.

The consequences of the rise of information and knowledge society themes on the institutional level are important for defining research, education and innovation policies. Even before the first phase of the World Summit on the Information Society (Geneva, 10–12 December 2003), the international community's reflections in this area had been followed up by a number of initiatives, such as the World Conference on Higher Education,[11] the World Conference on Science in Budapest, "Science for the Twenty-first Century: A New Commitment?"[12] and the World Summit on Sustainable Development.[13] This interest in the issue also translated, during the preparation of the Geneva Summit, into the organization of regional summits and initiatives on governmental and non-governmental levels. The intellectual and scientific communities, and civil society in general, were involved in this effort, as is illustrated by the many works on new scientific knowledge production methods, innovation, learning societies and the links

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that unite knowledge societies, scientific research and lifelong education for all. In addition to these initiatives by government, the private sector and civil society, and the emergence of mixed initiatives bringing together those three players – such as the World Bank's Global Knowledge Initiative and the United Nations Information and Communication (UN ICT) Task Force – are also worth mentioning.

It is very far from being the case, then, that governments have disregarded the transition to a new technological and social paradigm. Today, the concept of the knowledge society has become an essential framework of reflection not only for most member countries of the Organisation for Economic Development and Co-operation (OECD), but also for many emerging economies and developing countries, especially in East and Southeast Asia, Latin America, the Caribbean, sub-Saharan Africa, Central and Eastern Europe and the Arab States.

The limits of existing initiatives

The research that has been carried out so far, especially in the areas of education, scientific research and new technologies, is still massively dependent on a fragmented vision of existing interactions and a strong technological determinism. Interest in the short-term impact of the introduction of new technologies into education and learning might lead to neglecting a deeper study of the new contents of education, their quality and their formats. That development could become alarming at a time when education sometimes tends to give a high importance to the management of information pre-formatted by online content providers at the expense of the development of analytical skills and critical judgement. But it is not so much the brisk growth of new information and communication technologies, such as the internet and mobile telephony, that is the revolutionary breakthrough – it is the use of those tools by providers of informational, educational and cultural contents, among which the media play an increasingly important part.

In this context, it is important to have a historical perspective. Instead of offering developing countries a "single model" of knowledge societies, it is worth recalling that the breakthroughs achieved in many nations are largely due to patient and concerted efforts in such areas as education at all levels, technological catch-up in strategic areas of scientific research and the implementation of effective innovation systems.[14] The liberalization of trade has considerably altered the very nature of economic competition, which requires quick and deep changes of national higher education and scientific research policies – transformations whose future is certainly hard to foresee, but the attempt must at least be made to assess them more accurately insofar as they are already drastically challenging the very nature of higher education institutions and public research sectors. Many countries are already on that track. Sooner or later those changes will affect all education systems and the very definition of the goals of education at all levels.

The steady pace of technological innovation requires periodical updating. High-speed internet access over power lines (and no longer only over telephone lines), interactive television on mobile phones and the sale of new software significantly cutting the cost of telephone calls are drastically shifting the terms of the debate not only on access to technologies but also on access to diversified contents. Meanwhile, the internet itself might in the short term split up into a host of first-, second- and third-class internets, not only because of competing efforts to control mechanisms of registering domain names but also because of changes stemming from the development of a second – generation internet, whose costs will be high, limiting the circle of users to the wealthiest institutions. A case in point is the setting up of national and subregional infrastructures accessible only to paying institutional players, associated with a network in a limited number of regions, of which the extension of the Abilene project is the most outstanding example.[15]

Which challenges?

However, many experts think that the brisk growth of new technologies might help to overcome a number of constraints that until now have impeded the emergence of knowledge societies, such as geographical

distance and the limits inherent to means of communication. Of course, networking helps to open up entire realms of knowledge, such as scientific and technological knowledge, that until now were often jealously guarded for strategic or military reasons.[16] However, a number of old stumbling blocks still hinder access to knowledge and new ones have appeared. How could we accept that future knowledge societies will operate like so many exclusive clubs only for the happy few?

Towards a dissociated society?

Will knowledge societies be societies based on *knowledge-sharing* for all or on the *partition of knowledge*? In the information age, and at a time when the advent of knowledge societies is poised to become a reality, we are, paradoxically, seeing divides and exclusions emerge between North and South, and within each society.

There is no denying that the number of internet users is growing at a very brisk pace, rising from over 3 per cent of the world population in 1995 to more than 11 per cent in 2003 – or over 600 million people. But it is liable to come up fairly quickly against the glass ceiling of financial viability, nor should the question of education be overlooked. We are already living in a "one- fifth society", in which 20 per cent of the world's population monopolizes 80 per cent of the planet's resources.[17] The digital divide – or *divides*, so multifaceted are their forms – is a cause for alarm. There is a strong chance that the brisk growth in the number of internet users will slow down when the figure nears 20 per cent.

As we shall see, the digital divide helps widening an even more alarming divide – the *knowledge divide*, which adds up the cumulative effects of the various rifts observed in the main areas that make up knowledge (access to information, education, scientific research, and cultural and linguistic diversity) and is the real challenge facing the building of knowledge societies.[18] This knowledge divide is rooted in the dynamics inherent to knowledge gaps, be they global inequalities in the distribution of cognitive potential (gaps between forms of knowledge) or the unequal value put on different types of knowledge in the knowledge economy (gaps within different kinds of knowledge). The knowledge divide is particularly glaring between the countries of the North and those of the South, but it is also a problem within a given society, since it is highly unlikely that equal exposure to knowledge will result in equal mastery[19]. Closing the digital divide will not suffice to close the knowledge divide, for access to useful, relevant knowledge is more than simply a matter of infrastructure – it depends on training, cognitive skills and regulatory frameworks geared towards access to contents. There is no point in linking populations with fibre optics unless the development of skills and efforts to produce appropriate contents keep pace with that "connectivity". Information and communication technologies still require the development of new cognitive and legal instruments in order to realize their full potential.

The dangers of an excessive commoditization of knowledge

The economic and social promises that the information society seemed to hold out, including full employment, the "new economy" and the competitiveness boom, have yielded to concerns about the limits of the "information age". Some experts have noted that, far from confirming the hypothesis of "dematerialization", our societies may on the contrary be in the midst of a process of "hyper-industrialization" because knowledge itself has become "commoditized" in the form of exchangeable, and codifiable information. There is no shortage of criticisms and concerns about knowledge that might well end up self-destructing as knowledge from being handled in databases and search engines, integrated into the production process as a "technological-scientific" accessory and transformed into a condition of development– a stake in the struggle for power or a surveillance tool.

An excessive appropriation or commoditization of knowledge in the global information society would be a serious threat to the diversity of cognitive cultures. In an economy where the focus is scientific and technological knowledge, what role might certain forms of local and indigenous know-how and knowledge play? They are already often deemed less

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valuable than technological and scientific knowledge. Is there a chance they might simply vanish, even though they are a priceless heritage and a precious tool for sustainable development?

Knowledge cannot be considered an ordinary saleable commodity. The current trend towards the privatization of higher education systems and their internationalization deserves attention from policy-makers and should be examined in the framework of the public debate on the national, regional and international levels. Knowledge is common good. The issue of its commoditization therefore should be very seriously examined.

The UNESCO World Report on knowledge societies for all has been released at a crucial moment. After the achievements of the first phase of the World Summit on the Information Society, there is fresh international interest in the growth and development paradigm that bears within it the idea of "knowledge societies". We are witnessing the emergence of a need for clarification of its aims as a *project of society*. This is the challenge that the UNESCO World Report intends to address on the eve of decisive international meetings.[20]

Background resources

Castells (1996); Drucker (1969); Faure et al. (1972); Mansell and Wehn (1998); Sen (1999*a*); Stehr (1994).[21]

Overview

On what foundations could a global knowledge society that would be a source of development for all and, in particular, for the least advanced countries, be built? This question is the focus of **Chapter 1**, **From the information society to knowledge societies,** which emphasizes the need to consolidate two pillars of the global information society that are still too unevenly guaranteed – access to information for all and freedom of expression. The foundations of an information and knowledge society can never amount to technological breakthroughs alone. Undoubtedly, inequalities of access to information sources, contents and infrastructures cast doubt on the information society's global character and, consequently, hamper the growth of knowledge societies.

Our time is the stage of transformations and upheavals so momentous that some people claim we are in the throes of a Third Industrial Revolution – that of new information and communication technologies – associated with a change in knowledge systems and patterns. For decades, the magnitude of those technological transformations has been affecting the means of creating, transmitting and processing knowledge, and suggests that we may be standing on the brink of a new digital knowledge age. **Chapter 2**, **Network societies, knowledge and the new technologies**, focuses on those developments and their corollaries. The knowledge and the intangible economies, and the impact of new technologies on networked societies, are at the heart of the changes under way. Moreover, with new modes of preserving knowledge, are we in the midst of a transition from memory societies to knowledge societies?

Chapter 3, Learning societies, shows how those changes have kept pace, in terms of teaching and education, with the shift in focus from the possessors of knowledge to those who are seeking to acquire it in the framework of not only formal education systems, but also of professional activity and informal education, where the press and electronic media play an important role. At a time when increasingly rapid changes are rocking old models to their very foundations, and "learning by doing" and the ability to innovate are on the rise, our societies' cognitive dynamics have become a major issue. The learning model has spread well beyond the world of educators, to all levels of economic and social life. It is becoming increasingly clear that any organization, whether for-profit or not, will have to strengthen its "learning" dimension, to the point where the number of knowledge places and media is bound to rise in the countries of the North as well as of the South.

Chapter 4, Towards lifelong education for all? examines the impact of these new dynamics on progress towards achieving the universally proclaimed right to education. Basic education for all is still an absolute priority. But adult education, which might seem irrelevant for countries that still have a long way to go to meet basic education needs, has nevertheless acquired decisive importance today because it appears

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to be an essential condition for development. Thus, lifelong education for all can be one response to the increasing instability of employment and professions that most futurists foresee. Furthermore, it is advisable to focus on the increasingly visible risks and benefits involved in the privatization of educational offer, currently an especially sensitive issue in the area of higher education but which is starting to spread to other levels. Universal enrolment and a relevant education offer are hardly enough in and of themselves to guarantee effectiveness and success. These also depend on the quality of education offered. Some factors affecting quality have long been identified, such as the pupil/teacher ratio, teacher training, the quality of available infrastructures and the equipment available to pupils and teachers. They are strongly correlated to spending – especially public expenditure – on education.

Chapter 5, The future of higher education, also focuses on education and training, and more particularly on the fundamental role that institutions of higher education, which are facing an unprecedented upheaval in traditional patterns of the production, spread and application of knowledge, play in knowledge societies. Educational offer is diversifying as knowledge moves forward, but the "massification" of higher education is increasing the burden on national budgets. A growing number of establishments are opening up to other modes of funding, especially from the private sector. There is no longer a single model university in the complex fabric of public and private institutions. If nothing is done, the private funding phenomenon, which is leading to the emergence of higher education markets, might deal a serious blow to countries without a university tradition. Better international cooperation is necessary to ensure the quality and relevance of emerging higher education systems.

Chapter 6, A research revolution? stresses the importance that should be given to science and technology. The very idea of knowledge societies owes much to the brisk growth of research and innovation. Science players and locations are currently undergoing profound changes. With the market's increased involvement in the field of scientific activities, they should implement, at the crossroads of the scientific, economic and political sectors, research and innovation systems that promote sustainable development and benefit all, in the North as well as in the South. New knowledge-sharing models, such as the collaboratory, should be expanded in the future. These are the conditions in which science and technology can contribute to building knowledge societies based on the inclusion and participation of as many people as possible.

Chapter 7, Sciences, the public and knowledge societies, throws into relief the public's role in the debate on the risks and benefits entailed in the use of new technologies and the fruits of scientific research, especially in the areas of biotechnologies and nanotechnologies. Economic and social issues play an increasingly important part in the direction of research and innovation. Moreover, the ever-growing presence of science and technology is increasingly the focus of intense ethical and political debate, in particular when food, demographics and the environment are at stake. Science and technology are now a matter of governance and, therefore, of the responsibility of the players involved, whether scientists or policy-makers in the public or private sphere. This new situation requires a redefinition of standards, a strengthening of the scientists' ethical capacities and an improvement of the scientific information available to the public. It points up the importance of ethics committees, science education and successful public awareness-raising campaigns, which depend on effective science and technology media coverage.

Chapter 8, Risks and human security in knowledge societies, studies the emergence of a "risk society". The access of a large number of players to knowledge resources is full of promise, but it can also cause irreparable damage and create unpredictable dangers. The growth of knowledge societies might precisely be one of the most effective means to address this new complexity. Faced with the multiplication of risks, will adequate knowledge management help to dispel fears, to remove constraints and to reduce the uncertainty associated with the advent of complex societies?

Is there a chance that knowledge societies might accentuate the current trend towards a homogenization of cultures? **Chapter 9, Local and indigenous knowledge, linguistic diversity and knowledge soci-**

eties, examines the paradox of describing the growth of knowledge societies at a time when languages are vanishing, traditions falling by the wayside and vulnerable cultures becoming marginalized or tumbling into oblivion throughout all the world's regions. When one speaks of knowledge societies, what kind of knowledge is meant? There often is a creeping suspicion that such an expression mainly targets scientific and technological knowledge, which is mostly concentrated in the industrialized countries. But what about other forms of knowledge, in particular those labelled local or "indigenous"? Multilingualism, another challenge facing diversity, greatly facilitates access to knowledge, especially in a school setting. An analysis of knowledge societies cannot avoid seriously thinking about the future of linguistic diversity and ways to preserve it in a world where the informational revolution may lead to the risks of standardization and generalized formatting. Knowledge societies must turn to dialogue, knowledge-sharing and the benefits of translation in order to help create shared areas that preserve and enhance everyone's diversity.

Chapter 10, **From access to participation: towards knowledge societies for all** underscores the importance of a new conception of knowledge that is no longer a factor of exclusion, as might have been the case in the past but, on the contrary, promotes the full participation of all. However, there are many knowledge-related asymmetries on a global scale (the digital divide, the scientific divide, massive illiteracy in the Southern countries, the brain drain, etc.), whose accumulation is creating a *knowledge divide*. The knowledge divide, of which gender inequality is a glaring example, illustrates the potential for exclusion that knowledge societies may contain when their growth is reduced to the promotion of a knowledge economy or information society. Without the promotion of a new ethics of knowledge based on sharing and cooperation, the most advanced countries' tendency to capitalize on their advance might lead to depriving the poorest nations of such cognitive assets as new medical and agronomical knowledge, and to creating an environment that impedes the growth of knowledge. It will therefore be necessary to find a balance between protecting intellectual property and promoting the public domain of knowledge: *universal access to knowledge* must remain the pillar that supports the transition to knowledge societies.

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Chapter 1

From the information society to knowledge societies

The new information and communication technologies have created new conditions for the emergence of knowledge societies. Added to this, the emerging global information society only finds its *raison d'être* if it serves to bring about a higher and more desirable goal, namely the building, on a global scale, of *knowledge societies* that are a source of development for all, first and foremost for the least developed countries. Two challenges posed by the information revolution stand out in particular – bridging the digital divide and guaranteeing the future of freedom of expression. Is not the truly global character of the information society compromised by the unequal access of certain countries to information sources, contents and infrastructures? When the free flow of information is impeded, or when information itself is censured or manipulated, how can we speak of a global information society?

Knowledge societies as a source of development

Knowledge societies are about capabilities to identify, produce, process, transform, disseminate and use information to build and apply knowledge for human development. They require an empowering social vision that encompasses plurality, inclusion, solidarity and participation.[1] As emphasized by UNESCO during the first phase of the World Summit on the Information Society (WSIS),[2] the concept of knowledge societies is more all-embracing and more conducive to empowerment than the concept of technology and connectivity, which often dominates debates on the information society.[3] Issues of technology and connectivity emphasize infrastructures and governance of the network planet. They are clearly crucial but should not be viewed as an end in themselves. In other words, the global information society is meaningful only if it favours the development of knowledge societies and sets itself the goal of "tending towards human development based on human rights".[4] This objective is all the more vital since the Third Industrial Revolution – the revolution of the new technologies – and the new phase of globalization that accompanies, it have swept away many familiar landmarks and accentuated the divisions between rich and poor, and between industrialized and developing countries, as well as within national communities. For UNESCO, the construction of knowledge societies "opens the way to humanization of the process of globalization".[5]

The importance of human rights in knowledge societies

The human-development and empowerment-centred approach, implicit in the concept of knowledge societies, should ensure that human rights and fundamental freedoms are implemented more fully, while making for greater effectiveness in the fight against poverty and the framing of development policies. For the link between knowledge and development is fundamental to the building of knowledge societies – knowledge being both a tool for the satisfaction

of economic needs and a constitutive component of development. The political, economic and social dynamic at the heart of emerging knowledge societies thus offers a striking illustration of the indissociable link between the aims of fighting against poverty and promoting civil and political rights.

It follows that the emerging knowledge societies cannot limit themselves to putting forward a few reforms to reduce inequalities of access to the global information society and to combat the economic and educational disparities that underlie them. They must also include, among their main constituent principles, the safeguarding and promotion of the rights and freedoms proclaimed by universally recognized international human rights instruments – foremost among them the 1948 Universal Declaration of Human Rights and the 1966 International Covenants on Civil and Political Rights and on Economic, Social and Cultural Rights. Is there any surer guarantee of rights than knowledge and education? The saying that "ignorance of the law is no defence" not only prescribes the duty to know one's rights and one's duties; it also reminds us of the intimate link between acknowledgement of a right and knowledge of that right. A right must be known before it can be claimed and acknowledged.

What is more, knowledge, thought and conscience constitute the special dignity of the human being, bestowing the entitlement to rights. UNESCO's Constitution underscores this link between human dignity and the "wide diffusion of culture, and the education of humanity for justice and liberty and peace".[6] Fundamental rights and freedoms are and will accordingly remain at the heart of knowledge societies. As UNESCO emphasized at the World Summit on the Information Society, "the use of information and communication technologies to build knowledge societies should tend towards human development based on human rights".[7]

Freedom of expression and empowerment

Among these fundamental rights, special prominence must be given to freedom of expression as "the fundamental premise of knowledge societies".[8] As stipulated in Resolution 59 (I), adopted in 1946 at the first session of the United Nations General Assembly, "freedom of expression is a fundamental human right and the touchstone of all the other freedoms to which the United Nations are dedicated". The principle is proclaimed in Article 19 of the 1948 Universal Declaration of Human Rights: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers".

This right is furthermore guaranteed by the International Covenant on Civil and Political Rights, Article 19, which is drafted in very similar terms. The development of a global information society should be a spur to the full implementation of this right, "regardless of frontiers" in the terms of the Declaration. For freedom of expression is the *sine qua non* of the "empowerment" mentioned above. Its exercise requires the strict observance of rights that should evolve in step with the expansion of the new technologies (absence of censorship or control over information, free circulation of data and information, pluralism of the media and freedom of the press). It also requires that the fundamental rights of individuals are guaranteed, since they are essential for free participation in knowledge societies (freedom of opinion and freedom of speech). In societies in which information is assuming strategic importance, the growth of freedom of expression can further the spread of norms and professional ethics, thereby helping to ensure the quality of the information available. The emphasis placed on freedom of expression implies respect for the freedom essential to scientific research and creative work, as proclaimed in Article 15 of the International Covenant on Economic, Social and Cultural Rights. The free circulation of information is not in itself sufficient to build genuine knowledge societies. Information must be exchanged, compared, criticized, assessed and absorbed with the help of scientific research and philosophical enquiry, if everyone is to be able to produce new knowledge based on the flow of information.

Freedom of expression and freedom of scientific research and artistic creation, so long as they

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are fully respected, constitute an assurance, through the development of a global information society, of building genuine knowledge societies. To emphasize freedom of expression is to underscore the spirit of openness and dialogue that should govern relations between individuals and social groups within knowledge societies. Without it there can be no interchange or public debate. Freedom of expression guarantees the vitality of the links between individuals within a given society. In the absence of freedom of expression, knowledge may still exist; however, there can be no knowledge society, or any knowledge-sharing.

Freedom of expression and fight against poverty in knowledge societies

As illustrated by the research of Amartya Sen, the safeguarding of freedom of expression cannot be regarded as an exclusively political principle since it also has powerful economic and social implications that make it particularly relevant to development. From the standpoint of building knowledge societies, the effective promotion of freedom of expression in the global information society can contribute to solving many political problems such as censorship and the manipulation of information for political ends and generalized surveillance, as well as many economic ones such as the prevention of famines, the bridging of the digital divide, or the fight against unequal development. The free circulation of information and contents can also contribute to increasing public awareness, for purposes related either to public health[9] or to the prevention of catastrophes.[10]

This is a measure of the potential contribution of the growth of knowledge societies to the attainment of the Millennium Development Goals (MDGs) that the United Nations set itself at the Millennium Summit held in New York in the year 2000.[11] While the new technologies are a source of social change, they can only become a promise of development for all through the alliance of freedom of expression, knowledge, democratic principles and the concept of justice – which are at the heart of UNESCO's Constitution. This is the promise that knowledge societies can fulfil, provided the will to do so exists.

Digital solidarity

Today, only 11 per cent of the world's population has access to the internet. Ninety per cent of people connected come from the industrialized countries – North America (30 per cent), Europe (30 per cent) and Asia– Pacific (30 per cent).[12] These figures place in perspective the worldwide impact of the revolution of the new technologies. Indeed, while we speak of a global information society and of a World Wide Web, the fact is that 82 per cent of the world's population account for only 10 per cent of connections in the world.[13] This *digital divide* is first and foremost a question of access to infrastructures. Some 2 billion people are not linked to an electricity grid, the precondition of mass access to the new technologies. Furthermore, there is a problem of affordability, all more acute since telecommunication costs remain very high in the South in comparison with countries of the North, both in absolute terms and in terms of disposable income. Computers are also expensive. The provision of internet services constitutes a very considerable investment in urban areas, and is in short supply in the countryside. In addition, familiarizing oneself with the computer represents a considerable time investment for those concerned with what they are going to eat today. These problems of connection, and the related questions concerning the network economy, come within the remit of the International Telecommunications Union (ITU), the United Nations agency concerned with information society infrastructures.

"Info-exclusion" is not only a question of access and connectivity, but also of content. It results from the *knowledge divide* as much as from the *digital divide,* and relates to educational, cultural and linguistic barriers that make the internet alien and inaccessible to population groups marginalized by globalization (see Box 1.1).

The digital divide is thus of direct concern to UNESCO's task. If we wish to promote the development of genuine knowledge societies in the name of human development, there is a self-evident and pressing need to overcome digital inequalities. As part

Box 1.1 A multi-faceted digital divide

There is not one but rather many digital divides. They are not exclusive and tend to combine according to local realities. There are numerous factors that contribute to the digital divide.

- Economic resources: the continuing very high cost to individuals of acquiring a computer, of telecommunications in the South and of infrastructure investments is a potent factor of inequality.
- Geography: asymmetries between the town and countryside. In the countries of the South, the difficulties of access to land and credit, the free movement of labour, delocalization and the impact of the media, have led to an unprecedented growth of urban regions to the detriment of the participation of the countryside in this historic transformation. In India, 80 per cent of internet connections have occurred in the country's twelve largest cities. Of course, nomadic technologies offer a unique opportunity to open up the countryside, but their diffusion by telecommunications operators in the isolated regions of the South remains very inadequate.[14]
- Age: young people are often at the forefront of the uptake of technological innovation and its development. They are also, however, often among the most vulnerable and most affected by difficult social and economic conditions. As far as the elderly are concerned, the level of training necessary to reach technological proficiency might require unbearable work because of the lack of facilities and qualification programmes. Systematic training of young people into new technologies and greater intergeneration solidarity with the elderly would achieve a narrowing of present divides, but it would also contribute to the reinforcement of social and family links within knowledge societies.
- Gender: gender inequalities with regard to the new technologies are another aspect of the digital divide. Almost two-thirds of illiterates in the world are women. In the developing countries, an average of one woman in two cannot read. There is a serious risk, then, that the handicaps that limit women's access to the new technologies will be compounded. It follows that gender equality should be a main component of "info-development" policies. Civil society campaigners for women's rights should likewise take due account of the challenges posed by the new technologies.[15]
- Language: it is a major obstacle to the participation of all to knowledge societies. The emergence of English as the lingua franca of globalization leaves little room for other languages within cyberspace, as will be later explained in Chapter 9 of this report.
- Education, and social and cultural background: if it is true that in the second half of the nineteenth century, compulsory schooling enabled the challenges of the First and then the Second Industrial Revolution to be met, in the twenty-first century, will it not be necessary for basic training in the new technologies to become a main component of education for all? The future of the "post-industrial" society will call for considerable investments in education and training. Here again, the information society and knowledge societies will be intimately interwoven.
- Employment: in many countries, internet access is limited to the world of work. The exclusion resulting from loss of employment also means de facto exclusion from cyberspace.
- Disabilities: in the year 2000, only 23.9 per cent of people with a disability possessed a personal computer in the United States (the national average at the time stood at 51.7 per cent of the population).[16] Yet, because of their handicap, they frequently remain at home and the internet represents for them a unique opportunity for social integration, if only through remote working. However, people with a disability encounter a whole series of difficulties, whether economic, cultural or psychological, that help to deepen the digital divide. Furthermore, physical disabilities are a real obstacle to using computers. Whereas in the year 2000, 31.2 per cent of people with learning disabilities had access to the internet in the United States, the figure for those with hearing difficulties was little more than 21.3 per cent, for those with problems in using their hands 17.5 per cent, for the partially sighted 16.3 per cent, and for those with motor disabilities 15 per cent. Due credit must however be paid to those manufacturers who have tried to develop instruments that facilitate the use of computers by the disabled, such as access to contextual menus by means of single-handed key-in operations.

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of its mission, UNESCO should therefore put forward solutions to bridge the digital divide. The four principles, which the Organization advanced during the first phase of the World Summit on the Information Society, reflect this intention. Foremost among these principles is universal access to information. As we shall see, this question goes well beyond the digital divide, since it also involves the place of the "public domain" of knowledge within the global architecture of intellectual property rights and copyright protection. UNESCO wishes to work in close collaboration with the sister organizations of the United Nations system and relevant non-governmental organizations so that telecommunications tariff policies and internet access charges are geared to the economic capacities of developing countries and of remote and underprivileged areas. However, the three other principles – freedom of expression, cultural and linguistic diversity, and education for all – are not unconnected to the digital divide since they relate to one or the other of the previously mentioned factors, which contribute to or accentuate their effects. We shall also explore these other three areas in the framework of this report.

A global information society?

Globally speaking, the factors making for unequal access to the new technologies combine to create a true planetary digital divide, which inevitably throws into question the universality of the rise of the new technologies. Whereas the internet held out the promise of an open system, in which the effects of distance and remoteness would temporarily become irrelevant, the digital divide serves to remind us that a geography of the internet continues to exist. The map of the network is co-extensive with the geography of development. There is, moreover, a strong correlation between internet server facilities and the human development index (HDI) of the United Nations Development Programme (UNDP), although the relative tardiness of countries with a very high HDI rating in equipping themselves for the internet can sometimes be explained in institutional terms. Does this mean that the new technologies revolution must inevitably lead to greater disparities between the rich countries and the developing ones?

In fact, the profound causes of the digital divide make it particularly difficult for the countries of the South to bridge the gap. Inequalities in industrial endowment induce inequalities in the infrastructure development that drives the spread of the new technologies. There would therefore seem to be a correlation between inequalities of industrial development and disparities in access to information. The asymmetries that affect the global distribution of people connected to the internet are particularly flagrant (see Figure 1.1).

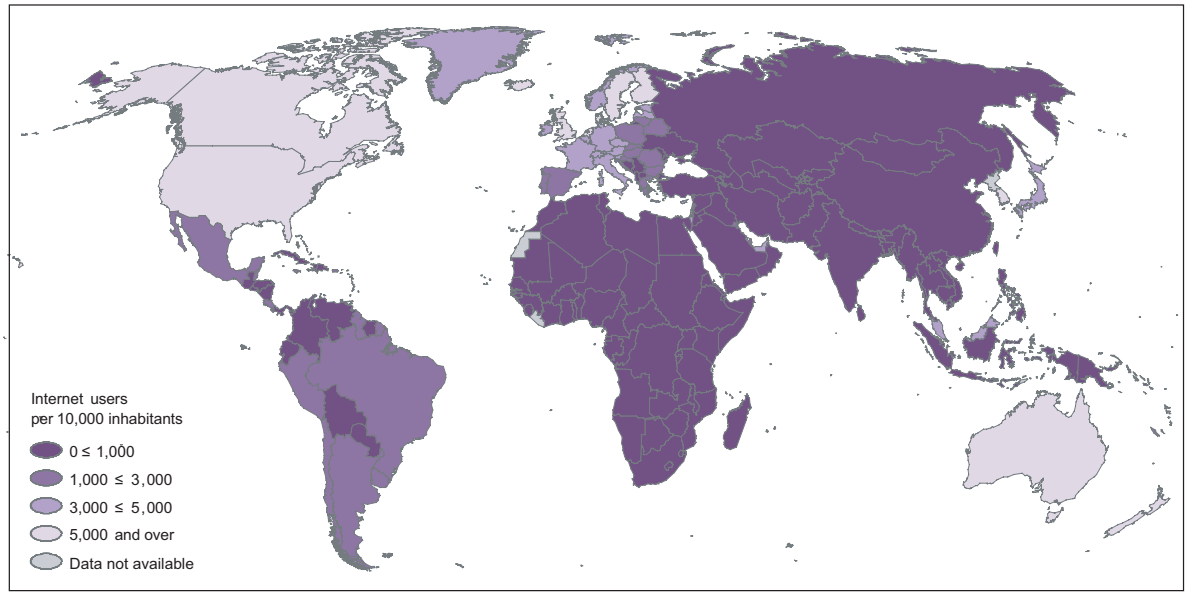
The geography of those connected to the internet obviously corresponds to that of infrastructures, as illustrated by the global distribution of hosts shown in Figure 1.2.

The most worrying fact is that this gap seems to continue to grow, as shown in current discussions with organizations such as the Organisation for Economic Co-operation and Development (OECD) or the World Bank. Thus, poor countries continue to have little or no access to the internet, while the number of people connected is growing rapidly in the industrialized countries. It is, of course, undeniable that the spread of the new technologies has speeded up significantly since the end of the 1990s. China, India, Brazil and the Russian Federation have registered remarkable progress in this field. But elsewhere in the world, sub-Saharan Africa, the Arab States and the least developed countries (LDCs) have experienced only slow progress, except among their elites.

Even among the group of countries with high connectivity, flagrant inequalities exist between the countries of the North, which have high-speed, low-cost access, as shown by Figure 1.3, and the countries of the South, in which connection, where it exists, remains slow and very costly.

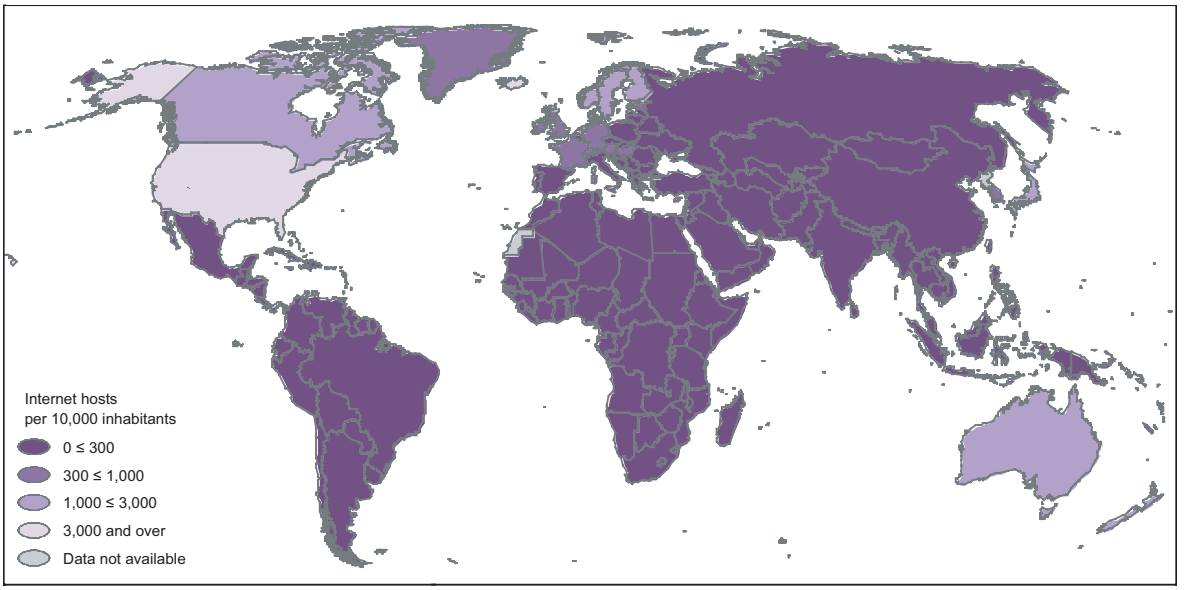
Thus, for low-income countries with a low rate of tele-density (access to telephone networks), charges for internet connection via a modem and a telephone line are much higher than for the higher-income countries. In the former, every point of increase in tele-density would coincide with a substantial reduction in internet charges. In Bangladesh, the annual cost of connection to the internet is sufficient to feed a family for a whole year. In the Philippines, it is

Figure 1.1: Number of internet users in 2003 (per 10,000 inhabitants)[17]



Source: UIS from ITU World Telecommunication Indicators Database (2005).

Figure 1.2: Number of internet hosts in 2003 (per 10,000 inhabitants)



Source: UIS from ITU World Telecommunication Indicators Database (2005).

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not even within the reach of the middle classes and remains a luxury item.

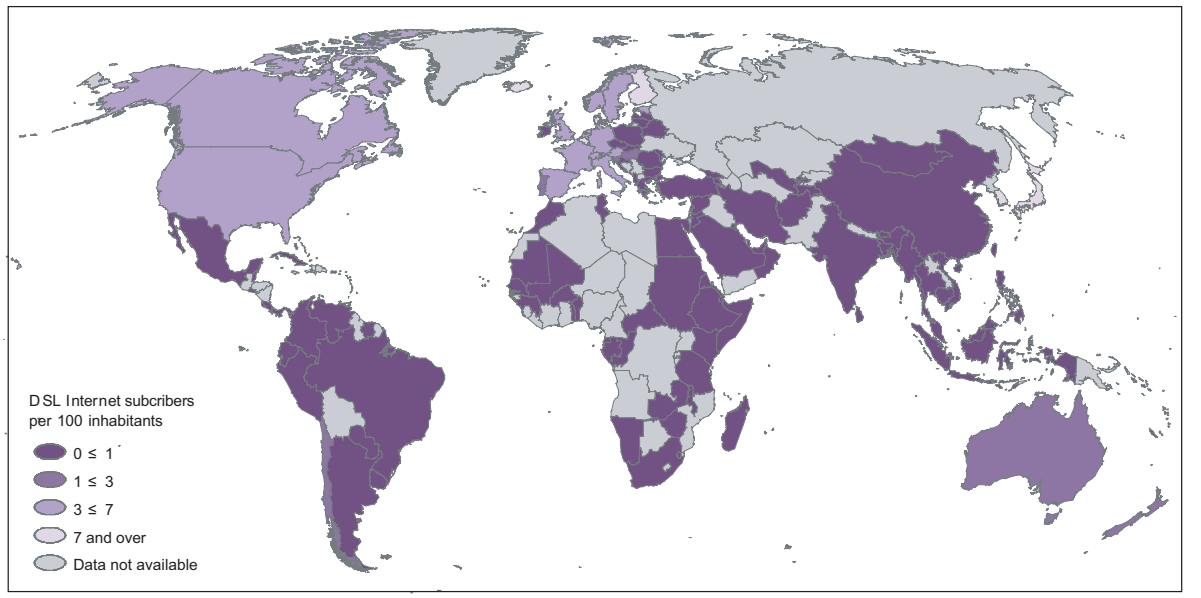
In the absence of specific policies, current disparities in internet access will clearly continue. We have seen that the countries of the North, and North America in particular, enjoy overwhelming supremacy in the information and communication technologies market (see Box 1.2). This acquired advantage leads internet service providers to connect up as a matter of priority with the United States or to give preference to American telecommunications operators, thereby strengthening their position still further.

For genuine digital solidarity

Bridging the digital divide is a priority objective if the new technologies are to contribute to development and favour the rise of genuine "knowledge societies". It is true that "info-development" results to a large extent from political decisions and cannot be based on economic mechanisms alone. However, such a challenge cannot, however, be met by governments alone. It will require close cooperation between governments, international organizations, the private sector, the associative sector and civil society. It is in this spirit that the Group of Eight (G8), bringing together eight major industrial countries, adopted at the Genoa Summit in July 2001, a plan of action drawn up by an international group of experts, specifying the role of the new technologies in development strategies and their contribution to the fight against poverty.[18] In November 2001 the United Nations established a working group on this question, the United Nations Information and Communication Technologies Task Force (UN ICT Task Force), whose membership included all the actors concerned in the effort of reflection and the framing of action strategies. Identical initiatives have been undertaken in recent years by the economic community, such as the Global Digital Divide Initiative launched by the Davos World Economic Forum in 2000, to which a number of large private-sector firms contribute, and the Digital Opportunity Initiative born of cooperation between the UNDP, the Markle Foundation (civil society) and Accenture (private sector).

The preparatory work for the first phase of the World Summit on the Information Society saw the emergence of the principle of *digital solidarity*

Figure 1.3: Number of DSL broadband subscribers in 2003 (per 100 inhabitants)[19]

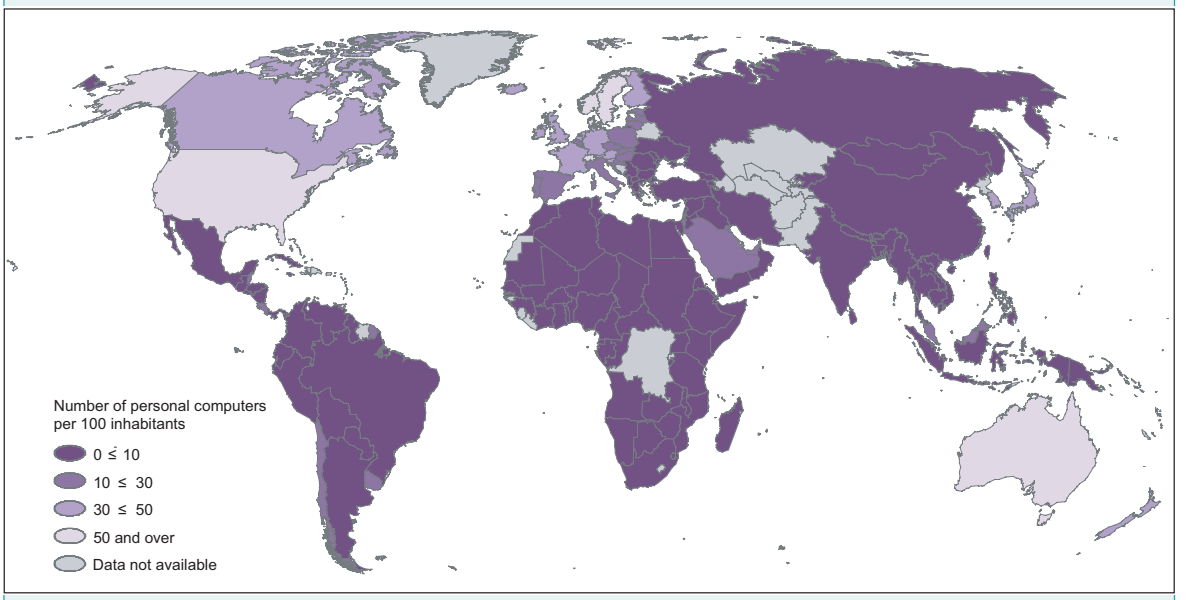


Source: UIS from ITU World Telecommunication Indicators Database (2005).

Box 1.2 The question of equipment

Closely linked to the issue of connection is that of equipment, which is another factor of inequality. The price of computers in certain developing countries amounts to several years' salary. Thus, the distribution of the number of personal computers relative to the population conceals important disparities.[20]

Number of personal computers in 2002 (per 100 inhabitants)



Source: UIS from ITU World Telecommunication Indicators Database (2005).

Yet, the rapid obsolescence of the computer stock in the industrialized countries could open the way to a redistribution of equipment between the countries of the North and South. Admittedly, an additional factor of inequality must be taken into account here: the industrialized countries have access to high-speed connections, whereas developing countries have to make do with out-of-date modems and to contend with discouraging waiting times. Still, it is better to have a computer, even an old and less efficient one, than no computer at all. Moreover, such a redistribution arrangement, based on voluntary decisions by individuals, companies, organizations and governments in the industrialized countries, and on a principle of sharing, would attest to a spirit of *digital solidarity* that could help to mitigate the economic inequalities that foster the digital divide. The feasibility of such an operation would nevertheless require an effort on all sides to solve logistical and legal problems (software and licence transfers) that would inevitable arise.

that would imply that states and other actors in the information society should take practical measures to overcome inequalities of access to the new technologies. Among possible initiatives, in addition to the idea of the creation of a fund for the promotion of digital solidarity proposed by Abdulaye Wade, President of Senegal, and officially set up in Geneva on 14 March 2005, include partnerships (or twinning arrangements) linking local authorities in the rich and poor countries. Some cities present at the Geneva Summit – notably Geneva and Lyon – came out strongly in favour of such measures, which are already central to many associative and local approaches, such as those involving gifts of computer hardware or school textbooks to the developing countries.

All the proposals aiming at encouraging digital solidarity, from the most "technological" to the most "political", merit careful study. Thus, in view of the current underutilization of many networks (telephone, cable and satellite), many experts have

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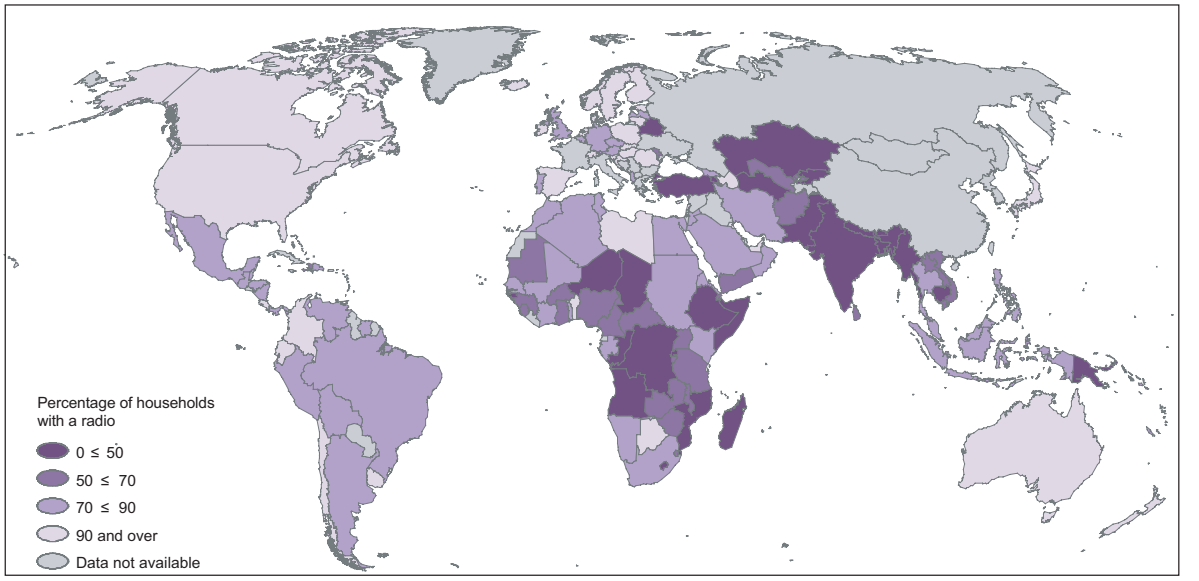
advocated offering the developing countries preferential tariffs. In this respect, the political choices of governments will obviously be decisive, since one of the main reasons for the high cost of telecommunications in the South is the very high level of taxes they attract. A reform of fiscal policies would seem to be needed in order to lower the cost of telecommunications and to promote info-development. A greater liberalization of telecommunication markets is yet another precondition for the lowering of the costs of telecommunications and for expanding the internet in some countries. The contribution of the private sector will also be of key importance in overcoming the digital divide since a better use of networks would lower telecommunication costs, thereby benefiting the majority.[21]

Furthermore, the countries of the South will need to adopt a pragmatic and low-cost approach, geared to the diversity of local situations. Thus, the diversification of information delivery networks (geostationary or orbiting satellites, terrestrial or cable networks, optic fibres, WiFi, new nomadic terminals such as PDA), which represents a singular exception to the hypothesis of "technological convergence", permits a variety of investment patterns, as a function of different national or regional contexts. However, without prejudice to the possibility that the international community may one day reach a consensus on the question of a "universal service" offering access to the new technologies, it should be borne in mind that the multiform character of the digital divide implies the need for a global approach to these problems, which cannot be met by a purely technological solution.

Are new information technologies a necessary condition for the creation of knowledge societies?

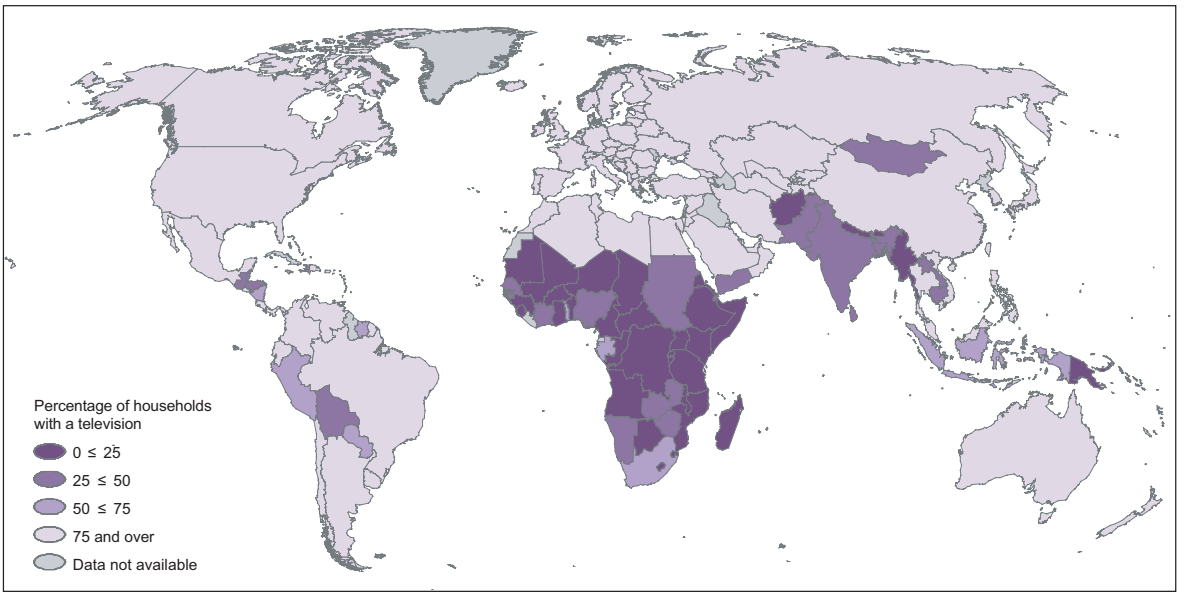
If the rise of knowledge societies is accelerated by the dissemination of the new technologies, the contribution of older information and communication technologies, such as books, radio and terrestrial television, will nevertheless be crucial in this process. Thus, alongside the new technologies, electricity and radio transmission have a role to play in building knowledge societies. It is probable, for example, that in Africa, a continent of oral tradition, the radio will remain the most popular medium for a long time, and not only among illiterate groups. This is why it is important, even today in the age of the internet and the new technologies, to support the creation of rural and community radio. The radio alone, not the internet, enables many disinher-

Figure 1.4: Percentage of households equipped with a radio in 2002[22]



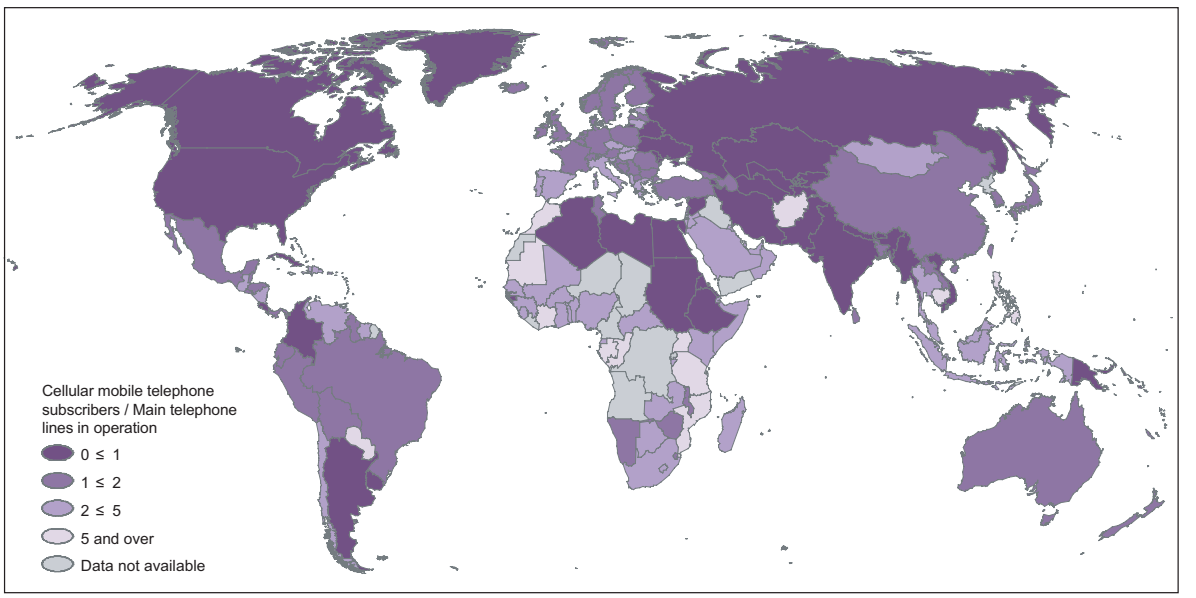
Source: UIS from ITU World Telecommunication Indicators Database (2005).

Figure 1.5: Percentage of households equipped with a television in 2002



Source: UIS from ITU World Telecommunication Indicators Database (2005).

Figure 1.6: Ratio of individual mobile phone subscribers and fixed telephone lines (households) in 2003



Source: UIS from ITU World Telecommunication Indicators Database (2005).

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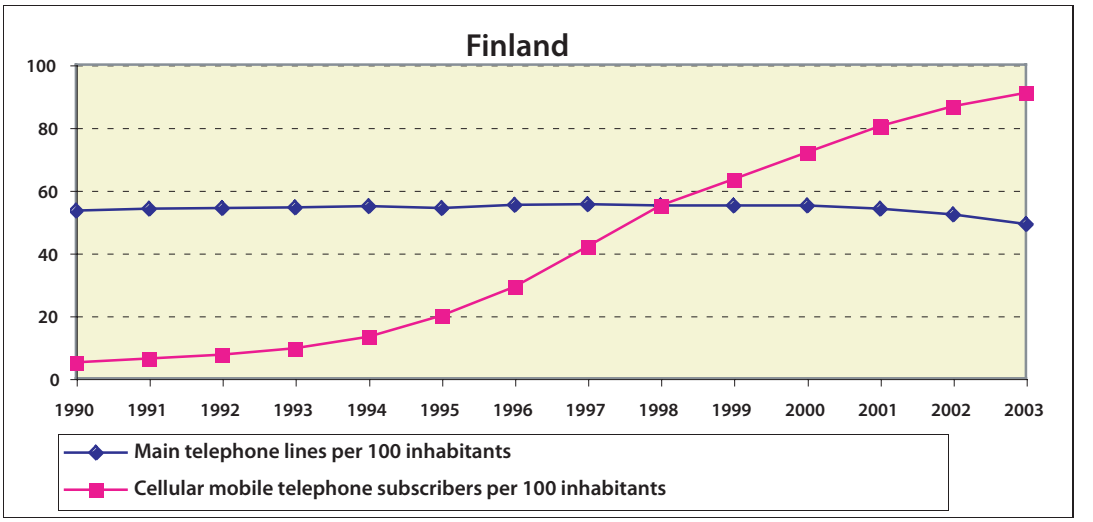
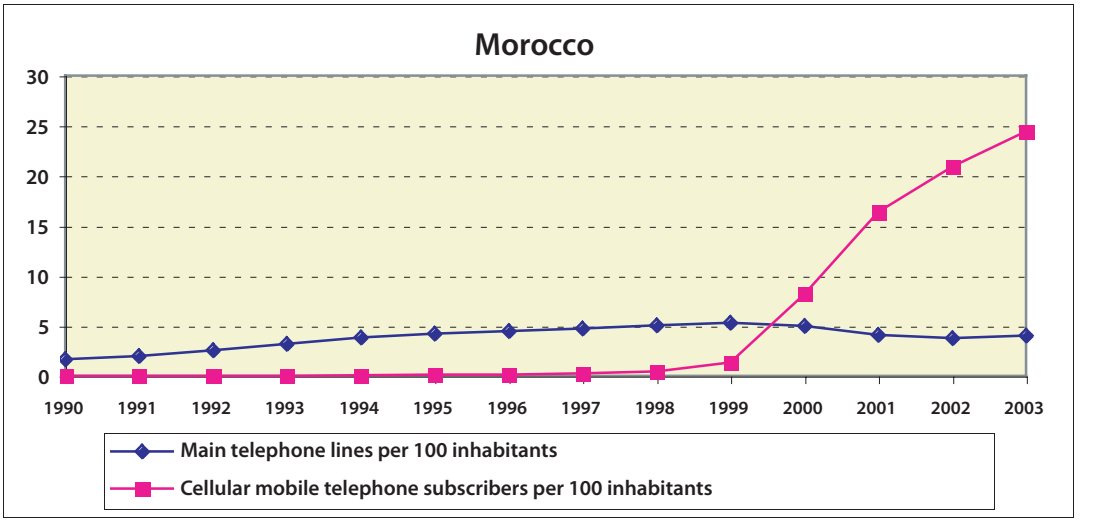
Figure 1.7: Evolution of the number of mobile telephones and fixed telephone lines in Finland



Source: UIS from ITU World Telecommunication Indicators Database (2005).

Figure 1.8: Evolution of the number of mobile telephones and fixed telephone lines in Morocco



Source: UIS from ITU World Telecommunication Indicators Database (2005).

ited and isolated communities to offer their members – particularly women – the possibility of making their voices heard, of participating in political life and of gaining access to a greater quantity of information and knowledge of particular use in everyday life.

Bridging the digital divide will therefore require several decades of efforts to achieve a more equal global distribution of radios and television sets. "Old" and "new" information technologies are not substitutable but rather complementary, the former serving to diffuse knowledge and to facilitate access to the latter. The geography of inequalities of access to these "old" technologies offers grounds for hoping that bridging the digital divide is not an impossible task. It is true

that the worldwide distribution of fixed telephone lines follows fairly closely the geography of the digital divide (which is in no way surprising since, as we have seen, connectivity, modems and telephone lines are bound up with the development of the internet). Nevertheless, the global distribution of radios (Figure 1.4) and television sets (Figure 1.5) is characterized by less inequality between North and South, as illustrated in particular by the situation in North Africa.

What is more, a number of new digital technologies arose out of "old" technologies. Digital television and the mobile telephone are two major examples (Figure 1.6). Furthermore, in certain continents, the mobile telephone has caught up with the fixed telephone (the case of certain African countries is particularly striking).

Mobile technology offers hitherto remote regions a formidable tool for breaking out of their isolation. It is striking that the technological transition in this domain is following a similar pattern (though not synchronous in time) in the industrialized countries (foremost among them Finland, where 84 per cent of the population possessed a mobile telephone in 2002, Figure 1.7) and in the developing countries (such as Morocco, Figure 1.8), where, compared to fixed lines, the development of the portable telephone has been exceptionally rapid.

Thus the attraction of the internet should not cause us to lose sight of the fact that the radio and mobile telephone can also facilitate access to relevant, accurate and high-quality information. A genuine diversification of the modes of access to the global information society should be encouraged.[23] As shown by the example of the community multimedia centres (Box 1.3), narrowing the digital divide very often involves recourse to mixed solutions combining "old" and "new" technologies and the building of genuine knowledge societies.

As can be seen, many solutions for overcoming the digital divide already exist, provided a clear political will exists. But it must be remembered that, while the spread of knowledge can help to eliminate some key factors that sustain the digital divide, the main danger that will weigh on knowledge societies will not be so much the digital divide as the existence of inequalities between the North and South with regard to knowledge production and access to knowledge. This challenge of the *knowledge divide* will be presented in detail in Chapter 10 of this report.

Freedom of expression as the touchstone of knowledge societies

What freedom of expression means

As we have seen, there would be little point in heralding the advent of a global information society unless such a society were based on the principle of freedom of expression. Under the provisions of the international normative instruments mentioned at the beginning of this chapter, freedom of expression implies freedom of opinion, freedom of speech and of the written word, freedom of the press, free access to information, and the free flow of data and information. Without freedom of expression, there can be no information society (see Table 1.1). Freedom of expression, which is closely linked with the essential freedom of scientific research and artistic creation, is the only safeguard against the global information society becoming a global misinformation or disinformation society. Furthermore, the freedoms set out in the Universal Declaration of Human Rights and the International Covenant on Civil and Political Rights also guarantee that individuals throughout the world will not allow themselves to be submerged by the mass of confused data produced by the information revolution, for it is through the search for relevant information, exchange, sharing, discussion and scientific or free creative activity that information can become knowledge. Freedom of expression is thus the guarantee not only of the very possibility of genuine knowledge societies but also of their longevity.

Freedom of expression is moreover the guarantee of access for all to contents that are as diversified and reliable as possible.[24] It goes beyond posing the question of access from the strictly economic and social point of view of infrastructure investments and overcoming the digital divide, and must be seen from the point of view of fundamental rights, the political safeguarding of those rights

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Box 1.3 Community multimedia centres

Since the objective of "a computer for all" currently remains a very remote prospect, the community solution can offer a rewarding approach to narrowing the digital divide. This was the starting point for UNESCO's decision to participate in the creation of community multimedia centres (CMCs) – an initiative launched on 10 December 2003 on the occasion of the World Summit on the Information Society. Adopting a global approach that links access, learning and the combination of new and old technologies, the CMC combines local neighbourhood radio with community telecentre infrastructures: computers connected to the internet, email services, telephone, fax and photocopying. The aim is to ensure that local users become regular users of the new technologies through the introduction of a new form of "public transport", that of information. Encouraging local ownership of the new technologies, sharing experience and learning through practice – this is the purpose of the CMC initiative, an initative showing that action at field level can be effective in overcoming the digital divide.

and the diversity of contents that circulate in the global information society. Indeed, is it right that all contents should be equally accessible? When vulnerable groups are exposed to content liable to harm them (such as disturbed adolescents who find on the internet veritable "instruction manuals" on how to commit suicide or lapse into anorexia), what attitude should we adopt with regard to freedom of expression? Should we opt for an uncompromising laissez-faire attitude in the name of the rejection of censorship, or should we apply legal restrictions in order to protect young people, to safeguard human dignity or to enforce respect for the memory of the victims of genocide? As we know, international opinions on these subjects differ while, at the same time, freedom of expression has become a universally recognized right.

What is new about freedom of expression in the global information society?

Freedom of expression and the corresponding national legislation are today facing the challenge of evolving in step with the development of the new technologies and the internet, which have brought about a change of scale in the diffusion of ideas and opinions. Rooted in the century of the Enlightenment, in political liberalism, and in the campaign for tolerance and press freedom and against arbitrary power, freedom of expression was conceived from the beginning as a negative freedom, that is to say, a freedom wrested in the constraints and obligations imposed by the state or by religious authorities. In the cyberspace age and after the legal breakthroughs contained in the Universal Declaration of Human Rights of 1948, self-expression has evolved into a positive freedom, the manifestation of a new spontaneity and autonomy. The transformation of the vectors of freedom of expression has inevitably thrown into question its definition and revived the debate on its possible regulation or the limits that, in the view of some, should be imposed upon it. For a discussion of challenges to freedom of expression since 11 September 2001, see Box 1.4. The internet and digital technologies have indeed disturbed the balance of forces involved. Until now, it was very easy for governments to monitor telephone conversations, to close down a newspaper, to ban the use of a radio frequency or even to set up a broadcast jamming system. The absolute character of freedom of expression was limited to the obligation to protect the vulnerable party, namely media professionals. Today, it is the state that often finds itself powerless in the face of information circulating on the internet, with cyberspace offering an ideal tribune to all forms of dissidence. This trend is reflected in a number of topical debates – for example, would it not be appropriate to align the time limit beyond which it is no longer possible to sue an electronic publication for its content with that applicable to the press?[25]

Freedom of information and media pluralism in knowledge societies

If it is true that the principle of freedom of expression is highly important in the global information society, in emerging knowledge societies on the contrary, the stress should be placed on a particular offspring of this principle – the freedom of information (defined as the right to access data held by public authorities and to receive regular information on the initiatives taken by public authorities). In that new context, the novel power bestowed by the ownership of a certain type of knowledge encourages those who know to

Table 1.1 A few examples of the recognition of the freedom of expression and of the freedom of information in the world (before 11 September 2001)

International and regional organizations (some examples)	At the national level (some examples)	
	Constitutional	Legislative
United Nations 1946: Resolution 59(1) of the General Assembly: "Freedom of expression is a fundamental human right and … the touchstone of all the freedoms to which the UN is consecrated" 1948: Universal Declaration of Human Rights, Art. 19: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." 1966: International Covenant on Civil and Political Rights, Art. 19: "1. Everyone shall have the right to hold opinions without interference. 2. Everyone shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice. 3.The exercise of the rights provided for in paragraph 2 of this article carries with it special duties and responsibilities. It may therefore be subject to certain restrictions, but these shall only be such as are provided by law and are necessary: a. For respect of the rights or reputations of others; b. For the protection of national security or public order (ordre public), or of public health or morals." 1993: creation by the Office of the United Nations High Commissioner for Human Rights of the post of "Special Rapporteur of the Commission on Human Rights on the Promotion and the Protection of the Right to Freedom of Opinion and Expression." **Council of Europe** 1950: European Convention on Human Rights, Art. 10 (modified by Additional Protocol No. 11, entered into force 1 November 1998): "1. Everyone has the right to freedom of expression. This right shall include freedom to hold opinions and to receive and impart information and ideas without interference by public authority and regardless of frontiers. … 2. The exercise of these freedoms, since it carries with it duties and responsibilities, may be subject to such formalities, conditions, restrictions or penalties as are prescribed by law and are necessary in a democratic society, in the interests of national security, territorial integrity or public safety, for the prevention of disorder or crime, for the protection of health or morals, for the protection of the reputation or rights of others, for preventing disclosure of information received in confidence, or for maintaining the authority and impartiality of the judiciary."	**United States of America** 1791: First Amendment to the Constitution "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances." 1978: Supreme Court ruling Houchins vs. KQED Inc.: "Freedom of speech and freedom of the press do not imply a right of access to government information or sources of information within the government's control." **India** 1982: Interpretation of Art. 19 of the Constitution of the Philippines 1986: Adoption of the new Constitution (Art. III, Section 7) **Republic of Korea** 1989: Interpretation of Art. 21 of the Constitution **South Africa** 1996: Adoption of Section 32 of the Constitution "Everyone has the right of access to: any information held by the state; and any information that is held by another person and that is required for the exercise or protection of any rights."	1766: Sweden 1888: Colombia 1967: United States of America 1982: Australia, Canada, New Zealand 1987: Philippines 1994: Peru, Belize 1997: Thailand 1998: Republic of Korea, Israel, Argentina 1999: Trinidad and Tobago 2000: United Kingdom

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International and regional organizations (some examples)	At the national level (some examples)	
	Constitutional	Legislative
1987: Leander vs. Sweden ruling of the European Court of Human Rights 1989: Gaskin vs. United Kingdom ruling of the European Court of Human Rights 1998: Guerra and Ors vs. Italy ruling of the European Court of Human Rights 2001: Recommendation No. R(81)19 on the Access to Information Held by Public Authorities **Organization of American States** 1948: American Declaration of the Rights and Duties of Man, Art. IV 1969: American Convention on Human Rights, Art. 13 "1. Everyone has the right to freedom of thought and expression. This right shall include freedom to seek, receive, and impart information and ideas of all kinds, regardless of frontiers, either orally, in writing, in print, in the form of art, or through any other medium of one's choice. 2. The exercise of the right provided for in the foregoing paragraph shall not be subject to prior censorship but shall be subject to subsequent imposition of liability, which shall be expressly established by law to the extent necessary to ensure: a. Respect for the rights and reputations of others; or b. The protection of national security, public order, or public health or morals" 1985: Advisory opinion of the Inter-American Court of Human Rights, interpreting Article 13(1) 1994: Declaration of Chapultepec (Hemisphere Conference on Free Speech, organized by the Inter-American Press Association) 2000: Inter-American Declaration of Principles on Freedom of Expression adopted by the Inter-American Commission on Human Rights "1. Every person has the right to access information about himself or herself or his/her assets expeditiously and not onerously, whether it be contained in databases or public or private registries, and if necessary to update it, correct it and/or amend it. 2. Access to information held by the state is a fundamental right of every individual. States have obligations to guarantee the full exercise of this right. This principle allows only exceptional limitations that must be previously established by law in case of a real and imminent danger that threatens national security in democratic societies."	**Thailand** 1997: adoption of Section 58 of the Constitution **Latin America:** Constitutional recognition of the right to file a petition (of *habeas data*) to see any information held by public or private data banks in the Constitutions of Argentina (Art. 43) and Peru (Art. 2/4)	2001: Japan

Source: Article 19 (Global Campaign for Free Expression)

Box 1.4 A turn to a new "security" policy?

A radical challenge to freedom of expression has moreover recently emerged in the form of the new security measures adopted by many governments in the wake of 11 September 2001, although its origins reach back further. National security imperatives have always claimed a special right to secrecy, even in modern democracies. The right to think and to say what one thinks is not the right to disclose what one knows. Thus, a large body of information, from the cartography of strategic sites to the publication of certain scientific discoveries, can be seen as sensitive and excluded from the information that may be freely circulated.

In the war against terrorism, knowledge becomes a strategic resource. In this respect, it is interesting to note that the rise of new technologies of control, censorship and even repression has closely followed the development of new technologies for expression – governments today are perfectly able to monitor content, identify access points, block sites or prosecute illegal forms of dissidence. For that purpose, they employ the traditional tools of regulation: restrictions on access enforced through constraints such as registration or licence requirements; restriction of content through data filtering and the official encouragement of "self-censorship", and the development of increasingly sophisticated surveillance techniques.[26] The state can also either formally impose access constraints (by making it obligatory for internet service providers to obtain a licence) or to induce the private sector to act preventively itself by refusing access to certain supposedly "undesirable" users. The emergence of the government practice of outsourcing censorship to private operators – i.e. the *privatization of censorship* – is a very worrying phenomenon since it has led to certain distributors opting to withdraw some publications deemed disrespectful by the authorities rather than lose their market shares in a large country.

Yet, even in the democracies freedom of expression is not proof from some abuses that can stem from the commercial interests of intermediaries in the transmission of information. "Expression" and "commoditization" obey logics that can be contradictory and, under certain conditions, the mere fact for an individual of placing a picture of his favourite cartoon character on his personal website without first paying royalties to the copyright holder can lead to a violation of the copyright. Trademark protection can also entail a restriction on freedom of expression. Furthermore, why should we suppose that the commercial interests of the media industry necessarily coincide with the safeguarding of pluralism, which is essential to democracy? We shall see that all these questions require a balanced approach combining protection of intellectual property and promotion of the public domain.[27]

take advantage of those who do not. The first historical knowledge societies – whether ancient Egypt with its literati or imperial China and its mandarins – were societies based on secrecy. Free access to information and knowledge can play a regulating role if one seeks the participation of all. Freedom of information thus guarantees the democratic dimension of knowledge societies. We will later see to what extent the exercise of the right is a means of developing the public domain of information, which is the key to the sharing of knowledge.

Freedom of information is to be linked with the right to diversified and quality information, which pleads in favour of the pluralism of the media. Let us recall that journalists, broadcasters, and radio- or television-programme directors are the vectors and the guardians of the free circulation of information and ideas. They can thus be active in the development of real knowledge societies if such is their ambition – and UNESCO is particularly attached to this prerogative. This special responsibility compels them to ensure as much as possible the diffusion of quality contents that contribute to opening people to culture, knowledge, tolerance and the "Other."

Striking a balance between freedom of expression and other rights

The United Nations General Assembly has declared freedom of expression to be the touchstone of all those other rights and freedoms to which the United Nations is dedicated (Resolution 59(1) of 14 December 1946). Yet, it has become clear that freedom of expression can sometimes come into conflict with other universally proclaimed rights or principles. Is it not the case that certain "contents" can prove no less harmful than "conducts"? One thinks, for example, of the role of the Radio Mille Collines in the incitement to genocide in Rwanda in 1994. Can censorship still be alleged when it is a matter of preventing incitement to racial hatred, or "ethnic cleansing", or even genocide and crimes against humanity? Thus, the criminalization of certain contents, which comes within the scope of national

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legislation whose provisions usually vary markedly from one country to another, raises the question of the possible limits of principle ("reasonable" limits) to the exercise of freedom of information.[28]

In democratic states based on the rule of law, two views can be discerned, the first along the lines traced by the first amendment to the United States Constitution and the second corresponding to Article 10 of the European Convention on Human Rights. The first amendment to the United States Constitution makes freedom of expression the constitutive principle of democracy: in the absence of freedom of expression, no society can truly call itself "free". Thus, there would not seem to be any "reasonable" exceptions to freedom of expression, because it would seem unlikely that everyone could agree on the reasonableness or otherwise of such exceptions, and because there can be no "abuses" of freedom of expression since the interchange of ideas itself introduces a form of regulation. The protection of freedom of expression and of freedom of information should therefore be absolute and without exception. The conception defended by Article 10 of the European Convention on Human Rights is rather different. There can be no freedom (and therefore no freedom of expression) without the exercise of a corresponding responsibility. Thus, the Convention justifies certain legitimate and desirable restrictions when certain content can prove damaging. These two possible approaches to the conflict between freedom of expression and other rights explain the difficulties that arise when one tries to implement the second one – the "European" view that implies a certain form of regulation – to a vector of freedom of expression such as the internet, whose principles derive from the first view.

Freedom of expression and universal participation in knowledge societies

Safeguarding freedom of expression is not simply a question of principle. It is a powerful lever for the promotion of the human development and opens the way to the sharing of information and knowledge. It derives, then, from the same ideals that justify the safeguarding of cultural and linguistic diversity in cyberspace: promoting a better use of the new technologies and, thereby, enabling a growing number of citizens, coming from increasingly varied cultural and geographical backgrounds, to access information and participate in the adventure of knowledge.

The benefits of the free flow of information and ideas are not confined to the safeguarding of fundamental rights. The transparency associated therewith contributes to the stability of the economic environment, to building and restoring the confidence essential to any sustainable development of human activities, to the efficiency of market transactions and to the development of democracy. As we have seen, freedom of expression is a constitutive component of development and is conducive to a better allocation of resources. The new technologies can represent a valuable instrument for the exercise of freedom of expression. The internet offers individuals the means to realize, on an unprecedented scale, what democratic constitutions have guaranteed to citizens for many years, decades or even centuries in some cases: the right to express themselves, to communicate and to trade freely (all practices previously requiring substantial technical and financial resources, and today accessible to all, provided we really wish to make it happen). As underlined by the work of sociologist Jürgen Habermas, the free flow of ideas and information, boosted by the new technologies, will be a formidable lever for democracy and the participation of all in public life and decision-making.

Yet, no technology can ever prevail over political choices. This is why it is so important to defend this right where it is flouted and to preserve it where it is threatened, for freedom of expression and the free flow of information, to which it is closely linked, are the essential conditions of the emergence of knowledge societies.

Background resources

Article 19 (2001); Bhatnagar and Dewan (2000); Boafo (2003); Burnstein (1996); Caden and Lucas (1996); Chase and Mulvenon (2002); Cukier (2003); Cuneo (2002); Goux (2001); Hardy (1994); Human Rights Watch (1999); Hussein (1994); Jensen (2002); Juma (2003); Kalathil and Boas (2001); Lavoie and O'Neil (1999); National Telecommunications and Information Administration (2000); Pew Internet and American Life Project (2002); Pimienta (1998); Post and Johnson (1996); Proenza *et al*. (2001); Schiller (1996); Sen (1981, 1996 and 1999*a*); Stehr (2004); Trudel (2002); UNDP (2003); UNESCO (1978, 2003*a*, 2003*d*, 2003*e* and 2003*h*); United Nations (2003); Vattimo (2002); World Bank (2002-2003).

Chapter 2

Network societies, knowledge and the new technologies

Are we witnessing a new industrial revolution? It is tempting to say yes, given the far-reaching reorganizations, transformations and innovations being introduced into the workings of the economy, society and the political sphere by the revolution of information and communication technologies, as well as biotechnologies and, soon, nanotechnologies. Knowledge and skills, work and leisure are being radically transformed by the new language of software and informatics. And as underlined by the UNDP's *Human Development Report* in 2001, the progress made through the use of technologies in the fields of health or agriculture have opened up new opportunities to improve human development. Those changes should have major consequences for the rise of knowledge societies.

Knowledge economy in network societies

Towards network societies?

Two models are often invoked to describe the third Industrial Revolution and the associated change of knowledge regime: one is that of the intangible, the other is that of networks. Economic history since the early stages of the first Industrial Revolution has been characterized by an increasing dematerialization of individual human work, made possible by the substitution of machines for manual labour, then by the development of services and, finally, the advent of the virtual during the digital revolution. In this society of the intangible, mastery of the intangible always confers greater strategic advantages and power over the tangible. Knowledge and the conquest of the intangible make possible the construction and utilization of satellites, enabling humanity to exert unprecedented worldwide domination. At the same time, the conjunction of the globalization process – that tends to unify global markets – and of technological mutations – that reduce the prices of telecommunication and have made possible the multiplication of speeds and volumes of information transmitted – have given birth to what are called after Manuel Castells's works "network societies". It is true that in any social organization there is a set of networks within which individuals maintain special relationships, whether family, ethnic, economic, professional, social, religious, political, or all of these simultaneously. But in the context of the information revolution, forms of organization have been created that no longer conform to the logic of spatial centrality and the poles of conventional decision-making. Traditional vertical hierarchies are giving way to burgeoning horizontal relationships, often transcending social and national frontiers. While it is in theory possible to access and participate in the networks from all parts of the globe in countries of the North as well as from the South, reality is that large and more powerful networks are found to form localized "hubs", part and parcel of the new urban reality of "global cities", such as Tokyo, London, or New York, which today are developing interactions among themselves through the interplay of international investments, crossfrontier movements or financial exchanges.

Are not emerging knowledge societies – which are definitely societies of the intangible and network societies – deeply different from historical knowledge societies that came before?

Knowledge economy

The knowledge economy is a particular knowledge-driven stage of capitalist development, based on knowledge, succeeding a phase marked by the accumulation of physical capital. Knowledge thus viewed is in the process of taking the place of the workforce, as Marx had foreseen in the middle of the nineteenth century, and the wealth created is being measured less on the output of work itself, measurable and quantifiable, and more and more on the general level of science and the progress of technology. The knowledge economy underlines organizational and technological complementarities between the expanded possibilities for information codification, storage and transmission offered by the new technologies, the "human capital" of the workers likely to use these technologies and a "responsive" organization of the enterprise (thanks to the progress of knowledge management) that makes possible the fullest utilization possible of the potential for productivity. One thing is certain: certain "intangible" activities linked to research, education and services, tend to assume increasing importance in the global economy. In quantitative terms, the share of these activities in the gross national product (GNP) of countries is continually growing. The proportion of research and development (R&D) expenditure in GNP has been increasing since the start of the 1950s (even before the information revolution); other intangible investments (education, health, etc.) are also increasing sharply in relation to tangible investments (physical capital, material resources, etc.), and statistics show that this tendency is also marked in the South. But the importance of knowledge in economic activity is not confined to the high-tech sectors: modes of organization of production in apparently low-tech sectors have also been transformed, or are in the course of transformation, with the new use of knowledge bases.

Just as in the nineteenth century the shift from an agricultural to an industrial economy was marked in Europe and the United States by the migration of a large proportion of the agricultural workforce to the factories, so the expansion of the service sector and the corresponding dramatic devaluation of unskilled labour have led to the de-industrialization of the rich countries, bringing about an accelerated industrialization of the poor countries. Is this good news for development? Theoretically yes, if we suppose that the result is an increase in the income levels of these countries. However, two factors tend to temper this optimism. On the one hand, this phenomenon for the moment mainly concerns the emerging countries, particularly in Asia, and does not affect the least developed countries notably in Africa. Above all, the value that the developing countries can derive from their recent industrialization remains, with some exceptions, fairly modest. The global economy now places greater value on design (it is at stake with R&D and patenting) and prescription (marketing and communication). Thus, knowledge economy significantly raises the hurdle facing developing countries if they wish to catch up with the most advanced countries.

The statistics that describe the emergence of knowledge societies and the expansion of knowledge-based economies should not be allowed to mask local diversities. Figures alone concerning knowledge economies do not necessarily take account of socio-cultural realities: thus in India, if the share of the service sector in the economy has just risen to 50 per cent, thanks to a capacity-building policy and the development of a recognized computer expertise, 75 per cent of the population still lives on agriculture and almost 40 per cent is illiterate, a large proportion not having telephone lines.[1] So what we should be talking about, rather than a generalized movement towards knowledge economy, is perhaps the coexistence of different systems, not only globally but also nationally. It remains the case, nevertheless, that in the countries most advanced as regards a knowledge-based economy, the consequences of such an economic and social organization on knowledge itself deserves special attention.

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The impact of new technologies on knowledge networks

Technological change and knowledge creation and transmission

The magnitude of technological change, which over recent decades has affected the means of knowledge creation, transmission and processing, have brought a number of experts to hypothesize that we stand on the threshold of a new era of knowledge. Following on from knowledge regimes based on oral tradition, written expression and then the printed word, the rise of digital media has fostered an unprecedented expansion of networks, along two axes: the horizontal axis of the acceleration of transmissions, and the vertical axis of the densification of connections. We are entering into an age when, if we are to exist, survive and not drop out of the race, we shall have to communicate more and more and, above all, more and more rapidly. Interactivity is another characteristics of these new media of knowledge. We need, in fact, to establish a distinction between "one-way media" such as radio, television or the press, which provide centralized communication from a source to a public, and interactive media such as the telephone – which for the first time made possible "face-to-face encounters at a distance" – or the internet, which offers immediate interconnection, multimedia interfaces and, above all, the possibility for the individuals or institutions connected to interact among themselves in real time. With the rise of the internet and the Web, communication capacities and cognitive skills develop in tandem, demonstrating that individuals are not passive recipients, but are capable of constituting, quite autonomously, virtual communities. Discussion forums being the most conspicuous example.

The influence of the new technologies on the creation of knowledge is considerable (see Box 2.1). They permit important advances regarding the accessibility and manageability of knowledge. As long as a clear distinction can be made by the user between raw information, indeed a hoax or a false statement, and information that can constitute the basis of true knowledge, the internet can work as a gigantic pool of ideas, whether it is a matter of pieces of information or of knowledge itself.

Box 2.1 From information to knowledge and vice versa

Transforming information into knowledge presupposes an effort of reflection. Information as such is only raw data, the basic material for generating knowledge. It follows that information can in a very real sense be "non-knowledge". The internet provides a particularly good illustration of this: according to some estimates, half the information circulating is simply false or inaccurate. Networks moreover favour the circulation of hoaxes. However, the reflective nature of the judgement required to convert information into knowledge means that this process involves more than a mere verification of the facts. It implies a mastery of certain cognitive, critical and theoretical skills that are precisely what knowledge societies will seek to develop. While we may drown in a flood of information, knowledge is precisely what enables us to "orient ourselves in thought".

The distinction between knowledge and information would remain fairly simple if we were to focus simply on the transformation of information into knowledge. However, information is not only raw data but also the product of an operation by which it becomes such – namely, a shaping or packaging to make it manageable, transmissible and consumable. This operation can be performed equally in respect of knowledge and non-knowledge. Thus, the distinction between knowledge and information must also take into account the process whereby knowledge is shaped as information (known in the current jargon as the "informationalization" of knowledge). In this process of commoditization, knowledge acquires a material dimension that makes it more operational and easier to process. It thus becomes the means for producing new knowledge. Information is what is transformed, through appropriate processing, whereas knowledge is what is produced – knowledge production always being based on a level of knowledge and on the transformation of information. While knowledge production arises from a kind of transmutation of information, knowledge itself is transformed into information so that it may be processed and produce new knowledge. The innovation that gives rise to new knowledge productivity gains is located precisely within this "virtuous circle".

Furthermore, the proliferation in our different environments of virtual objects, infinitely modifiable and accessible, facilitates cooperative work and the common acquisition of knowledge: learning, which has been long confined to specific places such as schools, is becoming a virtual space on a planetary scale, accessible from a distance, within which an infinity of situations can be simulated. Finally, the networking of knowledge and the speeding up of information processing open up new possibilities for work on databases, irrespective of their size, their use and their ultimate purpose. Very powerful knowledge management systems are being set up, at the level of scientific or governmental bodies as well as of large- and small-scale businesses.[2] In the future, most products, including plants and domestic animals, will probably be tagged with microchips which will supply, in real time, information as to their state (the wear and tear of materials, the maturing of plants, the health of animals, the obsolescence of foodstuffs and medicines), their localization (Global Positioning System (GPS) or satellite surveillance devices) and movements (tagging of migrating birds, traceability of products, etc.). We sense, here, the danger that such a mechanism might be applied increasingly to human beings, a development which could, in parallel with the rise of security systems, open a new chapter: that of global surveillance systems, as discussed above in Box 2.2. It is in such a context that the protection of privacy of personal data has arisen as a new fundamental right of the individual.[3] The ongoing transformations do not fail to raise a certain number of ethical questions.

What limits to the commoditization of knowledge?

The digital revolution is making it possible to commercialize the intangible with unprecedented efficiency. It is true that, in a global knowledge economy, the multiplication of digital materials greatly reduces the scarcity of intangible goods now infinitely reproducible. We have also seen that the form of the network, in making knowledge infinitely more accessible, tends to militate against the traditional scarcity of knowledge, thus against the foundations of the way the economy of knowledge has traditionally worked: a commodity that is everywhere available tends to become a free commodity. Is it not true that the generalization of digital contents – especially as the media of cultural experiences (music, cinema and video games) – compels us to urgently re-think economic models that underlie trade and commoditization? It

Box 2.2 Towards "societies of global surveillance"?

One often loses sight of the fact that the new technologies, based as they are on codes, are norms and, therefore, instruments of control. The idea of control is central to the digital revolution. Historically, the assertion of state authority was a response to the need to ensure freedom of movement and safety on the highway, in the face of banditry and danger. Will the situation be different in future on the "information highways"?

Network societies are destined to become "classifying societies". Information processing proceeds through the compilation of databases. Unless one is careful, this work of classification could favour the emergence of new powers exerting a "panoptic" control. The forms of surveillance are not limited to the ubiquitous installation of cameras at work or in public places, or to keeping tabs on all air passengers. From mobile telephone conversations and commercial transactions on the internet to the cookie unwittingly downloaded on your computer hard disk – the ways and means of extracting personal data are myriad and infinitely resourceful. Trafficking in personal data establishes social classifications. Is such a system, whereby public decision-making could be based on profiles, to be wished?

Are our societies going to be societies of technological surveillance? In the name of openness and the free circulation of information and knowledge, should knowledge societies always lead to confusion between knowledge for all and knowledge on all? Is there not a right *not* to know?[4] Should not the separation between the public and private domain protect us all against too intrusive an interest by others in what does not concern them? Too much knowledge can be harmful. As pointed out by the late American Senator Daniel Moynihan, secrecy is an important mode of social regulation, because it protects privacy. Yet we today observe a growing confusion between private knowledge and public knowledge. The counterpart of the right not to know is then, with regard to the circulation of knowledge about oneself, a right that the others shall not know, confined to that limited category of knowledge relating to private life.

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is true that the inconsiderate usage of "peer to peer" mechanisms and illegal downloading of music or films on the internet are evils that seriously threaten the economic viability of the creation of digitizable contents. The issue will be to know whether it is a youthful folly, destined to disappear once exchanges reach commercial maturity, or whether it is a cultural effect inherent in digitization, which will have to be taken into account in the shaping of knowledge societies. While a knowledge society must necessarily rest on the unrestricted circulation of knowledge, particularly between the North and the South, we cannot for all that envisage a society resting solely on "free" foundations, for there can be no society without economic activity. At the same time, considering that knowledge and ICTs may have a positive use (see Box 2.3), and in order to avoid the risk of trafficking, it is necessary to mark a boundary between what has a price and what has dignity – to borrow Kant's distinction.

In knowledge societies, knowledge will surely feel the impact of the densification of trade. Yet it will never be considered as any other commodity. We will later see how this particularity of knowledge is at the core of the balance between intellectual property protection on the one hand, and the promotion of the public domain and knowledge sharing on the other.

Towards the widening of North-South inequalities in a knowledge-based global economy

Some experts have not failed to stress that one of the most immediate consequences of the expansion of a knowledge-based economy would be rich countries growing richer and poor countries remaining at a standstill, whether for want of investment in infrastructure or knowledge-producing potential or for lack of standards guaranteeing optimal conditions for knowledge production (quality of governance or the ability to protect created knowledge from international competition).

In support of this hypothesis of a deepening of inequalities between rich countries and poor countries in a global knowledge-based economy, these commentators have emphasized the delinking that occurred, in the heyday of the "new economy", between the growth rates of the real economy and the rise in stock market values. While the stock exchanges of the OECD countries were in a state of bullish euphoria that did not coincide with their real growth performances, other countries such as China or India were experiencing a rate of real growth far higher than that of the industrialized countries, but which was not reflected in their stock market performances. Economic analysis explained the

Box 2.3 How knowledge and information and communications technologies (ICTs) can serve the great causes of the twenty-first century: the cases of solidarity with regions stricken by natural disasters and the fight against HIV/AIDS

The new technologies and the free circulation of information and ideas constitute precious instruments for drawing public awareness to the great causes of the twenty-first century. In January 2005, just after the lethal tsunami that devastated the coasts of South Asia, South-East Asia, the Maldives and East Africa on 26 December 2004, an important part of the funds collected in industrialized countries, in a vast campaign of international solidarity with the devastated regions, arrived electronically, on the internet websites of the main organizations taking part in the campaign (the United Nations Children's Fund (UNICEF), the Red Cross, Doctors without borders, etc.). The internet also helped some families to identify surviving relatives.

The new technologies can also play an important role in the fight against the HIV/AIDS pandemic, not only because they provide for new solutions that facilitate screening and research, but also because they make possible world campaigns meant to sensitize the populations exposed to preventive practices. *The Global Initiative on HIV/AIDS Prevention Education* launched by UNESCO and the other co-sponsors of the Joint United Nations Programme on HIV/AIDS (UNAIDS) in March 2004 – and meant to complete the "3 by 5" initiative by UNAIDS and the World Health Organization (WHO) – is based on the constitution of a solidarity network of prevention education that aims at clarifying the link between treatment and prevention. The new technologies thus allow to adapt the message and to *mobilize at all levels*, so as to change behaviours, to support people living with HIV and to limit the impact of the pandemic.

financial overvaluation of the market value of certain companies as compared with their book value, by the fact that they raised capital not on the basis of current profits, but by capitalizing on the value of an idea or innovation, i.e. of knowledge, that this capital would make possible (equitization). The online bookstore Amazon.com, created in 1995, only made a profit after six years of activity. Starting in the spring of 2001, the bursting of the financial bubble on the new technologies market showed how excessive was this illusory overvaluation of innovation and of return of equity that it would be capable of generating in the future. Stock market capitalizations were then readjusted to the performances of the real economy. This "return to normal" on the part of the world economy should perhaps cause us to look with another eye at the relations between knowledge and development. Does it not open up for the least developed countries, in so far as they can capitalize on knowledge in a real economy, the possibility of catching up with the others?

Towards the obsolescence of human values or new horizons for creativity?

Paradoxically, it seems that the more we master knowledge, the more ignorant we become. With the apparition of new knowledge media, the limitless rise of the machine world seems to herald the atrophy of human capabilities. With the accelerating increase of the speed of information processing and transmission, a growing gap is appearing between the scale of technological time, which is extremely rapid, and that of "cerebral thought" time, which seems to have scarcely evolved for thousands of years. Does this gap not entail the risk that the brain will be outstripped by the machines and programmes it has created? On the scale of human thought, the information now proliferating is becoming ever more difficult to filter, to process and to master. Such profusion of information will only become the means towards increased knowledge if the tools, meant to "process" the information and the subsequent transformation of a piece of information into knowledge through reflection, prove sufficient. Increasingly, this task is entrusted to machines, as shown by the proliferation of search engines on the internet. How many people – apart from mathematicians – will be able to perform a true piece of mental arithmetic in a few decades? Has not the rise of new technologies accelerated our technological addiction? Nevertheless, despite their sophistication, machines will never replace the human being when it comes to the reflection necessary to transform information into knowledge. With the end of rote learning, the next challenge for school will be to develop in learners the capacity to filter information relevantly.

Certainly, machines seem ready to replace human beings. But it is especially true with fairly mechanical tasks, such as rote learning or surveillance functions. Whatever the risk involved in building a "brave new world" in which the role of humans would be reduced to a minimum (one of today's most ambitious projects is to produce information systems that are autonomous and require minimal human intervention) the new possibilities offered by machines must serve human development.[5] Time freed up by machines is time made available for activities that are less mechanical and more human. What we ought to be looking towards therefore are the possible worlds that the new technologies are opening up to human imagination and creativity (see Box 2.4).

The cognitive effects of the digital revolution and the codification of knowledge

The new digital technologies have direct consequences not only on the speed of information transmission but also, and especially, on the processing and reception of knowledge. Henceforth, a cognitive act can no longer be thought of on the model of the classical theories of knowledge, which treat it as an individual psychological act. The use of electronic word-processing or of search engines are recent habits, yet they are already so deeply rooted in our everyday language and practices that cognitive activities are beginning to look more and more like computer-assisted processes.

Digitization has led to perfecting old forms of knowledge codification. In other words, it enables the transformation of data into a language which, being a means of communication, is in essence collective. The effects of that codification imply a new conception of

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Box 2.4 Artistic creativity and digital arts

Artistic creation implies the use of media and of matter borrowed from the sciences and techniques available at each period of time. In the past, it used to be the stone, scissors, the hammer, the paintbrush, the pencil, the knife, etc. Engraving was born at the time of printing, then followed by the photograph, films, the video, each bringing along a whole lot of new tools and techniques. Today, pictures have become digital. New artistic forms are mixing with new techniques and new artistic genres are arising from the imagination of artists. Digital art – which irrigates with its modernity fields such as virtual reality, robots, artificial intelligence, the internet or biotechnologies – uses media, such as creation software, computers and the digital screen, as matter. Those new tools do correspond to the present technological revolution. Each culture will then have to tame them and to design new creation tools (software) according to particular constraints and aesthetic references. It is the only way to preserve cultural diversity.

UNESCO initiatives in this domain (Digiarts Programme), which tend to promote knowledge transmission and cultural and artistic practices through the electronic medium, are heading in that direction.

knowledge, the production of which can no longer be considered as a feature distinct from other human activities. The interactive character of digital networks gives the users of these technologies a place they did not have before. They are no longer passive in the face of information, since they continually *sort* it and therefore *hierarchize* it. Communication technologies interact with, rather than precede, the elaboration and construction of knowledge.

Even though we usually stress the tendency towards dematerialization taking place in network societies, the new technologies have also enabled us to materialize and externalize various cognitive functions thanks to machines. The post-industrialized era is also a hyper-industrialized era. The appearance, in the 1940s, even before the internet, of computers and, more generally, of electronic information-processing devices, modified the conditions of cognitive activity, for knowledge ceases to have the same meaning once it can be automatized. The cognitive activity of users of digital technologies, even when working alone, is in fact distributed between themselves and their artefacts, and this is true also of perception, memory, logical operations and learning. The world of the obvious, what is "before our eyes", now depends on a cognition distributed between ourselves and cognitive artefacts, which are all the more "transparent" for being ever-more efficient. Now it is time for *distributed cognition*.[6] It has found numerous applications, especially in the spheres of computer-supported collaborative work and of computer-supported collaborative learning. Distributed cognition has led to the promotion of a model of social relations based on collective cooperation as exemplified by the successful case of *open source* software, to whose promotion UNESCO is particularly attached.

One of the most striking aspects of the information revolution is the ease with which artefacts and new types of information become commonplace in everyday life. In practice, however, despite social and cultural obstacles that hamper the diffusion of new technologies within societies, everyone who by choice or necessity uses these devices acquires the "natural" knack without too much difficulty. The answer is precisely that we are dealing with technologies that externalize cognitive functions and therefore have the capacity to take charge themselves of what could render them almost inaccessible to users. One of the reasons for the success of the new technologies lies, then, in their ergonomics: notions such as comfort and user-friendliness are crucial elements in the design of programmes integrating information technologies. The analysis of ergonomics is therefore an important issue, the question of ergonomics already central to the evolution of computer interfaces and of multimedia products, is bound to play a role in the definition of new knowledge-management systems. Let us only mention from a technical point of view the question of the access of people with disabilities to computers or, in a more anthropological perspective, the question of the adaptation and accessibility of contents according to the diversity of cultural and linguistic contexts.[7] Contents and methods must adapt to their real users. In so far as it is in large measure the users themselves who, by their practices, bring into general currency some sometimes unforeseen uses of the systems in operation, there exists no single overarch-

ing point of view that might enable us to determine possible utilizations: new technologies will not only develop in countries of the North but also in countries of the South, and it will be necessary to encourage local culture to invent operating systems, software and multimedia products that can satisfy local users.

From memory-based societies to knowledge societies?

Memory and new technologies

The expansion of digital technologies has introduced, alongside the classical forms of recording knowledge, new material storage bases with potentially unlimited capacities, characterized by a degree of accessibility previously unknown. Captured as it is now by the digital revolution in the form of hard discs, DVDs or memory-cards, memory is increasingly understood as a material, artificial and automatized function. In the same way as the invention of writing and, later, the generalization of printing, the invention of the internet may be considered a turning point in the history of the gradual externalization of mental faculties. Like all written archives, the internet is a device using externalized memory; however, it is not limited to texts and images; it accepts all information capable of being digitized. Like printing, the internet is a device for redistributing information, only the costs and time-periods involved are hugely reduced. Unlike writing and the print medium, the internet is active. The archived "pages" can include elements such as hypertext links and scripts that act, either automatically or at the request of the user. Furthermore, the "online" information is accessible from any point of access, making the internet a global archive of unprecedented and rapidly growing magnitude.[8] This huge and rapidly expanding complex, includes electronic publications, multimedia productions, websites, and cultural and scientific data banks – all of them new and variable forms of knowledge – which often demand specific forms of arbitration. The memorization of these forms of knowledge, which are digitized from the outset, probably constitutes one of the most important enterprises for the building of knowledge societies. Thus, the notion of heritage, which is crucial for UNESCO, now includes a digital dimension. The concept of digital heritage involves a wide variety of contents, relating not only to certain scientific data but also to media products, technical, medical and legal information, or digital art. The aim of this new type of conservation is twofold, directed towards conserving not only software but also the corresponding hardware (see Box 2.5).[9] The Charter on the Preservation of the Digital Heritage, adopted by UNESCO at the 32nd session of the General Conference (October 2003), stresses that electronic resources must be conceived as a heritage and as capital for the activities of future generations.

The more memory we have, the fewer our recollections. Does not the automatization of memory bring with it a decrease in individual efforts of memorizing? But do not the information technologies, by automatizing knowledge, provide grounds for the fear that we may witness the disappearance of know-how and traditions that, only a few decades ago, constituted the daily way of life over much of the planet? The prospect of that cognitive diversity atrophy would surely be a paradox, considering that information technologies are tools designed to optimize the conservation and transmission of knowledge. And if it is true that every innovation imposes the need to choose and select, the specific effect of the new technologies is to confront us with the cultural character of these choices. The digitization of human knowledge cannot be assimilated to a modernist elimination of traditional knowledge, such as would be brought about by a *tabula rasa* exercise, which would only recognize those cultural norms corresponding to the technical norms of the day. However important the culture of innovation might become, knowledge societies will remain memory and knowledge transmission societies.[10] Being a transferral technique, digitization is set to transform the transmission of tradition, in so far as it profoundly affects the workings of cultural, educational and scientific institutions (heritage institutions, museums, libraries and archival centres) – the traditional centres of memorization.[11]

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Box 2.5 The preservation of digital heritage

The information files stored on hundreds of servers constitute an educational, cultural and scientific resource that ought to be measured by the same yardstick as the traditional constituents of heritage. This "supplementary heritage" resulting from the rise of the internet is characterized, however, by volatility and instability that make the choice of what to preserve very difficult. The "Web culture" is characterized by an extreme rapidity of data-flow and the rapid obsolescence of its supports: according to the United States Library of Congress, the average lifespan of an internet page is 44 days. Therefore, how do you store sites that are constantly changing and sometimes evaporate overnight? The risk is high that in network societies, the collectivity might be threatened by a kind of "digital Altzheimer". And how is it possible to build knowledge societies from "societies of the present moment", endowed with a small working memory and turning their backs on future generations?

One of the possible responses to this material instability in time has been to introduce electronic capturing devices, "harvesting" software applications that effect regular recordings on the Web. It remains, however, difficult to specify adequate criteria for selecting pages and relevant contents. The American pioneers of archiving on the Web, who founded the non-profit-making association *Internet Archive*, proceed by random samples, whereas other structures proceed by content criteria. But how are we to index a file? By its uniform resource locator (URL)? By its date of release? How are we to deal with successive versions of the same document? Up to now many of these initiatives remain isolated, although the "The Memory of the World" programme launched by UNESCO is trying to remedy this fragmentation and to encourage the work of selection of the exceptional documentary heritage.

Ultimately, these new media call for a new concept of heritage in that, by definition, digital heritage is unlimited by time, geography, culture or format. It may be culture-specific but remains potentially accessible to every person in the world. In addition, the digital preservation of cultural contents is itself subject to some degree of standardization, without which the format "war" would lead to an altogether inextricable situation where an increasing number of readers would be needed to decode incompatible formats. We should also beware lest this prospect of a global memory becomes one of the most dangerous manifestations of the co-presence of different kinds of knowledge and different identities in the emerging knowledge societies: for, thus put before the public eye and becoming items of "information" and "communication", can different cultures still remain subjects of traditions and transmissions?

Towards new cultural behaviour patterns?

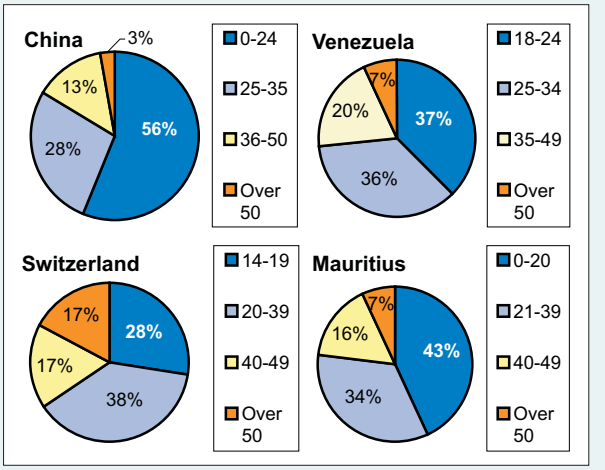
Even further, a specific Web culture is built up by a process of distribution in which all the actors have a role to play, if only through the choices and sifting they make between all the available sources of information, thus contributing to a continuous creative circulation of information and knowledge, of which no one person or institution is the originating source. Innovations that start off as isolated and lacking economic or institutional backing – such as the practice of *blogs*, those personal diaries that anyone can keep up to date online – are spreading and being transformed by the choices and actions of individual internet users. For a discussion on the role of youth, see Box 2.6. We are also witnessing the appearance of radically new cultural behaviour patterns, particularly as regards personal projection: personal Web pages are an example of a very original phenomenon, where we find an unexpected use of the internet satisfying a social and cultural function that was not foreseen by the constructors of the Web. The users of the Web are becoming not just the recipients and repositories, but also the agents, of this new information-age culture. The social dividing line that once clearly separated cultural producers from cultural consumers is becoming blurred, just as the boundary between the producers and recipients of scientific knowledge tends to disappear. Without going so far as to say that it will actually disappear and that in knowledge societies everyone will be a scientist or an artist, we may suppose that it will cease to exert hegemonic control over the circulation of scientific or cultural works.

The internet offers, moreover, radically new possibilities for experimenting with personal identity, thanks to the recent instituting of exchanges that are fixed up without the parties' physical involvement, in an entirely anonymous, disembodied and synchronous way. By enabling virtual selves to be superimposed on real selves, the Web establishes a wholly new realm of self-expression. According to some experts, it thereby

Box 2.6 Youth and new technologies

Young people play a major role in the expansion of new technology, in particular because they are the main users of the internet.

Internet users by age group in 2002



Source: ITU, *World Telecommunication Report 2004*

They contribute to the actualization of the potential of digital tools and to the emergence of new practices that constitute a true "digital culture" (network video games, personal Web pages, discussion forums, *blogs,* etc.). Thus, the main concerns of the young people can be expressed particularly through the development of the internet. One must also beware that the youngest – who are also the most liable to be influenced – are kept away from dangerous contents, in the respect of the free circulation of information and contents in the Cyberspace.

Youth constitutes a particularly vulnerable audience deserving special attention, especially in developing countries and in post-conflict situations. UNESCO, in the framework of several initiatives such as the "INFOYOUTH Programme", has pledged to help in mobilizing and encouraging the participation of youth to facilitate the access of the underprivileged to information and communication technologies. Concretely, this implies stressing the importance of ICTs in education as well as creating grants for training and selection in the field of ICTs so as to help the youth to use those devices more efficiently, in particular in developing countries. ICTs can also play a major role for the diffusion of information on matters having direct impact on the social, cultural and economic life of the youth.

functions as an indicator of the hidden forces and trends of the societies it informs: on the one hand, it fosters the tendency towards depersonalization and self-forgetfulness; on the other, it creates dynamics enabling individuals to multiply their virtual identities, under cover of an almost infinite number of pseudonyms. Legislation on digital identities and their relationship to social identities is still in the pipeline. The rise of the virtual vastly expands the domain of the possible. But there is another side to this coin; namely, the increased possibility of counterfeiting and defective production, and of imitation and dissimulation. The factors that encourage the free flow of exchange thus harbour within themselves the risk of disinformation. The question of identity links up, therefore, with the wider question of the authentication of persons and of suppliers of services. The odds are that the putting into force of standards of authentication will continue to be a major question in the coming years.

Finally, let us underline that is not because information is accessible online that it is necessarily used for knowledge-seeking purposes. The social changes brought about by the new technologies can only lead to the emergence of knowledge societies

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under certain conditions – which, as we shall see, are those associated with *learning* societies. Indeed, close observation of those "digital cultures" that have emerged alongside the spread of the new technologies, particularly among younger internet users, rather tend to support a less promising hypothesis: that of the emergence of a generalized *entertainment society*. This observation is applicable not only to the countries of the North, where the consumer society is triumphant, including in the cultural field, but even to the countries of the South where certain studies have highlighted a wide disparity of behaviour patterns online.[12] The internet can therefore also become both an instrument for the building of knowledge societies and a labyrinth that will lead us slowly but surely to the shores – enchanted or disenchanted – of the entertainment society.

Background resources

African Information Society Initiative (2003); Bruner (1990); Castells (1996); Clark (2003); David and Foray (2002); Flaherty (1989); Foray (2003); Goody (1977); Gorz (2003); Hatano and Inagaki (1991); Himanen (2001); Hoog (2003); IFLA/IPA (2002); Lessig (1999); Mansell and Wehn (1998); OECD/CERI (2000*a* and 2000*b*); Proenza J. *et al.* (2001); Ricœur (1992); Rodotà (1999); Sassen (1991); Schumpeter (1934); Serres (2001); Stehr (1994); Turkle (1997); UNDP (2003); UNESCO (2003*a*, 2003*c*, 2003*d* and 2003*e*); World Bank (1998).

Chapter 3

Learning societies

The term *learning society*, given currency by Robert Hutchins (1968) and Torsten Husén (1974), indicates a new kind of society in which the old limits on where and when organized knowledge could be acquired (inside educational institutions or immediately after initial training) no longer apply.[1] In an increasingly complex world, where anyone may need to ply more than one trade in the course of a working career, lifelong learning becomes indispensable. Around the same time as this notion of a learning society was becoming established, Peter Drucker (1969) pointed to the emergence of a "knowledge society", where what matters above all would be "learning how to learn".[2] This new concept of education was almost simultaneously put forward (1972) in the report to UNESCO by the International Commission on the Development of Education, chaired by Edgar Faure, entitled *Learning to Be: The World of Education Today and Tomorrow* (hereafter referred to as the Faure Report). The report argued that education is no longer the privilege of an elite, nor a matter for one age-group only: it tends to cover the whole community and the whole lifetime of the individual.

These works published in the late 1960s and early 1970s no longer concentrate on those who possess knowledge so much as on those who are seeking to acquire it, not only in formal systems of education but also through their work, and through non-formal or informal education where the press and audiovisual media play an important role. The rise of a global information society would seem to have borne out this hypothesis. In 1996, the International Commission on Education for the Twenty-first Century, chaired by Jacques Delors, stressed in its report to UNESCO (hereafter referred to as the Delors Report) the extent to which new information technology could contribute to the continuous updating of personal and professional abilities. As accelerating change challenges the old patterns and increasing importance is given to "learning by doing" and innovative capacity, the knowledge dynamics of our societies have become a major issue. The "learning" model has spread far beyond the world of education, into every cranny of economic and social life. It is now increasingly accepted that any organization, profit-making or not, needs to strengthen its educational, "learning" side; and here it is important to note that the rise of this pattern coincides with that of innovation generally, in all areas of human activity.

Now what do we really know about learning? Will the recent advances in modes of learning and cognitive science be translated one day into effective practices in the real world? These applications must not be limited to the teaching profession: all knowledge repositories and media, themselves undergoing transformation, ought to be able to benefit from them, both in countries of the North and of the South.

Towards a culture of innovation?

If the transmission and diffusion of knowledge are so important in our emerging knowledge societies, it is because we are now facing not only faster production

of new knowledge but, more importantly, a growing thirst for such knowledge throughout society. Never has the interval between the discovery of a new idea and its inclusion in secondary school or university courses been so short. This can sometimes cause trouble, not least if the way they are included has not been adequately tested; but above all it testifies to the emergence of a real culture of innovation, going well beyond the notion of technical innovation in the global knowledge economy to become a new value in itself, as its spread through field after field indicates – education, politics, the media and indeed culture in general.[3] Knowledge, techniques and institutions will find themselves increasingly threatened with the charge of obsolescence. Culture itself is no longer built with blueprints of permanence and repeat production, but with those of creativity and renewal. The general spread of "learnership" to all levels of society should prove the logical counterpart of this permanent instability engendered by such a culture of innovation. How, though, is such a culture to be reconciled with the handing on of values, or with any real economic, social or political planning? How, in other words, is the never-ending search for novelty ever to found anything lasting? How can it avoid disregarding the longer term for the sake of the immediate gratifications of profitability and fashion? Learning societies will have to cope with a major challenge in the twenty-first century: reconciling a culture of innovation with any long-term vision.

Innovation and knowledge valuation

What distinguishes innovation from simple invention (restricted to the field of research, as "the production of new knowledge") is the *attachment of value* to knowledge generated, for example, by the production of a demand for new goods or products. The entrepreneur is the mediator who transforms inventions into economic innovations. Innovation depends on the creation of new needs in society, for society must convince itself that the advantages to be gained from the innovation outweigh the cognitive costs incurred in the transition between the old situation and the new. To become an innovation, then, an invention must be attended by prior research aimed at facilitating its use and lowering the cost of the transition.[4] In this sense, innovation has no independent existence, but only arises when an invention finds an entrepreneur who gives it value, while meeting a social demand. A given invention might therefore lead to an innovation in one society but not in another, if either the demand or the entrepreneurs for it are lacking. An innovation often takes time to reach its full measure of success: the widespread use of computers, for instance, was initially hampered by the psychological fears of adults, while children and young people were already finding it natural: there had to be a generation's worth of waiting time before the new information and communication technology became established in our habits.

The process of innovation: collaborative and multi-dimensional

Sociologists, economists and philosophers who concern themselves with technological innovation now recognize that innovations and their diffusion make progress in patterns that are less one-directional than had been supposed. Nowadays, we take into account the interaction between the general public and the world of science, technology and industry. In the knowledge society the role of the public is bound to grow, for the public is in its own right an element of the innovation process, which brings out the social aspect of creativity and presupposes a real *knowledge-sharing* among contributors who come from the most heterogeneous of positions.[5] During the 1960s and 1970s, the most spectacular technical innovations usually sprang from large-scale technological projects (the conquest of space, high speed trains, nuclear programmes, etc.). The state provided funds for research and was very often the main user of its product. This pattern, though it could take on very different forms (the driving role of the state in France and northern Europe, or a more systematic public-private partnership in the United States), has been far less visible in the dynamic of innovation since 1990 – except, of course, in the military and nuclear fields. In the recent past, advances in computer science and the general adoption of the internet

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Box 3.1 Innovation and the development of the internet

In the case of the internet, while it was the state, the public sector and the universities which began the innovation, they were quickly joined by other players: companies, of course, but also more marginal innovators connected with various social movements. On the one hand, we find computer scientists working for the US Defense Department who wanted the means of cooperating and exchanging information (the aim being to use computers not just as calculating tools but above all as a means of working collectively). On the other hand, and in parallel to these, were the *hackers* (a term that appears to have begun in the laboratories of the Massachusetts Institute of Technology (MIT), often connected with the Californian counter-culture of the 1970s, who wanted to break away from a form of computer use that they regarded as primarily an instrument of control and centralization. The first micro-computers and local computer communication systems were created around the vision of an "alternative", convivial and decentralized computer use.

have illustrated the new way in which technological projects and the habits of the general public interact (see Box 3.1).

Thus, the general public makes its appearance as an agent of innovation in its own right. In some cases, the collective will driving an innovation is as much the work of the public as that of the engineers, or even more so. Sufferers' associations are a good illustration of this trend, as the example of "Telethons" shows. In other cases (HIV/AIDS, for instance), ordinary patients have not hesitated to stand up against the power of the medical establishment: as those with personal experience of the disease, they have set about influencing the therapeutic protocols even if it means forcing a reconsideration of some of the principles that have traditionally governed clinical trials, such as the use of placebos.

Culture of innovation and knowledge demand

In a global knowledge economy, where the touchstone of competitiveness will be capacity for innovation, the fostering of a culture of innovation is a matter of encouraging the rapid spread of inventions and new ideas throughout a society. But innovation cannot be arranged by fiat. It is precisely because innovation has become largely unforeseeable that it is important to concentrate on the conditions that favour the emergence of the *process* of innovation: for they constitute the only factor that it is in our power to affect. We also have to watch out for the human cost of these transformations, keeping in mind that, as Schumpeter used to say, innovation is truly a process of "creative destruction": the destructive mechanisms inherent in innovation must be paid special attention so that their social and cultural consequences can be mitigated.

The technological revolution underpinning the rise of the knowledge society carries, like any other, a serious danger of making some social relations and the position of some social groups precarious. Does recognizing this necessarily mean accepting the idea that certain individuals or whole generations may find themselves being sacrificed on the altar of change? Knowing that there is often a violence inherent in times of foundation, can we really not envisage that, on the contrary, this challenging of established practice and knowledge will itself crucially depend on the development of individual and collective capacities? This is the true issue for societies, which are going to need to be both knowledge societies and innovation societies – and must therefore become *learning societies*.

Tomorrow's jobs will be more and more a matter of producing, exchanging and transforming information or knowledge. Our societies will be wholly engaged in assimilating a continuous flow of new knowledge. The demand for learning will be greater than ever, but its expression will be different: the object will no longer be an apprenticeship in one specific type of activity, which scientific and technological progress may very well make obsolete in no time. In an innovation society, the demand for knowledge will be in terms of ever-recurring needs for re-skilling. Vocational training will itself be forced to evolve. Today, a first degree is above all a social qualification, and the culture of innovation will require even these degrees to carry a "Sell By" date, in order to combat the inertia of cognitive skills and to meet a never-ending demand for new capabilities.

Innovation and permanent renewal: the issues at stake in a new culture

The great novelty of our contemporary world is the unprecedented value attached to whatever is different, new and unheard-of. Symbolically, transformation trumps permanence and the radical departure trumps the continuation – sometimes at a considerable cost in instability and feelings of insecurity. The supremacy of the ephemeral nowadays parallels the high status attached to aesthetic awareness. An increasing number of human activities – even economic ones – are conceived in terms of aesthetics and creativity rather than reproduction and continuation. Just as in the nineteenth century we moved from a needs-based economy of demand to an economy of supply resting on the law of markets, so now the new, the surprising and the "magical" have become real assets, productive of added value.

In its current expressions, this high social value attached to innovation for its own sake is often destabilizing; after a while, our societies that are so concerned to foster the spectacular become haunted by the spectre of a somewhat hollow frivolity. But the culture of innovation is not simply a matter of fashion. For a proper understanding of all the phenomena it covers, the model of artistic creativity is particularly illuminating. We observe that under the combined influence of networking, globalization and the rise of new technologies, creativity itself is experiencing an unprecedented degree of upset. With the current overuse of the prefix "post-" in contemporary discourse (a feature, for example, of the pre-eminence of the conception of "post-modern" art), it is in fact the essentialist view of the human being that is making its final bow. From now on, creativity is taking over new areas that one might describe as "anthropopoetic": people increasingly create themselves, with all the dangers that this involves. These dangers are neatly summarized by the fear expressed by some thinkers that "post-humanity" is on its way. If what is essential to each of us as human beings can now be read in our genomes, this only emphasizes the eminently political character of the choices we face. Innovation and invention are thus rescued from the media-nourished cult of the speedy and the startling, and revealed as the necessary conditions for mastering the future, not only of our societies but also of our species.

Learning, a key value of knowledge societies

By definition, a learning society cannot be just an information society. In the face of the potential excesses that the rise of a global information society is likely to generate, the notion of learning reintroduces a critical dimension, allowing our societies to face the possibility of assimilating the incredible amount of new knowledge that they regularly produce. Thus, learning as a phenomenon may generalize at all levels of our societies and offer a model for organizing the time, work and lives of our institutions. Such an evolution illustrates a paradigm shift. On the one hand, education and learning can no longer be confined to a set and settled space-time, but may develop over a lifetime. On the other hand, the human actor must be put at the heart of a continuing process of knowledge acquisition and communication. This return to the specifically human dimension of knowledge does not put into question the importance of new computer tools (automatic database managing or knowledge processing systems) described in Box 3.2 below. Rather, they should be seen as mere tools, and should not allow us to overlook the role of *learning* and particularly the role that teachers and educators of all kinds are destined to play.

The diversity of learning

Learning societies will need to engage in a study of the different forms of knowledge, distinguishing descriptive knowledge (facts and information), procedural knowledge (answering "How?" questions), explanatory knowledge (answering "Why?" questions) and behavioural knowledge.[6] Such a study shall encompass the advances achieved in cognitive sciences (see Box 3.3). Hence, the growing knowledge that we have of the memory and emotions will eventually serve to develop a new type of learning based on learner stimulation. But the recent advances in cognitive sciences and

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Box 3.2 Knowledge management and search engines

Technological innovation makes possible the emergence of new knowledge management systems that are shaped, to an important extent, by the choices and behaviour of users. Thus, systems of knowledge management, that is to say, the automatic management of knowledge and information, are founded on a filtering principle that depends on the interaction of individual actions and of the automatic processing of data.

For example, the action of a user who buys a book on the site of an online bookseller will enable the system to select other information that is potentially of interest to that user. Each action thus leaves a trace, and after a certain time these traces, accumulated by different users, form a pattern that can be used by automatic information-processing systems. Computer engineers working in knowledge management multiply the creation of these kinds of systems, designed on the basis of the way people behave.

Second-generation search engines thus make possible a very extensive automatization of certain cultural information-filtering and information-retrieval functions. Thanks to such tools, the structure of the Web may be described as a hierarchy of sites, which is in itself a source of information (the "value" of a site being, in this case, its position in a search engine). It is, in fact, the user who expresses their preferences and share with others their filtering of the information available on the Web, by establishing a link from one page to another. And so the structure of links becomes a mine of cultural information, constantly enriched by the behaviour of users. These methods of extracting information decompartmentalize the traditional categories of knowledge and create new circuits of knowledge and information, and above all a form of "meta-cognition", a knowledge of knowledge overlaying the knowledge already distributed in society.

The integration of knowledge management techniques and of the new search engines has, then, a major influence on the processing, structuring and perceiving of information, which it alters substantially. We could go so far as to envisage future systems capable of establishing new links automatically between pages of the Web, or of eliminating some of them on the basis of user behaviour. So conceived, the internet would be capable of organizing and automatically updating itself by integrating the choices of actors. Research programmes on future ways of searching out and linking information do exist, but their outcome remains uncertain for the time being.

neurosciences are taken into account insufficiently in the conception of educational programmes.

One of the tasks of the learning society, therefore, will be to rethink, in the light of these discoveries, the social acts involved in the production and transmission of knowledge – education, of course, but also the public dissemination of knowledge – as well as the material media related to their practice: books, voices and screens.

Among the four different classes of knowledge that have been evoked (descriptive, procedural, explanatory and behavioural knowledge), behavioural knowledge deserves our undivided attention. Indeed, its acquisition requires unnatural cognitive efforts, in opposition to imitation and exploration behaviours. Whatever the violence often imposed by others (family, school and society) to ensure these cognitive efforts, the whole set of punishments that has for too long accompanied learning is unjustified.

Moreover, knowledge is divided into different disciplines, whose potential rigidity is nowadays put into question, hence the debate over the relevance of a strongly hierarchized transmission of knowledge (through lectures, for instance) whose evaluation methods emphasize the symbolical and economic value of diplomas. Moreover, the existence of common-core syllabuses of specific knowledge is currently under debate. It is as though basic knowledge did not exist anymore, for want of a consensus. However, it is relatively easy to draw a list: fundamental knowledge must encompass language, exploratory cognitive abilities (experiences), mathematics (enumeration and the search for regularities, causes and effects), fiduciary abilities (adherence to cultural codes) and abilities to abide by the social rules, and artistic and manual abilities (drawing, sculpture, music, etc.). Many experiences have shown that these abilities must be developed very early in life. If not, they can be strongly affected or can even disappear.

Since the speeding-up of technical progress makes competences obsolete increasingly rapidly, it is advisable, in all fields of knowledge, to encourage the acquisition of flexible forms of learning instead of imposing a well-defined set of knowledge. *Learning*

Box 3.3 Learning and cognitive sciences

The term *cognitive sciences* embraces a vast range of disciplines, including psychology, philosophy, artificial intelligence, linguistics and neurosciences (biology and medicine), as well as cognitive anthropology and sociology. Cognitive sciences may be defined as the set of scientific disciplines that deal with the mental aspects of knowledge whose veracity may be subjected to evaluation, i.e. to which methods of analysis and logic apply. Cognitive sciences are multidisciplinary by nature: their scientific benefits are not limited to the algorithmic aspect of data processing. In such a field, the conjunction of human and social sciences, and of exact and natural sciences, is particularly fruitful.

As regards learning and the educational sciences, more attention is being paid to the learning environment, whatever it may be (classroom, work setting, or elsewhere), together with the information exchanges and flows of emotion that take place there. The scientific approach to cognitive activity has been considerably enriched and bids fair to usher in major new discoveries.

In the field of education, but also in that of cultural and scientific policy, decision-makers must, it is true, keep up with developments in the cognitive sciences. But they must also give cognitive scientists a goal. Efforts still need to be made to establish an interface between the neurosciences and psychology, and the educational sciences. Educators and researchers must find a common language in order to formulate the questions that each group may want to put to the other, along with the answers that will need to be found. Hence, knowledge transmission must occur between scientists and educators before it can take place between teachers and learners. The educational sciences must therefore acquire new tools of evaluation that go beyond the measurement of performance alone, in order to measure the capacities and alertness of the learning mind.

to learn means learning to think, to doubt, to adapt as quickly as possible, and to be able to question one's cultural heritage while respecting consensuses. Such is the basis on which knowledge societies will be built.

Knowledge evaluation

Learning societies will have to enable each individual to keep up with knowledge. This will require an in-depth debate over knowledge evaluation, whether of "learners" (schoolchildren, students, workers following a training course, seniors, etc) or of teachers and researchers.

All the difficulty lies in the fact that knowledge, unlike goods and services, cannot be measured objectively, even if, in learning societies, knowledge is at the core of continuous exchanges. This is a global issue that goes beyond the question of knowledge trade; it also concerns job remuneration in the immaterial sector and thereby knowledge remuneration. This difficulty is all the more acute since the necessity to assign units of measure to knowledge has led to the development of measurable forms of knowledge – "formatted" or standardized knowledge – that can be evaluated quantitatively (with units) and qualitatively (with a reference table). Worse than that, the execution speed of cognitive tasks can become a unit of measure, even for tasks requiring thinking and, thereby, time. Hence, we end up favouring exercises such as text summaries, teaching the learner to skim over knowledge instead of analysing it. Multiple choice question papers have taken this form of evaluation to appalling extremes. By generalizing knowledge evaluation, "knowledge temples" might well become supermarkets selling standardized information or cognitive routines.

If it is difficult to establish global standards to evaluate knowledge, for most forms of knowledge cannot be quantified; it is however possible to suggest a few safeguards. One of the solutions could consist in distinguishing the role of the teacher from that of the examiner: this would prevent knowledge from being excessively subjected to evaluation. Examiners would have broader bases for comparison and would not be confronted to the relationship problems between teachers and students. Indeed, entrusting the teachers with teaching and evaluation makes them both judge and judged. This solution entails organizational problems and may be more expensive. However, it would bring a solution to the crucial issue of global evaluation accreditation, so necessary for the emergence of "knowledge for all" societies.

Multiple intelligences

The emergence of learning societies must go hand in hand with the calling into question of monolithic and unitary conceptions of intelligence, which

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justified the relatively stable character of knowledge evaluation and transmission procedures in conventional teaching systems (see Box 3.4). The theory of multiple intelligences and the concept of *emotional intelligence* have encouraged the calling into question of all too exclusive a focus in teaching practices on logico-mathematical and linguistic intelligence. The ultimate aim of education is not to develop all forms of intelligence equivalently in everyone, but to identify the approaches best suited to each learner's intelligence. However, when there is diversification of the methods and types of activity proposed in the educational context, it becomes easier to recognize, put to use and develop these intelligences. Thus, spatial intelligence, bodily-kinesthetic intelligence, interpersonal intelligence, intrapersonal intelligence and naturalist intelligence are so many facets that are often neglected in conventional teaching and can no longer afford to be marginalized. In the same way, in a multifunctional approach to education, the "teacher" (in the broad sense of the term) must be able to put him/herself in the learner's place and feel the stimulation provided by the act of learning in order to teach students to learn.[7] The converse, in the form of role swapping, has already been successfully applied.

Thus, a culture of learning that valorizes the teacher as much as the student and extends these relations beyond the educational framework is necessary if learning societies are to develop. Networks of professional communities offer an excellent illustration of this, particularly in terms of their prolific use of the internet. The members of such networks transmit their knowledge and enable young professionals to benefit from their experience to advance society itself. Moreover, the aspect of personal valorization is also seen here in the psychological support that such a network represents. It has indeed long been recognized that the feeling of belonging to a professional group is a confidence-building factor and that the possibilities of meeting and exchanging ideas with other fulfilled professionals stimulate professional vocations and the desire to learn.

The availability of knowledge

We have seen that the existence of different ways of gaining access to knowledge is one of the major characteristics of learning societies. This diversity is linked to the end of two monopolies, that of educational institutions and that of books. Of course, educational institutions continue to play an essential role; as for books, and printed matter in general, they are not likely to disappear. Technological innovation provides the publishing business with new growth opportunities, through tailor-made printing and significant savings in storage space, and the internet creates new virtually unlimited opportunities for promoting, selling or negotiating rights. But the digital revolution, which has transformed our relationship to knowledge, is speeding up the erosion of these two monopolies very significantly. Long a symbol of the circulation of knowledge, how will books be changed through contact with the new media? And with the advent of these new media, what will become not only of the text itself, but also of the experience of reading? In learning societies, whose which must

Box 3.4 Artistic education offers children and adolescents a passport for life

Stimulating children's activity and sharpening their sensitivity to artistic practices, game- and repetition-based learning, as well as the use of artistic techniques (theatre, music, painting, etc.) in general education are living realities that offer inexpensive increased possibilities of expression and understanding, and stimulate the interest of children and adolescents in school and knowledge. Such techniques are extremely helpful in teaching the official language of a country, in particular in the case of children who have different mother tongues, and are far less costly than underachievement, indiscipline and school violence. This is well illustrated by the various experiences led by UNESCO in this field. In Brazil, children are invited to follow artistic, cultural or sports activities on the weekend, along with their families. In Senegal and the Ivory Coast, children are introduced to the study of French through theatrical techniques. In India, dance breaks the isolation in which marginalized children live.

For more details, see: http://www.unesco.org/culture/lea

multiply and improve learning environments, what is to be the place of libraries? How are they to fit in with networking? None of these questions is unimportant for, behind them, we see outlined a whole series of opportunities for lifelong learning.

Texts and reading: ongoing and upcoming metamorphoses

The computer screen has by no means meant the disappearance of texts and writing, since a large proportion of what appears on our screens is of a textual nature. However, the development of hypertext and the increasingly frequent combination of text with other elements (images, sounds, etc.) are tending to change the status of the written word, which is not without an effect on the act of reading itself as well as on all forms of writing, whether literary or scientific.

A text is a place of basic tension. On the one hand, it is a speech object that unfolds within a span of time, through the regulated and linear succession of words in accordance with the syntax of the language. On the other hand, apprehended by the eye, the text may in part escape from this linearity and take advantage of the resources of space to create other types of meaning events, through page layout, typographic arrangements and colour schemes. The tension between two dimensions of cognition, space and time, has become more perceptible as in our time people have tended to cast off authority – religious and political as well as that of the written word – and to want to take in at a glance only those elements of information that are of interest to them. Reading, far from being an unchanging activity, depends not only on the medium used for texts, but also on the type of texts to be read and on the way in which reading itself is regarded and taught in any given society. Whether set out on a papyrus scroll or organized in a book, texts do not elicit the same attitude. When codices (manuscripts composed of pages appeared), it became easier to annotate and actively appropriate a text. The structure, composed of folded sheets, encouraged the introduction of pagination and the various innovations that ensued, namely, word separation, punctuation, paragraphs and subparagraphs, division into chapters, tables of contents, indexes, etc. Previously designed in a purely linear manner, texts were written in separate pages and subsequently increasingly came to be organized in ordered sections, each separated from the others. This lends itself to a personal appropriation of the text, and to silent reading. This individualization of reading was to become even more marked with the spread of printing and the appearance of extensive reading (instead of intensive reading), which tended to become the norm with the booming of daily press in the nineteenth century and magazines in the twentieth century.

A new era in the relationship between human beings and texts began when, with the development of the internet, the screen rapidly became the most commonly used medium for texts. The migration of texts and reading activities to computer screens is not without implications for the nature of texts, whose new attributes – ubiquity, fluidity, interactivity, integral indexation and fragmentation – are increasingly considered essential by today's readers.

Ubiquity makes any text placed on a server instantaneously accessible everywhere, thus auguring a movement towards the decontextualization and interpenetration of cultures on a scale still unthinkable just two decades ago. *Fluidity* refers to the fact that digital documents can be modified extremely easily, which is ideally suited for correcting, copying, serializing, forwarding, public display and commentary in forum discussions.

With *interactivity*, texts are increasingly seen as spaces to be explored, crammed with hyperlinks leading into windows containing additional information and audio or video clips. Computers have opened up a new dimension to the written word – the capacity to interact with users, encouraging them to adopt an active, targeted reading attitude. The supreme organizing principle of this type of text is no longer the structured book but the database. The user can thus scan successively all the information relating exclusively to his or her line of enquiry, which can prove particularly efficient in terms of learning. Hence, the transfer of large conventional bibliographical collections onto a database is a particularly promising prospect.[8]

If we can speak of *integral indexation* it is because web texts are so to speak integrated into a gigantic database, where search engines allows the page, text or information sought to be found very

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swiftly. The effectiveness of the question-and-answer system tends to transform the reading experience into an active quest, and reading is less and less seen and experienced as the activity of absorption and rumination that it was formerly.

Lastly, the *fragmentation* of the digital text epitomizes a more fundamental change, related to the future of the written word and of culture at large. Indeed, the slight discomfort experienced, even subliminally, tends to encourage feverish reading with frequent zapping. There is, as a result, a notable loss of the usual reference points, particularly in the navigator window – with the elevator bar, it is no longer possible to use one's visual memory to spot a particular passage, as is the case with books. This marker, which suits short texts, proves too approximate for a substantive article and very inadequate for continuous reading over several sessions, as is usually the case for novels. Could the future of this literary genre be endangered if the computer screen were to become the standard reading medium?

The future of books

The issue of the scarcity of books and their distribution, particularly in countries of the South, and notably as regards school textbooks and children's literature, is as crucial as that of the "digital divide". When prohibitive book prices are accompanied by a lack of library facilities, then the availability of reading materials becomes far too low to be of any help in combating illiteracy, spreading knowledge and widening people's horizons.

However, as objects, books will indeed give birth to hybrid forms. In the past few years, various attempts have been made to recreate the printed book format on screen, either with the help of hypertext markup language (HTML), as is the case with the *International Herald Tribune*, in which articles can be read by scrolling down or through a succession of screen pages, or with portable document format (PDF), or again with a machine entirely given over to this format, like the electronic book (e-book). However, this last option has not had much success so far. On the other hand, it is plausible that an electronic book will soon be developed, designed as an assemblage of pages on which the text would be displayed like a book. Among the technologies under study, the one in which the most progress seems to have been made consists in enclosing, in flexible plastic sheets, millions of microcapsules of virtual ink that a change of electric polarity can put into different positions. This material started being marketed in 2004. We can therefore soon expect to see an electronic book, probably in the form of a copyright system belonging to a few very big publishing groups.

The potential offered by the new media gives rise to an interesting phenomenon, which is that practices of internet users open up the internet to fields and types of logic that were formerly specialized and reserved to all the book-related trades: documentalists, printers, publishers, distributors, etc. As was underlined at a conference organized by UNESCO at the National Library of Brazil in August 2000, we are witnessing the extension and spread of publishing practices, as is illustrated by some online publishing experiments, through which famous writers receive voluntary contributions from their readers.

The future of libraries

No longer confined geographically, texts and knowledge become nomadic. They thus partly escape the pressures of certain types of authority or centralization. Libraries, whether specialized or general, increasingly split into a physical place and a virtual space, between printed materials and screen, will now have to work with a considerable mass of documentation.

Conservation does not consist in *storage* alone but also depends on all the legal and social procedures allowing it to be put into effect. Since the nineteenth century, when libraries were recognized as having a public social function, closely linked to education, universities, research or the development of the human faculties, they have played a key role in making knowledge publicly available. Libraries must now discharge this mission not only within societies but also between countries and regions worldwide, in particular through networking. This can also involve other institutions such as universities, research centres or museums through a multimedia and playful approach aiming at active knowledge acquisition.

In some circles, it was thought that the information technology boom would spell the end of libraries. What we are now witnessing, however, in many coun-

tries, is a real estate boom in big public libraries.[9] Far from withering away, libraries are fast changing when financial means are availalble. If there is a crisis, it is more a crisis of growth than anything else. Henceforth, for the most richly endowed, the name "media library" has become more appropriate than that of "library" alone, since such places are no longer concerned exclusively with books and printed matter but also with house documentation and works presented or even designed outside the book format.

But as libraries become attuned to the logic of networking, so they come to occupy a central place among the economic challenges of the new information paradigm. Libraries will have an important role to play in bridging the digital divide. But how can we ensure that they maintain their public role and continue to be free of charge, in an economy of access to information flows? In addition, in the present age of cultural trade, libraries are going to have to take a stand in regard to the glaring imbalance between the exponential development of databases and the spread of billing for access to short-lived information. Above all, they are going to have to cope with the important costs of access charges, licences and subscriptions, particularly in the case of university libraries. When, on 14 December 2004, Google announced its intention to start digitizing over 15 million printed documents so as to make them available for free downloading, the big libraries, particularly in Europe, responded rather suspiciously, even if the copyright issue was to be tackled separately. The future of libraries hinges largely on the capacity of our societies to transcend the mercantile logic of information society and to install new models in which what creates value is knowledge and the value of its contribution to cognition.

The new issues of library economics

Through their contribution to the dissemination of knowledge from all and for all, libraries can become crucial actors in development, which must entail a reduction in the strong polarization of our world as regards access to cultural goods and to information. In this context, professional cooperation needs to be strongly encouraged, in particular through the North/South and South/South twinning arrangements between libraries – exchanges of expertise ranging from shared cataloguing to cross-training and online assistance – and through partnerships with the various publishing, press, education and research sectors. Encyclopaedism has a cognitive dimension that the gains in productivity resulting from digital technology will not suffice to address alone. Without suitable financial and, especially, human investments (skills, expertise and social practices), the lasting development of documentation-related work will lay in jeopardy. However, infrastructures for conservation and preservation (archives, museums and libraries), as well as expertise and methodological know-how, remain far more concentrated in rich countries than in developing countries. In addition, publishing activities and the distribution of printed materials are very unevenly spread throughout the world.

Here again, a positive step would be to set up an international legal, economic and ethical framework to establish safe protocols for online access for disadvantaged countries, in order to create free flows of documents covered by rights in developed countries and commodity areas, on the understanding that such "positive discrimination" policies should go hand in hand with monitoring and follow-up measures in order to eliminate the risk of smuggling. Moreover, the prospect of a world public library and the cooperation that this would entail, presuppose the fulfilment of requirements for consistency of access, calling for the matching up of signaling and standardization, particularly at the level of metadata. There has been some progress in this regard: different online catalogues (Online Public Access Catalog, OPAC) are thus accessible through single links. A project like the "Bibliotheca universalis", involving a dozen countries, clearly shows what is at stake. This library lists its objectives as coordinating the efforts of the partners within an international cooperation framework, providing free access on electronic networks to their digitized and born-digital documents, implementing interoperability protocols to their different systems to facilitate access to their digitized collections for the end-users, and creating a common digitized content in the form of images, texts and sounds around the theme of exchanges between peoples.

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Box 3.5 Bibliotheca alexandrina

UNESCO was involved from the very beginning in the project to rebuild a major cultural centre in the city of the famous ancient library, Alexandria, in Egypt. Inaugurated in 2002, this new institution illustrates a desire to link together documentation activities and cultural events. In addition to the main library, museums, research centres, specialized libraries (including one for the blind), the center houses the first planetarium in Egypt, as well as art galleries, a conference centre, etc. With more than 250,000 visitors a year, the *Bibliotheca alexandrina* has already become one of the most important libraries in the Arab world.

There paper and digital documents exist side by side, just as the conservation of exceptional manuscripts goes hand in hand with the Internet Archive, an American system for consulting web archives since 1996 (more than 10 million pages). A manuscript digitization department will help to put the cultural heritage of humanity online.

The circular architecture of the building (the work of the Norwegian architect's office Snohetta, winner of an architecture competition launched by UNESCO in 1987) is crowned by a disk inclined towards the sea, while the visible part of a circular granite wall embedded in the ground is covered with all the known forms of writing – a symbol of the universality to which this institution of learning aspires. Beneath the disk, the biggest open reading room in the world occupies a space organized over several levels.

This cultural complex is designed to be a centre of excellence, but also a place open to the public at large and a meeting place for researchers and artists from all over the world, contributing to the dialogue between cultures.[10]

However, technological prowess and cost reductions, as spectacular as they may be, should not cause us to evade the question of real human uses. The library, whatever its size, will also remain an institution located in a physical space, a meeting place and a centre for cultural activities (see Box 3.5). As a true *cultural centre and clearing house for knowledge*, the library could represent a kind of portal for new knowledge, often serving as a link and junction point between the local and the global. Its anchorage in the local network enables it to play its public role in cultural and social mediation, and in the shaping and transmission of knowledge in its diversity. Libraries will thus be a basic tool for the promotion of linguistic and cultural diversity, not by confining themselves to a heritage function but by allowing this diversity to be incorporated into living practices.

In order to be able to make the best use of libraries, training – sometimes formal, but very often informal – has always been necessary and may be gained through their frequentation and the gradual familiarization with bibliographic tools. In other words, libraries have long been places where people learn how to learn, where the foundations are laid for transforming information into knowledge. In learning societies, which are based on lifelong learning, libraries must promote and facilitate learning at all levels. This is true in countries most affected by illiteracy, where they should be used to provide literacy instruction and to promote the written word. It is also true for optimizing the flow of knowledge in the context of an increased demand for training in all regions of the world. They can considerably facilitate learning processes charted according to individual requirements. Storage networks, which open up the prospect of virtual storage capacity whereby it becomes possible, in particular, to benefit from storage on request, will play a significant role in the development of self-tuition.[11]

From mobile library to huge contemporary architectural complex, the library will remain a pillar of the social circulation of knowledge and a factor of vitality for learning networks. Is it not, with its cognitive and evolutive functions, the paradigm of the learning organization?

Background resources

Bateson (1973); Bazillon and Braun (2001); Bénard and Hamm (1996); Brophy (2001); Chartier (1997); Cornu et al. (2003); Damasio (1994); Debray (1992); Delacôte (1996); Delors et al. (1996); Dickinson (2002); Dione (2002); Dortier (2003); Drucker (1969); Edelman and Tononi (2000); Gardner (1983 and 2003); Garzon (2000); Goleman (1995); Goody (1977); Hoog (2003); Husén (1974); Hutchins (1968); IFLA (2002); Maignien (2000); Maturana and Varela (1992); Miao (1998); Minsky (1988); Mollier (2000); Morin (2003); Nowotny (2005); Nowotny et al. (2001); Nunberg (1996); OECD/CERI (2000*a*, 2000*b* and 2002); Parker (2003); Raymond (1999); Rifkin (2000); Schölkopf and Smola (2002); Sen (1999*a*); Seonghee (1999); Serageldin (2002); Serres (1997); Stehr (2000); Turing (1950); UNESCO (1997); Vandendorpe (1999); Weizenbaum (1977).

Chapter 4

Towards lifelong education for all?

Education has been universally proclaimed as a human right (see Box 4.1). The twentieth century has produced an abundance of legal instruments and standards, and repeated pledges by the international community on the subject, but what has been gaining ground in the past few decades is a new social, political and philosophical perception of the whole approach to education, going hand in hand with the emergence of knowledge societies. With the development of the concept of lifelong education for all, education is no longer equated with school. Meanwhile, in a sector in which the role of the state has predominated in most countries, there is an increasingly perceptible trend towards the privatization of educational provision in response to a growing and more varied demand. Is this trend, mainly to be found today in higher education, likely to spread to the other levels of education, as can be seen already in some countries?

How can we reach gender equality as soon as possible and offer everywhere equal opportunity to boys and girls? How are we to approach education to ensure that learning societies are open to everyone and not just to the countries, families and individuals that can afford the most appropriate, highly valued knowledge? How can we make sure that education does not end up widening the gap between a more and more educated class of people and people who would have only limited access to quality education? In other words, how can we make sure that education does not end up widening the *knowledge divide*, the main pitfall of a global knowledge economy?

To meet these challenges and offset the little progress made in the 1990s (amounting to no progress at all in some cases), the international community gathered at the World Education Forum in Dakar (26–28 April 2000) and set six basic goals to be reached by 2015 (see Box 4.2). UNESCO is responsible for the monitoring and coordination with the other United Nations institutions, agencies or programmes involved in this project. The six Dakar goals are:

1. Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children;
2. Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities have access to, and complete, primary education of good quality;
3. Ensuring that the educational needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes;
4. Achieving a 50 per cent improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults;
5. Eliminating gender disparities in primary and secondary education by 2005 and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to, and achievement in, basic education of good quality;

Box 4.1 The right to education: a conquest and a goal

The right to education is one of the human rights proclaimed in the Universal Declaration of Human Rights (1948):

1. Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit.
2. Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace. (Universal Declaration of Human Rights, art. 26/1 and 26/2).

Education is also mentioned in the International Covenant on Economic, Social and Cultural Rights (1966):

> The States Parties to the present Covenant recognize that, with a view to achieving the full realization of this right: (a) Primary education shall be compulsory and available free to all; (b) Secondary education in its different forms, including technical and vocational secondary education, shall be made generally available and accessible to all by every appropriate means, and in particular by the progressive introduction of free education; (c) Higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular by the progressive introduction of free education; (d) Fundamental education shall be encouraged or intensified as far as possible for those persons who have not received or completed the whole period of their primary education; (e) The development of a system of schools at all levels shall be actively pursued, an adequate fellowship system shall be established, and the material conditions of teaching staff shall be continuously improved. (International Covenant on Economic, Social and Cultural Rights, art.13.2).

The universal right to education is also referred to in the Convention on the Rights of the Child (1989), the World Declaration on Education for All (Jomtien, Thailand, 1990) and the Dakar Framework for Action (2000).

The right to education lies at the heart of UNESCO's mission and the fundamental principle of "equality of educational opportunity" is one of the purposes of UNESCO as laid down in its Constitution (Art. 1, subpara. 2(b).) The *Convention against Discrimination in Education* (1960), which reflects this principle, has been recognized as a pillar of Education for All (EFA) by the Executive Board of UNESCO. The resolutions on the right to education, adopted by the Commission on Human Rights, have also attached great importance to this Convention.

As far as the right to education is concerned, the role and responsibility of UNESCO within the United Nations are crucial. The collaboration of UNESCO with the Committee on Economic, Social and Cultural Rights (CESCR) of the Economic and Social Council (ECOSOC), whose importance, along with that of the right to education, is recalled in the *Medium-Term Strategy 2002-2007* (paras. 16 and 62), relies on the complementarity of the approaches adopted for the implementation of the right to education. In this context, the establishment by the Executive Board of a Joint Expert Group UNESCO (CR)/ECOSOC/(CESCR) on the Monitoring of the Right to Education marked a milestone. According to the experts, the normative implications of education for all – particularly in the constitutional and legislative fields – deserve further consideration if we really want to implement the right to education. With this in mind, UNESCO provides technical assistance to the Member States in order to develop education legislation on online education. The goal is to implement the right to basic education for all and give it an expression that meets present needs.

As Koïchiro Matsuura, Director-General of UNESCO, has pointed out, the exercise of human rights is inconceivable without an effective right to education:

> … much remains to be done to make all human rights – civil, cultural, economic, political and social – affordable and attainable by all. Raising awareness on human rights is a key to their attainment. This is why the right to education is so fundamental for human rights in general. This is why knowledge and awareness are a condition of empowerment. Only a person who is aware that he or she has rights can better strive for those rights, whether it be the right to a job, to obtain adequate food, shelter or medical care, to participate actively in political life, or to benefit from the progress of science and technology. Only a person aware of his or her rights can fully utilize all the means to protect those rights and the rights of others.
>
> UNESCO strongly believes that every child – girl or boy – should have access to education. Indeed, we believe that quality basic education should be available to everyone by right. The implementation of the right to education, together with other human rights and fundamental freedoms, lies at the heart of the Strategy on Human Rights just adopted by the Organization. We seek to ensure that all of UNESCO's activities in the fields of education, the sciences, culture, communication and information are designed with a view to improving the daily life of people (message on the occasion of Human Rights Day, 10 December 2003).

Source: <http://www.ohchr.org/french/law> and <http://www.unesco.org>

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6. Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.[1]

Moreover, achieving universal primary education is Goal 2 of the Millenium Development Goals (MDGs) (Target 3. "Ensure that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling"). Eliminating gender disparity in primary and secondary education (Target 4) is part of Goal 3 ("Promote gender equality and empower women").

Basic education for all

First priority: literacy

What kind of basic education should we be providing in the future, and how can we make sure that it will be provided to all? In most education systems, the period of compulsory schooling, especially at the primary level, is when children are given basic education. All the evidence indicates that the school, as a place and an institution, will remain the pillar of basic education for a long time to come. School is therefore responsible for the fundamental mission of literacy. The promotion of basic education for all must accompany the ongoing eradication of illiteracy. About 785 million adults – some 17 per cent of the adult population in the world – were illiterate in 2005, the majority of whom were girls and women. In Europe, for every illiterate man there are two illiterate women. In 2000-2004, illiteracy affected 48 per cent of women in sub-Saharan Africa and over 53 per cent of women (for over 32 per cent of men) in West and South Asia (see Figure 4.1). The battle against illiteracy is absolutely vital and urgent. That being said, school is being undermined by a crisis in education, although the forms this crisis is taking vary from one region to another.

Box 4.2 Will the goals of Education for All be attained?

At the end of 2004, the international community was far from meeting the goals of Education for All by the year 2015:[2]

Forty-one countries (one third of those for which the Education for All Development Index can be calculated) had achieved the four most measurable goals (2, 4, and 5) or were close to doing so. None of the Arab States was close to achieving the goals;

Fifty-one countries were in an intermediary situation. In about half of these, mostly in Latin America, the quality of education (measured by the survival rate to Grade 5) was lagging behind. In these countries, many children who had access to education left school prematurely, partly because of poor-quality education;

Thirty-five countries were very far from meeting the goals of Education for All. Twenty-two of these (more than 60 per cent of the countries falling into this category) were in sub-Saharan Africa. Three very high-population countries of South Asia – Bangladesh, India and Pakistan – were also in this group. Most of these countries were characterized by underachievement as regards all EFA goals. School enrolment at primary level was low, gender disparities were strong, illiteracy was widespread and education quality was poor, triggering high drop-out rates, so that many pupils never made it to Grade 5;

About 800 million adults (18 per cent of the world adult population) were illiterate in 2002. About 70 per cent of them lived in only nine countries, among which were India (33 per cent), China (11 per cent), Bangladesh (7 per cent) and Pakistan (6 per cent);

Girls accounted for 57 per cent of the out-of-school children of primary school age (more than 60 per cent in the Arab States and South and West Asia), and girls' participation remained substantially lower than boys' in 71 out of 175 countries at primary level. Gender disparities were more extreme at secondary level and in higher education. In 2001, of 83 developing countries with data, half had achieved gender parity at primary level, fewer than one-fifth at secondary and only four at tertiary;

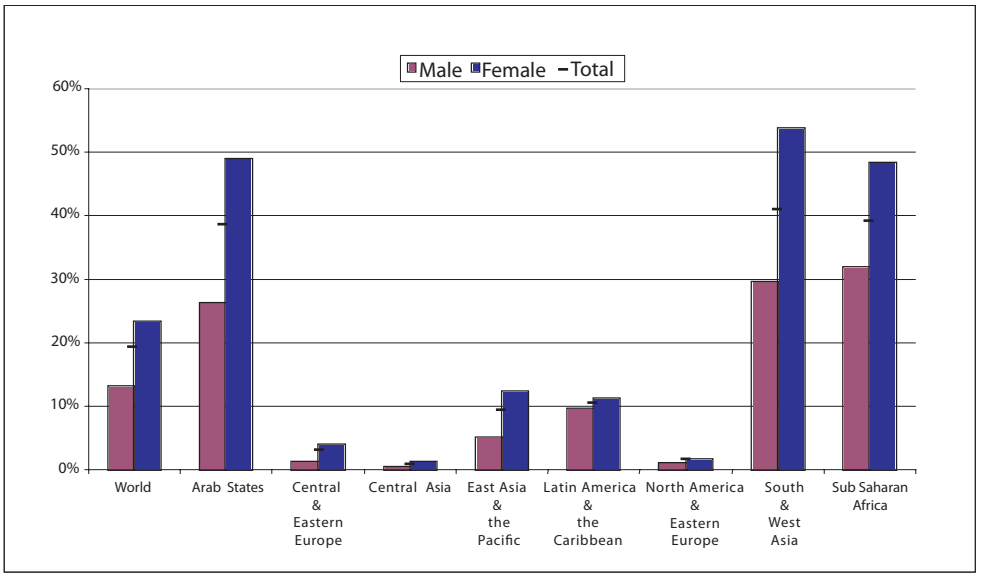
Basic education aid could double by 2006, reaching about US$3 to US$3.5 billion. This amount remains strongly inferior to the US$7 billion foreign aid for basic education that would probably be necessary yearly until 2015 if we want to meet the EFA goals on universal enrolment in decent-quality primary education.

True, there have been advances in school enrolment in all regions of the world and at all levels. Illiteracy rates have fallen worldwide and, overall, the average standard of education has undeniably risen. Moreover, the literacy rate of young people (aged 15 to 24) has risen, representing an encouraging step towards education for all. Why, then, do we speak of a crisis? In the countries of the South, universal enrolment efforts are often hampered by population growth, poverty, social barriers of various kinds and, in some instances, a lack of political will. Even when a real effort has been made in terms of schooling and literacy, this effort is not always homogeneous and can be affected by important disparities persisting in some regions or countries. School is therefore often discredited in the eyes of the public and decision-makers alike, since it is not considered as an investment guaranteeing the future of all. In the countries of the North, school seems less and less able to promote equality and to fulfil its mission of social promotion and redistribution.

In the South, primary education statistics speak for themselves (see also Figure 4.2). In 2003, some 100 million children of primary school age, most of them in sub-Saharan Africa (40 million), South and West Asia (30 million) and the Arab States (7 million) were not enrolled in school. Of these, 55 per cent were girls. Whereas in Asia, with the rapid development of education systems, the number of out-of-school children fell by some 20 per cent in a decade (1990–2000), in Africa the number of out-of-school children rose by 13 per cent, partly because of population growth and partly also because of school drop-out, as many parents take their children out of school or simply do not enrol them.[3] In the developing countries, not only has the pace of progress in education been slowing down, but inequality of access is particularly acute. The rates of access of girls and women, and of the poorest segments of the population, rural dwellers, the disabled and certain marginalized minorities are still significantly lower than those of other population groups. Low levels of public spending make for further inequalities. Another factor is that many education systems in the least developed countries have to rely heavily on international governmental and non-governmental organizations.

These difficulties, specific to the developing countries, do not preclude the fact that, in some

Figure 4.1: Adult illiteracy rates by region and sex



Source: UIS, Literacy database, June 2005.

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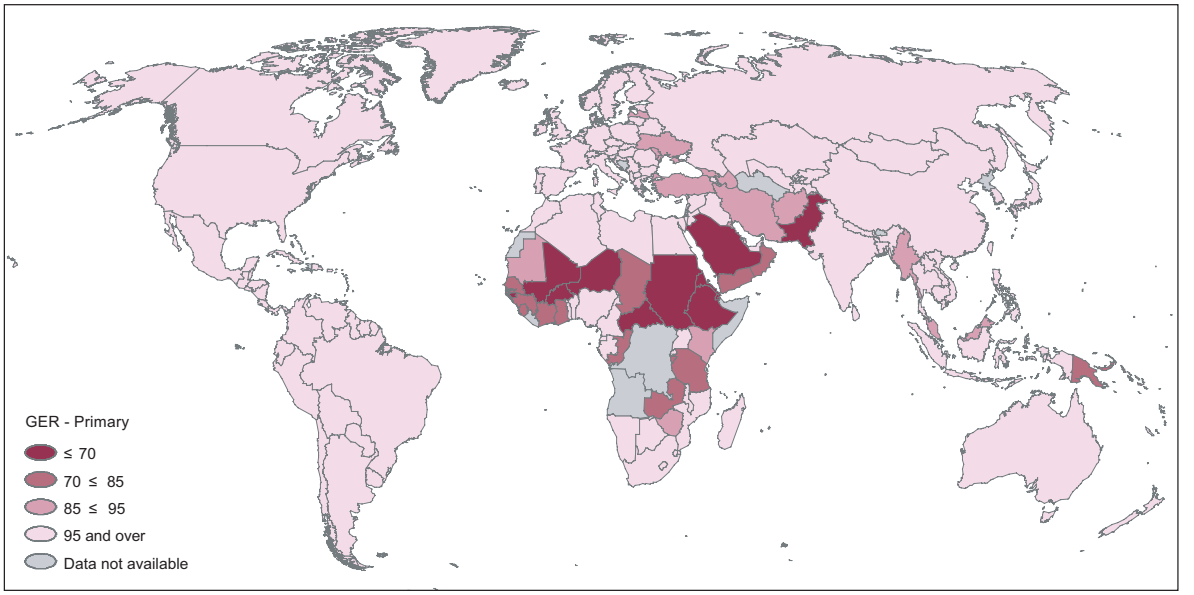
regions or in the more affluent segments of the population, there are signs of the crisis affecting the more developed countries and the countries in transition. In many countries, and notably in the industrialized countries, it is proving difficult for school to find its proper place in the social arena. It is as though it were both too closed and too exposed. Exposed to violence of all kinds (verbal, physical and social), from which it is by no means safe, but at the same time closed to the contents and the people that should be at home there. School should no doubt be reinvented – keeping its function as a safe haven, an ideal place for interaction, but without the walled-in antiseptic atmosphere.

ing for example from serious disabilities. In 1994, 94 governments and 2 international organizations – UNESCO being 1 of them – adopted the Salamanca Statement on Principles, Policies and Practices in Special Needs Education, and also a Framework for Action on Special Needs Education.[4] Inclusive schools in the strict sense of the term are still very few and far between. The situation of special needs education, for its part, varies widely from one country to another. Some already have well-established special schools for students with specific disabilities. Elsewhere, particularly in the developing countries, there are few special schools and those that exist are

Figure 4.2: Gross enrolment ratios in primary education (ISCED Level 1) by country, 2002/2003



Source: UIS, Education database, May 2005.

Gross enrolment ratio (GER): Number of students enrolled in a specific level of education, regardless of age, expressed as a percentage of the population in the official age group. The GER can exceed 100 per cent where there is a large number of students outside the official age group enrolled due to late entry and/or repetition. ISCED refers to the International Standard Classification of Education.

ISCED: International Standard Classification of Education. ISCED Level 5 corresponds to non-university tertiary education, ISCED Level 4 to non-university post-secondary education and ISCED Level 3 to upper secondary education.

School must welcome all those who need it, in all their diversity, and not exclude them. However, the universal right to education and the involvement of the international community to ensure its implementation are particularly jeopardized in practice when children have special education needs, result-

expensive and hence accessible only to a minority of children, usually from better-off segments of the population. In many countries, it is estimated that almost 99 per cent of children with special educational needs are denied any form of schooling. There is a long road ahead.

What kinds of basic knowledge?

Mapping out the configuration of basic education is no easy task. What are the criteria that should underpin the definition of the minimum basic knowledge that any individual should possess on leaving school? How can this basic knowledge be brought up to date with the rapid developments in science? In societies in which writing and counting are omnipresent and are indispensable both for everyday life – and also for the exercise of citizenship – proficiency in reading, writing and basic arithmetic remains the paramount purpose of basic education. Basic education provides the foundations on which the house or structure of one's choosing can be solidly built. Those foundations must be sturdy and broad enough to support a structure in progress without being subject to strict limits. *Learning to learn* remains the best guarantee for students to be able to go on with their educational careers, whether in formal or non-formal settings.

One of the skills needed for learning to learn is the ability to locate, classify and sort the information that is now to be found everywhere, for instance (but not only) on the internet – this is what "information literacy" is about.[5] Only if this condition is met will students, put in front of a computer, be taught not just to be simple users, but to make active, rather than passive, use of it, and to adapt it to their uses and to their culture. Proficiency in reading and in digital skills are not mutually exclusive, but rather complementary. With the promotion of self-learning, basic education for all takes on a new meaning since it no longer refers solely to an amount of knowledge that each individual should possess at a certain time of their lives. In knowledge societies, we will always be learning. But many adults in all regions of the world have never had access to basic education and have to know where to go to acquire that vital knowledge. However, the development of adult education takes time. It requires very deep changes in mentalities (particularly in the relationship to learning, since learning often remains associated to childhood) before reaching full legal age. Generally speaking, this new idea will take shape only under certain conditions. Computer literacy will develop on a wide scale only if we train competent staff and extend the use of computers at school. Moreover, such an effort requires heavy financial investments implying strong political will and bold budget choices.

We must also remember how important it is to build on and keep up through secondary education what has been learned during primary education. Indeed, in some countries, with the massive focus of international aid and national policies on primary education, secondary education has lost out. But too low a transition rate from the primary to the secondary level can have a destabilizing effect on an education system as a whole. In this case, primary education is seen as offering no prospects and, as a result, families may have less incentive to enrol their children. It is important therefore to underline that secondary education is a pivotal period, not just confined to consolidating the fundamentals but providing an introduction to more specialized subjects.

However, even though secondary education is the sector of formal schooling that has grown most rapidly throughout the world, it is still not within everyone's reach.[6] In industrialized countries and countries in transition, over 95 per cent of pupils go on from primary to secondary education, but in developing countries the percentages vary a great deal. In nineteen sub-Saharan African countries, the enrolment rate for the age group concerned is under 30 per cent (Figure 4.3). By contrast, the rates in the Arab States and in Latin America and the Caribbean are in many cases over 70 per cent. Nevertheless, girls' access to secondary education increased in all the developing countries during the 1990s, even though the overall figures may conceal significant underlying disparities. The gap between boys and girls has closed to a considerable extent in Algeria, Malawi, Mauritania, Nepal, Niger, Pakistan, Rwanda, Sierra Leone and Tunisia. In Bangladesh, the disparity has been reversed, with girls now outnumbering boys in secondary education. Overall, in countries where wide gender gaps are to be observed in primary education, they widen still further in secondary education, whereas the disparities in secondary education tend to decrease in the countries where there are fewer inequalities in primary education.

Secondary education is a stage at which pathways begin to diverge. The debate is in fact about the comparative validity of systems offering a single core curriculum up to the end of secondary education (this

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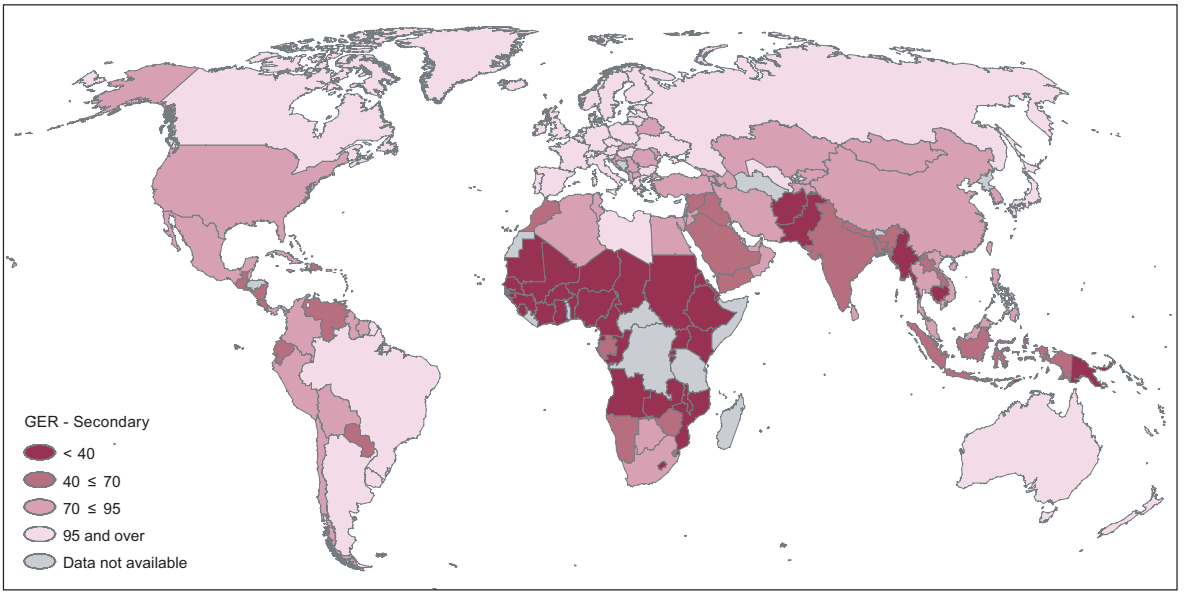
core or "polyvalent" model is predominant worldwide, and is to be found particularly in North America, Asia and the Pacific, the Arab States and sub-Saharan Africa, where the proportion of pupils enrolled in general courses of study is higher than those enrolled in technical education) and than those offering a choice between general, technical or vocational courses. This "differentiated" model was, until recent years, very much the rule in Central and Eastern Europe. Should we offer a single core curriculum and run the risk of excluding those who do not fit, or should we prefer a more flexible system and run the risk of confining pupils in courses that are sometimes seen as demeaning? Table 4.1 offers six scenarios for the future of schooling.

A pragmatic vision of secondary education consists in looking at the way it is to be organized in terms of future employment opportunities in a given country. Seen in this light, the multicourse system would be a good response to present and anticipated job prospects in many developing countries, particularly as what we often see today in those countries is that those – the minority – who pursue their studies tend to opt for long courses of general study leading to competitive examinations for the civil service, whereas there is a shortage of highly skilled manual workers and middle-level supervisory personnel. If we look at the development prospects in the South of industries such as the agrifood business and the textile trade, and also the health and social sectors, there is a strong likelihood of a growing need for qualified personnel with ISCED Levels 3, 4 and 5B qualifications. The introduction of vocational and technical courses, with alternating periods in school and in the workplace, would provide openings for the students concerned. But if such an approach is to offer real prospects for the future, technical and vocational education should be given a higher profile and enjoy greater prestige in society, as underlined during the Second International Congress on Technical and Vocational Education (Seoul, Republic of Korea, 26–30 April 1999). Only then would it be seen as a real link in the chain of lifelong education and not, as now, a passport to exclusion or social insecurity. Whatever the option chosen, it seems vital to maintain a solid core of general culture, seen as an ability to apprehend, not as a specialist but in an informed manner, the postulates, the literature, the methods and the key issues pertaining to all the subject areas that structure

Figure 4.3: Gross enrolment ratios in secondary education (ISCED Levels 2+3) by country, 2002/2003



Source: UIS. Education database. May 2005.

knowledge.[8] The development of multidisciplinary or interdisciplinary approaches will help mitigate the risk of piecemeal knowledge that specialization inevitably entails. Will these approaches be sufficient? Or will we need a radical reshaping of the way programmes are organized today? These are the key questions of any forward thinking in education.

Lifelong education for all

Lifelong learning

The idea of recurrent education emerged in the wake of adult education and what at the time was called "popular" education. To begin with, adult education was seen as a personal option offering the prospect of catching up socially or of vocational retraining, but by the 1970s lifelong education came to be seen as part of a broader vision of a person's educational career, with education viewed as a continuum "from the cradle to the grave". In particular, such a vision inspired the reflections of the Faure report. Starting out from the premise that initial training was inadequate and incomplete, and should henceforth be regarded as simply the basis for learning to learn, to be constantly reactivated throughout life, lifelong education for all has become one of the cornerstones of self-construction. Originally the question of adult

Table 4.1: Six scenarios for the future of schooling

The OECD's Centre for Educational Research and Innovation (CERI) has proposed six scenarios for schooling in the period up to 2020 in the industrialized countries, which can be grouped by sets of two into three models:

The status quo extrapolated	Scenario 1: Robust bureaucratic school systems	Scenario 2: Extending the market model
Re-schooling	Scenario 3: Schools as core social centres	Scenario 4: Schools as learning focused organizations
De-schooling	Scenario 5: Learner networks and the network society	Scenario 6: Teacher exodus

On the basis of Alain Michel's work, *three scenarios for schooling in the knowledge societies* may be proposed, in a broader international perspective than that of the industrialized countries alone.

Scenarios 1 and 2: Dynamics of the *status quo*

Education systems do not undergo radical change but evolve sufficiently to perform their traditional tasks satisfactorily and to stabilize the imbalances resulting from demographic, technological and economic change.

The public education sector remains broadly dominant, especially in primary and secondary education. Bureaucratic-type regulation is still prevalent, although with schools more decentralized and autonomous, and the development of assessment approaches.

Periodic revision of curricula, growing use of ICTs, new forms of partnership with local authorities, the corporate sector and associations, greater opening up to international providers and the maintenance of international aid in the least developed countries – these are all factors enabling schools to keep their place in society.

Teachers' unions remain strong but fail to secure any significant rise in teachers' salaries or enhancement of their social status. In some countries, this may lead to a shortage of teachers. There is a tendency towards increased private sector involvement at all levels of education, but particularly in higher education and continuing education for adults.

Scenarios 3 and 4: Public schooling reinforced, as central to local, national and international society

Education becomes a priority in most states. Public funding increases, both at state level and by local or regional authorities and international organizations. The objective of social equity prompts positive discrimination policies and greater autonomy for schools so as to ensure greater relevance to specific local conditions and to foster innovations in the field.

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education appeared to reflect concerns specific to the industrialized countries and did not seem very relevant to countries where basic educational needs are far from being met. The potential for empowerment contained in education matched the aspirations of the developing countries. Lifelong education should be seen, today, as one of the preconditions for development conceived as an ability for adaptation and autonomy, as well as a means for ensuring the sharing and flow of knowledge worldwide.

Lifelong education can provide a response to the growing job volatility that most forecasters predict. Increasingly, people will be changing jobs several times in a lifetime, and education can no longer be limited to offering a single specialization, but must develop each person's ability to change course during his or her lifetime, and to cope with economic and social change. But the labour market problems also had the effect of sometimes overemphasizing the economic and occupational implications of lifelong education and sidelining, as a non-essential bonus, the personal development aspect. In fact, lifelong education extends far beyond the time spent at work, and goes on before, during and after an individual's working life. Lifelong learning is a process that should ideally be meaningful at three levels which, though closely linked, can be ranked differently according to the individual and the period in life. In short, there are

To allow a posteriori state oversight, new steering instruments are put into place: improved statistical indicators, new contractual arrangements and assessment procedures, better communication, more personalized human resources management, etc.

Schools become learning organizations whose special status is in phase with the development of the knowledge society. Increasing use is made of ICTs, particularly for more active involvement in learning by students and teamwork. Partnerships, even international partnerships, develop on a much wider scale. School and university establishments play a greater part in adult education and become core cultural centres for local communities.

The scope of the teaching professions widens to address new target groups. Teachers are recognized as fully-fledged professionals; higher incomes attract to the profession people who have previously been in other jobs. The private sector's share in primary education is still small, slightly greater in secondary education, and greater still in higher and adult education.

The state (centralized state or state/province in federal systems) is still the main decision-making authority in education. At the international level, a far-reaching plan for international aid is devised to finance action against illiteracy and functional illiteracy.

Scenarios 5 and 6: Commercialization of education in the network society

Public sector schooling progressively and ineluctably declines as a result of its inability to meet the new challenges and of the erosion of State prerogatives.

The growth of educational consumerism, due to the importance of diplomas as the key to employment, gives rises to a boom in the education market and the establishment of new private schools. These are strong on innovation, but weak on integration. Social and political pressure leads to the development of "education voucher" systems, but allowing for freedom of choice between public and private schooling. In the latter case, parents pay for the difference in school fees. Competition among private schools generates a new labour market for teachers who are attracted by higher salaries and better working conditions.

Grouping of students by ethnic or religious communities leads to the progressive erosion of national public education systems. Regional or local inequalities increase. A public sector subsists, mainly to cater for disadvantaged children, but public schooling no longer plays its "social integration" role.

New teaching profession profiles emerge: educational consultants, specialists in distance teaching, multimedia module designers, specialists in the assessment and certification of formal and non-formal educational achievement, communication and education market experts, etc.

At the international level Official Development Assistance (ODA) is at a standstill and falls short of needs. Illiteracy and functional illiteracy remain at high levels and even increase in the LDCs. Meanwhile, however, a distance higher education and continuing education market flourishes for the skilled workforce. The gap between rich and poor countries widens.

three levels of development: personal and cultural development – the meaning a person gives to his or her life; social development – one's place in a community, citizenship, political participation and living together in society; and, lastly, professional development – stable quality employment and its links with production, job satisfaction and material well-being.

Lifelong education thus entails transforming, redistributing and re-harmonizing individual and social periods of learning. Over a lifespan, several periods of education and training can be identified.

The first is pre-primary education, which is both an effective introduction to later schooling and a way of raising the living standards of the children who are most exposed socially. The second is basic school education, and the third is that of education and training after compulsory schooling.[9] The fourth period is that of "continuing training" after the completion of initial schooling. Here again, opportunities for access vary greatly from one country or region to another. But generally speaking it is still anything but "lifelong". Some public policies give short shrift to this fourth period, leaving it to the corporate sector to train its workers where necessary, or abandoning the vast continuing education sector to the market. The influence of professional or family constraints also entails an unequal distribution of opportunities. The fifth period, after working life, is no doubt where there are fewest constraints. Assessment, in particular, is no longer as crucial as during the earlier periods, and what distinguishes this period from the others is the freedom for people to pursue their own inclinations, interests and social activities once released from the restricting influence of their professional activities.

If we are to abide strictly by the principle of lifelong education for all, then all five periods should receive equal attention from decision-makers and social actors. But, in fact, this is far from being the case. Public policies concentrate on the second period. As a result, access by adults to lifelong education for all is very uneven; few countries actively encourage opportunities for going back to school or university. Structural resistance also comes from labour market constraints. The individual and social costs of lifelong training increase as individuals proceed with their working careers. Furthermore, as the expected returns from lifelong education decrease with age, simple economic arithmetic points to maximum investment in the younger generations. But this works to the detriment of continuing education and training, particularly as all the indicators show that there is a close correlation between access to continuing education and the level of initial education: the higher it is, the greater the will to embark on further training and the higher are the chances of success. And so we are caught up in both a "virtuous circle" (it is less expensive to invest early in education and training, and more profitable for both the individual and the community) and a "vicious circle" – for this rationale makes it even harder to break out of the mould forged by initial education; makes subsequent retraining more difficult; excludes the large number of people who have derived no benefit from the growth of initial schooling; and minimizes the importance of sustaining knowledge on an ongoing basis. But at a time when the tendency in more and more societies, especially in the industrialized countries, is towards raising the retirement age, how, in the long term, will it be possible for lifelong education and training to continue to be the preserve of the most highly educated and youngest individuals?

Giving more importance to early childhood education

The very first period, that of *early childhood education*, has traditionally been left in the hands of families (see Figure 4.4). Even today, education for the under 3 year-olds is still largely provided in informal settings, whereas in many countries there is a preschool cycle for the over-3s that is perfectly incorporated into the education system. Today, pre-primary education can no longer be considered to lie outside the sphere of political action. At the international level, increasing attention has been given to this age group in recent years. This interest springs from an awareness of several factors starting with the acknowledgement of the importance of a stimulating environment at an age at which emotional and sensory experience is not without consequence for the development of a child's faculties. Secondly, this interest also stems from a concern to protect very young children from

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the risks inherent in unstable social, family and health environments, and very often the absence of working parents. In that sense pre-primary education is part and parcel of a wider set of social issues, including family policies and their connection with women's work, the extent to which parents are educated and informed, and various forms of prevention, notably in the health field. This concern for childhood care suggests that pre-primary education does not boil down to the idea that a child's fate is determined in the first three years of life, as the media "hype" to be seen in some quarters on the subject of early learning would have us believe. A deterministic view of the importance of the first few years in a child's life for his or her future development entails the risk of overlooking older children's and adults' ability to learn, and the importance of investing in lifelong education

Early childhood care and education is still relatively new compared with the long-standing concern for primary education. In many countries it is still very much an urban phenomenon and concerns children with two working parents. It is not easy to measure this type of education, much of it being informal, and every sociocultural environment has it own specific, usually appropriate, approaches.

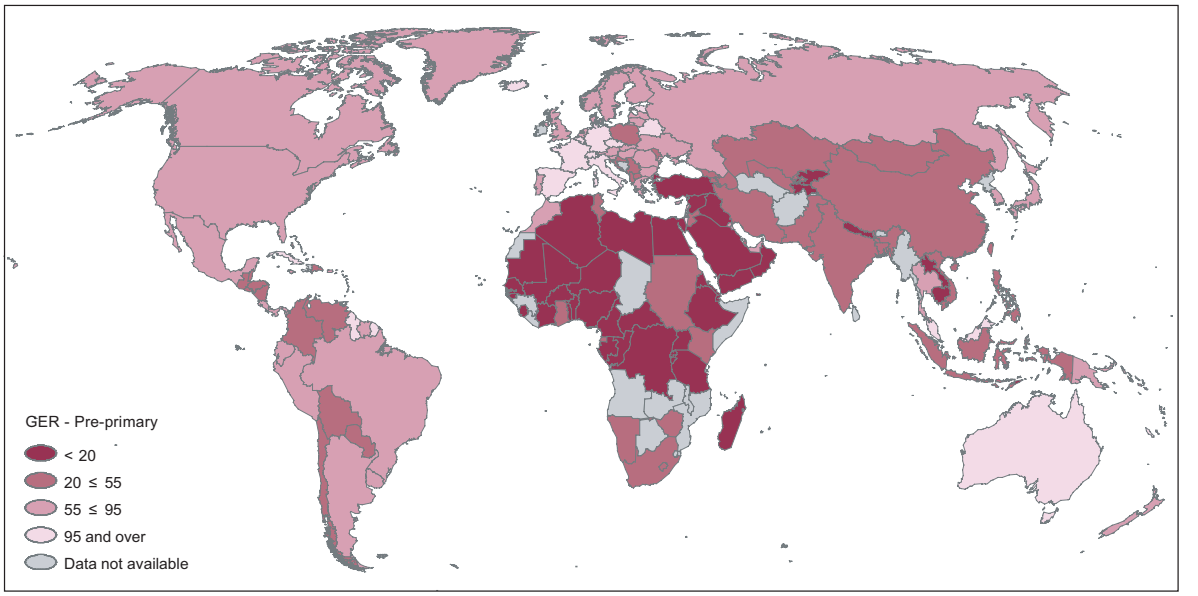
What, in short, is to be encouraged, is clear, well-reasoned information on the current state of knowledge about early childhood cognitive development, and access to appropriate educational services for families that are unable to cope with all these tasks. The fact is that this provision is very patchy. A point to note is that some developing countries, such as Jamaica, Mauritius, the Seychelles and Thailand, already have (in 2002/2003) high enrolment rates (75 per cent or more) in early childhood education programmes. Cuba has achieved universal early childhood education.[10]

The issues of lifelong learning

One of the most remarkable features of the new educational paradigm is the proliferation of potential places of learning and training (see Box 4.3 for one example). If education becomes a continuing process that is no longer confined to a particular place and time, preceding working life or alternating with it, what must be more fully acknowledged is the scope of informal learning, whose potential today is vastly increased by the opportunities opened up by the new technologies. If we look not just at the activities of conventional educational institutions (teaching-centred paradigm) but also, increasingly, at the forms of learning open to individuals and communities (learning-centred paradigm), we see that there is a wide range and variety of places and institutions that can legitimately claim to be imparting knowledge. This is why one of the important aspects of lifelong education is the need for continuing learning to be socially recognized as such. Lifelong education policies must incorporate these many different places and forms of learning, including self-education. This can be seen in embryo in the systems known as "validation of experience". What is at stake here, then, is also a demystification of formal certificates or diplomas as attesting to completion of a course of study and as a passport to working life, and the predictable emergence of new forms of recognition of educational careers and skills. This transition is not always easy, especially in countries where diplomas or successful performance in examinations is still very highly regarded as the qualifying factor. In the developing countries, this point is just as crucial, as the inadequacies of education systems and infrastructures for storing and disseminating knowledge make the non-formal education sector vitally important. With the marked tendency in many countries to cut back on public spending on education, alternative financing and co-financing arrangements will need to be developed. True, we are already witnessing the growth of new and far more varied private educational provision. But the "for all" imperative demands that access to such provision should not depend solely on people's financial resources, and one of the aims of public policies will therefore be to make sure that individuals and groups are not de facto excluded from lifelong education for all.

This general trend in learning is open to some criticism. Some experts have pointed out that, with the growing calls for lifelong education, coupled with an expanding vocational training industry, there is a danger of people becoming permanently cast in a mould to suit the demands of the economy and

Figure 4.4: Gross enrolment ratios in pre-primary education (ISCED Level 0) by country, 2002/2003



Source: UIS, Education database, May 2005.

employers' expectations. The permanent sustaining of a stock of profitable knowledge capital can therefore generate perverse effects and a progressive blurring of the boundaries between workplace and place of learning, between leisure and productive activity.

To avoid these pitfalls, it is important to recall that citizens must be able to express their own educational aspirations and choices. As strongly underlined by Amartya Sen, in his analyses on development as well as on education systems, the complexity of development cannot be subsumed to a mere management of economic parameters. Human development must go hand in hand with freedom of expression, and it is the role of education to help the individual reach this freedom of expression. It is not lifelong education as such, but insufficient and poor-quality education, that may lead to the individuals' subservience.

Against this background, sweeping statements of intention are not enough. What is needed is a policy targeting specific groups that may find themselves outdistanced or even *pushed out* of the mainstream of the learning societies – people with low incomes, ethnic minorities, migrants, young people who underachieve at school, the unemployed, poorly qualified, low-skilled workers, the disabled and isolated elderly people. Generally speaking, individuals with the skills needed to manage and organize their own long-term learning paths are not the majority. It also means taking due account of the conflicting perceptions of lifelong education. Some see it invariably as a means of increasing their social capital, whereas others view it as a potential source of insecurity. Some salaried workers, for instance, fear that their jobs may be at risk if they spend too much time on training activities, while others, particularly older people, may also feel a sense of vulnerability at being back in a learning situation, ill-at-ease with what they perceive as a negation of everything they have learned and having to submit to forms of assessment and work to which they are not accustomed. There are ways of dealing with these difficulties. The proposal put forward by the International Commission on Education for the Twenty-first Century to introduce a "study-time entitlement" or education voucher or credit system is most interesting (Box 4.4) and would obviously require an important financial effort. In an environment where technological renewal is becoming the norm, and where instability represents a factor of insecurity for the individuals, educational careers can offer both flexibility and security through a concerted

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Box 4.3 Community learning centres

The Asia-Pacific Programme of Education for All (APPEAL), a UNESCO regional programme launched in 1997, focuses on the eradication of illiteracy, the universalization of primary education and the promotion of continuing education for development. The programme is behind an initiative launched in 1995, which led to the establishment of Community Learning Centres (CLCs) intended for children of all ages – youth and adults. The centres are aimed at personal empowerment and the promotion of community development. The project is currently being implemented in eighteen countries across the Asia-Pacific Region.

CLCs provide lifelong educational services to a broad range of people who have least access to education, particularly pre-primary age and out-of-school children, women, youth and elderly people. Methods and contents vary according to the different locations of the CLCs and their target groups' needs – conventional primary education, active learning methods, training in the new technologies, fostering increased social participation, literacy, agronomic counselling, environmental awareness, etc.

The centres are based on community mobilization, flexibility, links with other community development activities and cooperation with information services (libraries, multi-media centres, etc.).[11]

action of the state and the private sector leading to the production of new skills, away from mere charity.

What is more, placing individuals in an educational continuum in which their knowledge, skills and outlook on the world is continually renewed and consolidated, might provide them with the benefits of advances in new technologies and, above all, the implementation of efficient and diversified systems of distance education.

New inputs for education: institutional reform, pedagogical research, teacher training and quality of education

Education and quality

Universal enrolment and relevant educational provision will not, on their own, guarantee the effectiveness and success of education, which depends also on *quality*. Some of the factors conducive to quality have long been identified and have a lot to do with expenditure on education notably by the state (see Box 4.5).[12] Among them are the student/teacher ratio, teacher education, the quality of available infrastructure, the equipment available to both students and teachers, etc. But even in the most affluent countries, which in theory can boast universal enrolment, it is estimated that up to a quarter of the population do not have the skills and aptitudes needed to participate fully in life in society and in employment.

This is evidence of a *major shortcoming in existing systems and institutions*, to which we referred earlier in connection with basic education. We must try to ascertain the causes of this crisis. It is often attributed to the inertia of education systems – their resistance to any radical social technological change. Thus, education would lag behind because of the widening gap between a booming education demand and the decreasing efficiency of conventional education systems. According to some experts, there is a gap between the small number of media on which conventional education still heavily relies and the diversity offered by the advances of communication and information technologies such as the cinema, the radio or the internet. This discrepancy tends to accentuate the relative slowness of educational establishments to come to terms with the real world, and to widen the gap between what pupils are taught in school and what they see around them in everyday life. They are left with feelings of scepticism, disaffection and confusion about the ends to be pursued and the reasons for pursuing them.

And so, the end purposes of education must be redefined – failing which the hopes raised by the digital information technologies will not be achieved. The use of the new technologies must, then, be incorporated

Box 4.4 A proposal by the International Commission on Education for the Twenty-first Century, chaired by Jacques Delors: "study-time entitlement"

In order to guarantee access by all to lifelong education, Jacques Delors proposed the introduction of a "study-time entitlement", a sort of education voucher that would entitle each individual to a "capital" of a number of years of education that he or she could draw on according to his or her own choices, career, school experience and timetable. He suggested that, at the time of the report, a study-time entitlement could be granted at the end of compulsory education.

Such an approach would effectively give those who leave the formal system at 16 or 18 years of age, a second chance. The education voucher would, furthermore, aptly meet one of the major requirements of lifelong education in the twenty-first century – the personalization of educational careers.

into a broader strategy than the one to which it is usually confined, not always successfully.[13]

Furthermore, despite the considerable advances in educational research, school institutions are in danger of missing out on their benefits by failing to come to grips with the discrepancy between their stated aims and the social realities they run up against. Educational research and proposals have focused, in recent decades, on new learner-centred approaches to education. These new approaches have taken over from the conventional model in which learners are often considered as the passive receptors of knowledge to which they have not contributed. On the contrary, one acquires knowledge not just by receiving it, but by actually constructing it. Knowledge is built up within a network of interactions with others (teacher, schoolmates, family, society, etc.). The teacher here is seen as a guide, a person who accompanies the learning process, rather than an authority imposing codified knowledge that the learner must simply assimilate or absorb.

The new technologies can play a significant role, provided they are not just used to substitute media technology for traditional classroom interactions and exercises. One of the most promising prospects is the application of new technologies to the problem-solving model. The model, which teaches how to solve problems instead of offering ready-made solutions, confronts students with didactic situations in which there is an obstacle to be overcome. Problem-solving combines practical experimentation with theoretical knowledge in order to arouse the imagination and stimulate motivation. Such a technique is a promising source of inspiration for the design and production of educational computer tools, both in schools and in institutions offering education outside the formal education context.

The most thought-provoking vision for the future of education is the constitution of new humanities to occupy the void gradually left by outdated literary traditions, to bridge the gap between scientific knowledge and the human sciences, and to provide a synoptic grasp of current knowledge. The new humanities would be consonant with the complex thinking advocated by Edgar Morin, which he associates with the need to promote knowledge conducive to a grasp of global and fundamental issues that incorporates partial and local knowledge.[14] If a field of study is not just to be an accumulation of facts, a dead letter, it is vital for learners to know where the knowledge they are required to learn comes from and how it was developed. How do scientists work? What motivates them? What is done in a laboratory? Why do writers write? What are the human sciences about? These are crucial questions all too often glossed over in teaching today, but which would hold considerable appeal if there were more interaction with the intellectual circles concerned.

The magnitude of these challenges for education calls for *trained teaching staff with updated knowledge about the latest technological, scientific and epistemological developments,* both in their own subject area and in educational processes themselves. Teacher training must therefore extend beyond the bounds of competency in a particular discipline and must include, as components in their own right, training in the new technologies and study of the ways and means of stimulating the students' motivation and personal commitment. What they will

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Box 4.5 The cost of free education

The high hopes risen by the massive commitment of many countries and international institutions in favour of free education at the "elementary and fundamental stages", to quote Article 26/1 of the Universal Declaration of Human Rights, have been checked by the booming rate of school enrolment, particularly on the African continent.

Since the mid-1990s, many African countries such as Malawi, Lesotho, Uganda, Cameroon, the United Republic of Tanzania, Zambia and recently, Kenya, have instituted free primary education. In 2002, the World Bank, which encouraged families to participate in the purchase of textbooks in the 1990s, revised its position as they became aware that such expenses were impossible for the poorest families.

This policy resulted in an immense flow of pupils, raising various short- and mid-term issues for the education systems of these countries. The *EFA Global Monitoring Report 2005* underlined that advances in school enrolment are, for the moment, generally correlated to a rise in underachievement in the courses where the student/teacher ratio is too high. Some experts fear that this important increase in school enrolment may have consequences on the quality of education. How can we reconcile quantity and quality in the long term?

Although the role of governments is essential for the implementation of reforms aiming at greater education quality, the success of education for all also depends on international concertation and requires sustainable financial support. Rather than limiting access to education,[15] we should encourage compatibility between free education and high quality standards through a steady rise in international support as well as a sustained effort from the countries involved.

In 1996, the International Commission on Education for the Twenty-first Century, recommended that a quarter of development aid be devoted to education.[14] With this in mind, we can recall the suggestion made within the framework of the International Forum on Education for All organized by UNESCO, the World Bank, UNICEF and UNDP, that the debt of the poor countries be converted into investments in human development, with a particular focus on education.[16]

need to learn, then, is not so much a technical skill as the ability to *choose* from among the increasingly abundant array of teaching and other software and educational programmes on offer, those that are most appropriate. This is particularly true in the countries of the North. For the countries of the South, the main priority consists in focusing on more flexible, learner-centred teaching practices. The teaching profession is, in fact, ideally suited to distance education using the new technologies. Teachers, with their experience in handling and passing on knowledge and know-how, can make the most of the new media. On a last point, given the objective of gender equality in education, teachers must be made more aware of gender stereotyping, particularly since students' incentive to study a particular subject is not strictly limited to acquiring skills or qualifications, but often hinges also on personal identity, including gender identity.[17]

Seen in the context of lifelong education, teaching may move closer to tutoring, including distance tutoring. The role of the teaching profession, understood as a professional community sharing the fruits of experience and practice, whose members provide face-to-face tuition to learners, remains nonetheless essential in basic education. The problem is that there is likely to be a shortage of primary- and secondary-school teachers, especially in industrialized countries, for economic and demographic reasons, but also in developing countries, because of the needs resulting from the growth in population, budget issues and lack of training resources. In sub-Saharan Africa, this phenomenon is accentuated by the devastation wrought by the acquired immunodeficiency syndrome (AIDS).[18] The use of the new technologies will not make it possible to save as much on staff as was thought.[19] And yet, we are faced with the same paradox in education today as in other areas recognized as socially crucial, such as certain branches of research[20] – the key players are experiencing a marked decline in their social status.[21] The teaching profession is less and less attractive to young graduates because it does not enjoy sufficient social status and is not well enough paid. The only way of reversing this trend is to take practical steps to upgrade the profession's status and teachers' working conditions and salaries, in accordance with the International Covenant on Economic,

Box 4.6 The Virtual High School

The Virtual High School (VHS) project was launched by a team from Massachusetts (United States) carrying out research on the use of technologies in learning. It was opened in 1995–1996. Financed in its early years by generous funding from the United States Federal Ministry of Education allocated to all public schools in the city of Hudson, the scheme was able to carry on with the establishment of a not-for-profit corporation that became self-financed within the space of two years. In 2003, some 200 high schools in 21 states and 1,500 students per semester were involved in the scheme, with 150 courses on offer. The originality of the project lies in an approach centred on high schools, which are invited to become members of a "collaborative". In order to participate, schools are required to identify from among their teaching staff one or more teachers who undertake to teach one of the 150 courses. Better still, some teachers agree to take a training course in online course design. The quality of the course is guaranteed by outside counsellors and the support of the VHS Inc. team. All volunteer teachers receive online training in the management of discussions forums and the monitoring of the students enrolled, which require skills and abilities that are different from those needed for face-to-face learning.

The main reason why schools join VHS is to extend their range of courses at little extra cost. These can, moreover, be organized flexibly. There are very few courses that are a substitute for regular basic courses – the guiding principle is complementarity, not replacement. More recently, summer courses have been opened to students who have failed a classroom course during the year. Examination pass rates and attendance rates are high.

Hundreds of teachers have thus acquired expertise from which thousands of students have benefited. The results of the project and the reactions to it have been mostly positive, despite two major difficulties encountered by its organizers – the lack of educational policies on online teaching in many states and the absence, in online education in general, of "quality standards" to be met by the designers and advocates of this kind of education. A considerable effort is therefore needed to guarantee the quality of the courses and of the teaching.

Social and Cultural Rights (see Box 4.1). In an attempt to make up for the shortage of teachers in rural areas, China, for instance, has raised teachers' salaries in rural areas, and they are now higher than those of some local officials. Steps should also no doubt be taken to avoid the disconnection from research work that is so often observed when teachers practise their profession outside the university context.[22] Building bridges between primary and secondary education, such as long existed in the industrialized countries, would be of considerable benefit to individuals and institutions alike.

In short, there is no "ready-made" form of education to fit all educational contexts. In this respect, language teaching should be encouraged from the primary level of education, through language awareness initiatives and the teaching of at least two foreign languages from the first level of education. This would allow the development of knowledge of "the Other" and of other cultures. Innovative programmes must be regarded as a source of innovation and not as resource banks that can be dipped into for "ready-made" components – be they teaching materials, approaches or concepts.

"E-learning": new technologies and distance education

Overcoming geographical obstacles

The new technologies are changing the face of education with the development of *e-learning*. The term covers a wide range of applications of these technologies, from the use of computers in the classroom to the entirely online distance education programmes that are beginning to emerge. Virtual classes offer personalized monitoring coupled with flexibility in the management of learning and greater autonomy in the acquisition of knowledge. Apart from the institutional programmes on offer, the internet is becoming the foremost medium of self-instruction by providing tools for informal learning and allowing the creation of virtual classes.

The internet has already given rise to virtual communities of learners, which will predictably increase in number and diversity at all levels of education. Large distance education institutions have emerged, in the

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developing as well as the industrialized countries. How many people are aware that, out of the eleven largest open universities in the world, eight are situated in the countries of the South? Although the experience of these open universities enables them to make the most of new technologies, financial investments in virtual campuses remain very costly. As underlined by the Plan of Action of the World Summit on the Information Society, the establishment of knowledge societies is impossible without important efforts from the rich countries and an active commitment from the international community to encourage the emergence of technological infrastructures in developing countries. Without material infrastructures, virtual education is but a mirage. Electronic networks make transmissions faster and cheaper, but we should not forget that this requires major equipment. In order to enjoy functional virtual campuses, computers and connections do not suffice. Whatever the hemisphere, powerful computers, high speed web connections, and competent engineers and net administrators are necessary if one wants, for example, to have easy access to the intranet or to download teaching material.

Some prestigious institutions have gone a long way towards increasing the educational potential of the Web. A case in point is the Massachussetts Institute of Technology, which has undertaken, through its OpenCourseWare project, to make all its course material – plans, notes, exercises and solutions, and reference works – available online.[23] Some 500 courses are already available, with another 1,500 expected in the next three years. Knowledge of a high standard is thus accessible to students all over the world. The same policy of openness and sharing of intellectual resources is to be seen in countless local initiatives, with the daily publication of 7 million new pages, many of them with no print equivalent. *E-learning* is beginning to make an appearance in secondary education and is directed at three target audiences: learning at home (this concerns about 1 million pupils in the United States), schools in difficulty for which an alternative is needed, and secondary schools that cannot teach everything and want to supplement the range of courses on offer with those available on the internet. The developing countries are following this trend, as the example of the Indian National Open School shows. As can be seen, distance education can meet very different educational needs and challenges, and its development will involve the use of far more flexible models than those used in traditional education. The improvement of online courses and the attractiveness of the diplomas on offer open up new opportunities, especially in the most lucrative sectors such as high-level university education, vocational training and continuing education. In the short term, mixed models are expected to expand most in formal education – the same does not, of course, apply to informal education. In the United States, for instance, the Virtual High School project is based on complementarity between distance education and face-to-face teaching – not on substitution (see Box 4.6).

A government initiative such as the National Grid for Learning in the United Kingdom is another good example, linking as it does as many libraries, museums, schools and learning centres to form a far-reaching virtual educational resource centre.[24] These ubiquitous repertories of knowledge are therefore set up to be accessible everywhere. In this sense, the very term "distance education" is ambiguous, as it can be said that connectedness spells the death of distance. This is why, when we talk about new forms and schemes for distance education, we must think in terms of new ways of putting individuals and knowledge face to face.

At the same time, the expansion of distance education does not herald the end of the economic constraints on access to knowledge. *E-learning* will be up against the same challenges as research and other activities involving a high degree of knowledge – the challenges of access. We are beginning to see the patenting of learning methods, and some teachers are demanding copyright for their courses. Politicians are slow to respond and to take decisions on crucial questions such as: What kinds of exemption from copyright are acceptable for education and research? How can we restore to the notion of *fair use* so dear to Thomas Jefferson in his day its full meaning and full scope?

In the long term, *e-learning* is expected to do more than bring about radical change in the pace of learning. Some experts believe that open and distance

education may replace schools and the classroom model altogether. Some are already looking ahead to a time when, in addition to learning at home, there will be community learning centres with no separation between age groups and no distinction between periods of work and holidays. Intended for children and adults alike, they would provide guidance and counselling services, and work stations linked to databases and to the Web. Teachers would be there to give guidance to learners, with simulation occupying a prominent place.

But for the time being, generally speaking, the relationship between distance and learning has yet to be clarified, for communicating does not suffice to put a message across. It takes more than retrieving and exchanging information by a click of the mouse to build up and share knowledge. This is why there are still unanswered questions about how valid *e-learning* may be. Can virtual communities really replace real-life communities in every respect? Can distance tutoring be conducted on trust? How can we be sure that the sharing relationship inherent in teaching and learning will not suffer from the many and varied ways in which knowledge can be acquired?

Background resources

Arrow *et al*. (2000); Bateson (1973); Brunner (2001); Buarque (2004); Charpak (1998); Delors *et al*. (1996); EFA Global … (2002, 2003/2004 and 2005); Field (2000); Freire (1980); Jantan H. *et al*. (1997); Jarvis (2001); Ji (2004); Kim and Nelson (2000); Michel (2001); Morin (2001); OECD (2001*a*); OECD/CERI (1996, 1999 and 2001); Portella (2002); UNAIDS (2004); UNDP (2003); UNESCO (1994, 1999, 2000*b*, 2001*b* and 2002); Vérez. (2000).

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Chapter 5

The future of higher education

Institutions of higher education are destined to play a fundamental role in knowledge societies, based on radical changes in the traditional patterns of knowledge production, diffusion and application. Over the past 50 years, these institutions – modelled for the most part on the European university – have experienced an explosive growth in student numbers, described by some as a "massification" of higher education (see Box 5.1). Educational provision is becoming more varied as knowledge advances. Constraints on government spending are inducing more and more establishments to envisage other modes of financing, notably from private sources. As a result, higher education in most countries now consists of a complex network of public or private institutions – polytechnics, engineering faculties, business and management schools, distance education centres, research laboratories, company subsidiaries, etc. Are we to conclude that there no longer exists a single model of the university, as was the case in the nineteenth century?

As a result of the decline in public funding, higher education establishments are often forced to turn to the private sector to give themselves greater margin for manoeuvre. The risks of "commoditization" in the field of higher educational are very real even if all countries do not find themselves in the same situation in relation to such challenges. Those with a long university tradition are generally less threatened by this diversification of higher educational provision.[1] The most worrying case is that of countries lacking a university tradition: the advent of knowledge societies is often linked to the emergence of full-scale *markets* in higher education. This has prompted some commentators to speak of the "Macdonaldization" of knowledge. There is a need to ensure that these trends do not lead to a distortion of the original missions of higher education.

While there is no single organizational model, it is important to ensure emerging systems of higher education a high enough level in terms of quality, relevance and international cooperation if they are to play their full role as key components in building knowledge societies. Generally speaking, most United Nations agencies, programmes and institutions have a purely sectoral approach to these problems. UNESCO is the only one in a position to undertake this mission and to carry out the tasks needed to ensure the quality and relevance of systems of higher education, while at the same time furthering the development of international cooperation in this field.

Towards a market in higher education? Issues of funding

> The diversification of funding sources reflects the support that society provides to higher education and must be further strengthened to ensure the development of higher education, increase its efficiency and maintain its quality and relevance. Public support for higher education and research remains essential to ensure a balanced achievement of educational and social missions. (World Declaration on Higher Education for the Twenty-first Century: Article 14, Financing of higher education as a public service, subparagraph (a).)

The production and diffusion of knowledge have a cost. Throughout their history, human societies have devised and experimented with different means of financing these costs. With regard to teaching and education, irrespective of the relevance – or indeed excellence – of a system, account must be taken not only of the cultural, social and cognitive costs, which cannot generally speaking be evaluated in monetary terms, but also of the cost of gearing the funding system to the missions and to the explicitly or implicitly proclaimed goals, together with the costs of transition from one funding system to another – be they financial, social or cultural.

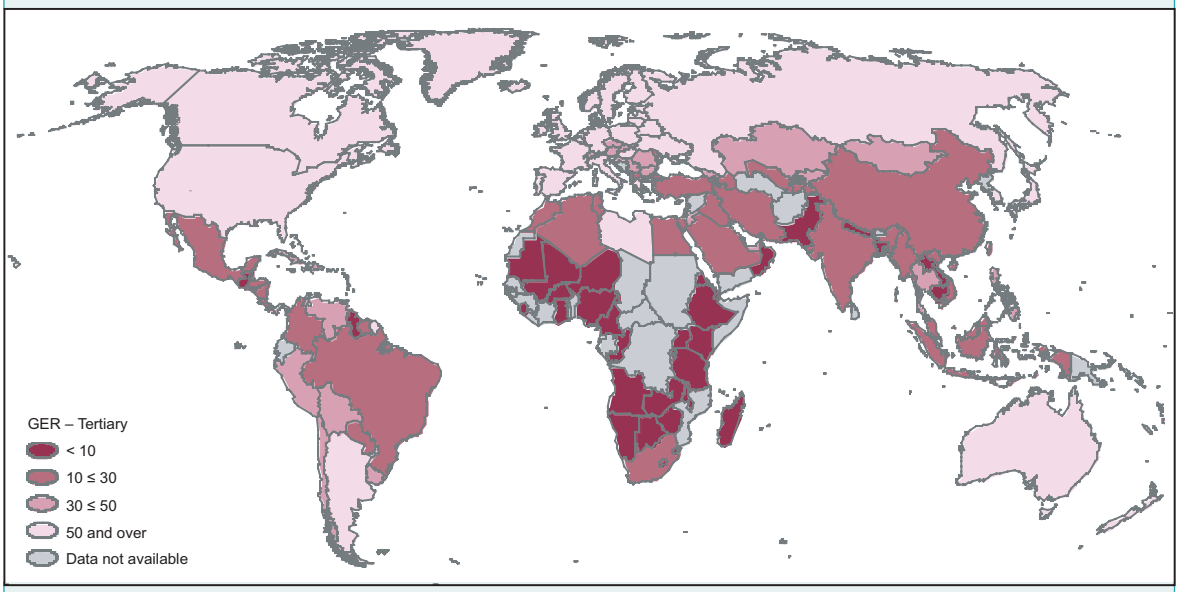
The higher education funding modes in each country, inherited from the past, invariably oscillate between direct public financing by students and their families, and public funding by the state or local authorities (via public taxation), with correctives such as study grants also needing to be taken into account. Direct financing is supposed to ensure that the demand for knowledge is geared to supply, while encouraging responsibility on the part of students and those supporting them financially. Public funding should in theory guarantee a measure of equality of opportunity. In the nineteenth and twentieth centuries, the funding of universities after the European model was by and large a matter of state policy. Private funding emerged progressively, in marginal fashion initially in Europe, but more strongly in North America. American universities, whether public or private in character,

Box 5.1 The massification of higher education

Enrolments in higher education almost doubled between the early 1970s and 1990, the estimated number of students rising from 28 to 69 million, and reaching the figure of 122 million in 2002.[2] According to certain projections, the student population could reach 150 million in 2025.[3] This trend is not confined to the wealthy countries. In Africa, Asia and Latin America, strong population growth has helped to swell numbers at the primary and secondary levels, thereby boosting enrolments in higher education, although to a lesser extent than in Europe or North America.

Thus, while enrolment ratios in the wealthy countries rose from 2.2 per cent in the 1960s to 59 per cent in 2002 in Europe and from 7.2 per cent to 55 per cent in North America, rates in the least developed countries barely increased from 1.3 per cent to 4 per cent. In Latin America, they increased from 1.6 per cent to 29 per cent.[4] Thus one finds a marked disparity between rich and poor countries as regards participation in higher education (see the following figure).

Gross enrolment ratios in tertiary education (ISCED Levels 5 + 6) by country 2002/2003.



Source: UIS, Education database, May 2005.

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have for the most part developed an entrepreneurial-type organization, embodying strongly competitive aspects. The student thus resembles a customer who demands an education commensurate with the often very high costs that he or she personally has to bear. Competition is sometimes fierce in this market. To attract the most famous researchers and best teachers, universities do not hesitate to outbid other institutions in terms of the salaries they pay and the working conditions they offer. Management of these universities also includes the search for private-sector funding. This commercial-style organization gives rise to a whole range of higher education institutions, some 3,000 in the United States, from the most celebrated universities to local colleges. Each student can thus choose to apply for admission on the basis of the perceived level of the establishment and of his or her own aspirations. This kind of management relies on media and advertising techniques. For example, the funding of a sports team can help to establish the reputation of a university institution as much as academic excellence.

The opening up of universities to forms of market-style organization and the commercialization of educational services has been made all the more necessary by the calling into question of the generalized public funding of higher education, regarded as being incapable of responding adequately to the growth in student numbers.[5] Without increased financial support, institutions of higher education cannot respond to the challenges posed by the emergence of knowledge societies. Such support is particularly necessary in view of the obsolescence of certain infrastructures and of the cost of renewing teaching and research practices.

Some experts have however warned of the dangers of a "commodification" of higher education. It is a fact that educational services have acquired considerable economic importance: in 2002, the global market in higher education represented over 3 per cent of the total services market. For some countries, higher educational services even represent one of their chief export items.[6] In 2000, the income earned by the United States from receiving foreign students was put by the OECD at US$10.29 billion (i.e. significantly more than the amount of public spending on higher education in all of Latin America).[7] This country, moreover, heads the countries attracting the greatest number of foreign students, followed by the United Kingdom, Germany, France and Australia. The United Kingdom, Australia and New Zealand have seen the strongest growth in this area, as a result of deliberate policies aimed at internationalizing their higher educational institutions.[8] Up to now, the developing countries have been reduced to the role of consumers in the global higher education market. Yet, while the part played by the private sector remains marginal in these countries because of their level of development, or indeed underdevelopment in the case of the least developed countries, it is likely that in a few years time the countries of the South – easy targets in the educational services market and faced in many cases with a declining state commitment – will find themselves confronted by the dilemma experienced by the industrialized countries, without however benefiting, in most cases, from the existence of strongly established flagship institutions that could help to frame balanced policies with regard to the funding of higher education.

This privatization of higher education has been made possible by the emergence of new actors. By 2010, the number of corporate universities, created initially for the in-service training of personnel, could well exceed that of traditional universities. The commercial-style universities are mainly aimed at making a profit, which distinguishes them from the traditional universities, motivated above all by considerations of academic prestige. Applied knowledge is more important to them than the production of new knowledge. As for the virtual universities, of which there were 1,180 in 2001, they could well have more students by the year 2020 than the traditional universities, which require a physical presence in the lecture hall.[9] The penetration by these new actors of the educational markets in the different countries of the world is however far from uniform, and it is possible to distinguish a number of different types of situation in this regard (see Table 5.1).

This trend towards the privatization of higher education could serve equally to encourage or delay

the emergence of a global knowledge economy. Since institutions of higher education have acquired a major strategic interest in international competition (Box 5.2), we are today witnessing a whole series of restructuring exercises whose consequences are just starting to be evaluated: the concentration of resources on the most high-performance universities or departments, or the dissociation – in the name of the principle of return on investments – of the research and teaching functions; the promotion of leading-edge disciplines, notably in the key science and technology sector (new information and communication technologies, biotechnologies, nanotechnologies), at the expense of the humanities; and the encouragement of more entrepreneurial forms of management. This is particularly true of certain OECD countries (e.g. Australia, Denmark, Ireland, Japan, New Zealand and the United Kingdom) and, more recently, of a number of other states such as Hungary or South Africa, and even China with its 2011 programme.[10] The convergence of such initiatives needs to be underlined, particularly since the increased liberalization of educational services – currently under discussion in the framework of the General Agreement on Trade in Services (GATS) – is liable to have not-inconsiderable consequences. These could even prove counter-productive in the absence of a genuine effort to evaluate the experiments currently underway in a field in which ideology sometimes overrides pragmatism. Some surveys carried out among institutions in the countries concerned aimed at measuring the impact of these policies moreover reflect a growing disquiet: a number of institutions fear in particular that the growing differentiation within particular systems of higher education, coupled with the constitution of centres of excellence, could lead certain establishments, particularly the most recent, to abandon any attempt to pursue a genuine research programme and thereby to cease to be competitive. Nor can one minimize the risk of a reinforcement of social and territorial stratification through the creation of systems of higher education that are profoundly unequal in social and geographical terms.

While this may seem utopian, particularly in the developing countries, it is possible to conceive of funding systems reconciling equality of educational opportunity (in a given cultural context) with giving the beneficiaries of education a sense of respon-

Table 5.1: The role of the private sector in tertiary education (ISCED Levels 5+6)

Countries with a large private higher education sector (over 50 per cent of enrolments)	Bangladesh, Belgium, Bermuda, Botswana, Cape Verde, Chile, Colombia, Cyprus, El Salvador, Estonia, Holy See, Indonesia, Islamic Republic of Iran, Israel, Japan, Latvia, Luxembourg, Namibia, Netherlands, Netherlands Antilles, Palau, Palestinian Autonomous Territories, Paraguay, Philippines, Republic of Korea, Slovenia, Tonga, Turks and Caicos Islands, United Kingdom
Countries with a medium-sized private higher education sector (between 25 per cent and 50 per cent of enrolments)	Angola, Armenia, Burundi, Ivory Coast, Ecuador, Jamaica, Jordan, Kenya, Lao People's Democratic Republic, Lebanon, Malaysia, Mexico, Mongolia, Nepal, Nicaragua, Peru, Poland, Portugal, Rwanda, Saint Lucia, United States of America, Venezuela
Countries with a small private higher education sector (between 10 per cent and 25 per cent of enrolments)	Argentina, Aruba, Azerbaijan, Belarus, Bolivia, Bulgaria, Ethiopia, Finland, France, Georgia, Honduras, Hungary, Iceland, Iraq, Libyan Arab Jamahiriya, Mauritius, Norway, Panama, Papua New Guinea, Republic of Moldova, Senegal, Spain, Switzerland, Thailand, Uruguay
Countries where the private sector is negligible or non-existent (less than 10 per cent of enrolments)	Australia, Austria, Cameroon, Chad, Congo, Costa Rica, Croatia, Cuba, Czech Republic, Denmark, Germany, Ghana, Hong Kong SAR of China, Ireland, Kyrgyzstan, Madagascar, Morocco, New Zealand, Pakistan, Russian Federation, Saudi Arabia, Serbia and Montenegro, Slovakia, Sweden, The former Yugoslav Republic of Macedonia, Trinidad and Tobago, Tunisia, Turkey, Uganda, United Republic of Tanzania, Viet Nam, Yemen

Source: UIS Education database, May 2005 and García Guadilla, C., 2004.

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Box 5.2 International competition among universities

Only a small number of leading universities in a few countries can genuinely claim the status of "world class university". The focus of most higher education establishments is rather on strengthening their particular fields and their appeal to a very closely targeted student clientele. This is why these establishments must often try to meet a number of contradictory demands: to respond adequately to the "massification" of higher education while ensuring the quality of the degrees and diplomas offered; to establish quality control procedures that do not infringe on the academic freedom of teachers; to diversify courses while coping with a substantial decrease in public funding; to be autonomous while remaining responsible and civic-minded; and to combine research excellence with teaching excellence.

sibility (arguably a more relevant notion than that of efficiency). Among the suggestions put forward, mention should be made of the "study-time entitlement" proposed by the International Commission on Education for the Twenty-first Century.[11] This could involve the community providing a fixed number of years of free education – which would be the same for every child – aimed at promoting equality of opportunity. Such entitlements should enable each student to apply for admission to the establishment of his or her choice. Where admission was granted, the community would finance the effective cost of the training, which would vary according to the branch of education chosen. This form of higher education "market", in which students would be the consumers and teachers the producers, could function along the following lines: the community would no longer have the task of imposing or restricting, through bureaucratic, centralized and all-encompassing rules, the distribution of pupils and students between the various institutions; this would avoid identifying selection and exclusion, thereby moderating the painful debate between the supporters of education financed directly by individuals and those in favour of centralized state funding. This training capital (involving a specified number of years of free education) could either be spent on a continuous basis or saved with a view to the later resumption of studies, in-service training or retraining. Once this capital of so many years of free education was exhausted, the cost of subsequent studies would be borne by the student who wishes to pursue his or her education or training. This restriction in time would also induce a sense of responsibility in students, since failing an examination would entail additional financial cost for them.

University networks yet to be invented

Why the "University of the Future" does not exist

The model of the European university has attained its natural limit as a geographically localized establishment producing and diffusing codified knowledge to an elite selected on the basis of intellectual, sociopolitical and economic criteria. The explosive growth of new knowledge, and its organization in increasingly specific disciplines and ever more complex and decreasingly hierarchical "knowledge networks", is calling into question the viability of the functioning of universities.[12] A long history has led them to give birth to the prototypes of the North American institutions of higher education. These have evolved rapidly and have succeeded the early twentieth-century European university, which had developed in step with the linear and apparently coherent development of an imperious science, organized around disciplines with well-established frontiers. The changes that have accompanied the rise of institutions of higher education in the twentieth century have revolutionized the organization of research and teaching programmes. The most flexible among these institutions are increasing the number of their departments and experimenting with new cross-disciplinary or interdisciplinary departments. These are organized on the basis of new subject fields (e.g. neurosciences, and sciences of complexity) or new scientific techniques. The explosion of knowledge and knowledge combinations has, in this

way, led many university institutions to reshape and to review their functioning. Even where these academic institutions retain the name of university, their organization, missions and functioning are destined to evolve and diversify.

A new phenomenon, then, is in the process of transforming higher education. Academic institutions are multiplying and diversifying. Within large establishments, the number of departments and research centres is increasing. The disciplinary "chairs" in European universities – which made sense when the established disciplines evolved more slowly and when the way they were taught commanded a consensus – could well disappear or change in nature. Naturally, these transformations will take place at a different pace in the developed and the developing countries. In many of the latter, the social and human sciences still attract a considerable proportion of students even if the knowledge in question is harder to turn to account and to exchange on the global skills market. But, from the standpoint of the intellectual reform needed to call into question the watertight division between the natural sciences, and the social and human sciences, and to favour the promotion of genuine transdisciplinarity, should we not now be anticipating the rapid growth of combinations of disciplines, while ensuring the methodological coherence of each branch?

In most countries, the quasi-standard model of the twentieth century university is in the process of losing its dominant status within higher education. However, the inertia inherent in organizations and cultural codes is placing a brake on the necessary diversification of models. Given the loss of appeal of certain disciplines, already perceptible in the European countries, it would seem vital to increase the cultural diversity of education courses and content. This will also be one of the major challenges facing developing countries seeking to turn their local knowledge to greater account. Despite their global preeminence, the large American institutions will similarly be called upon to evolve along lines that most of them have already started to pursue, diversifying their subject matter and teaching methods in partial anticipation of future trends.

Towards the emergence of university networks modelled on research networks?

This development has already taken place in the research sphere. Knowledge is expanding rapidly and diversifying through the establishment of new crosscutting disciplinary communities organized in the form of networks around international symposia and specialized research journals, which are springing up in increasing numbers alongside the old generalist reviews. Learned societies are losing their national character and are being assimilated into international organizations, which sometimes appear *ex nihilo* in the case of emerging disciplines. More often than not, they are the result of an association or a takeover involving the most powerful national societies, mostly American. These new learned societies in this way become the matrix of international or multinational organizations. Such organization in the form of international networks is an example of self-organization that remains for the moment spontaneous and decentralized.

What is remarkable is that the associated activities become "deterritorialized": the events organized by these networks are deserting university campuses for large hotels; editorial committees meet at itinerant congresses; the funding of reviews and meetings becomes increasingly independent of academic institutions, and is covered for the most part by grants or contracts granted by extra-academic institutions. A tell-tale sign is that free attendance has disappeared – conference fees have rocketed and more and more reviews seek a financial contribution on part of authors or their institutions. The emergence of the internet is set to alter the picture further.

There is a strong likelihood that everything we have witnessed in the past few decades in the field of research and knowledge production will spread to higher education. One example is the development of "summer universities" operating at the frontier between research and teaching: they enable researchers to disseminate new knowledge more efficiently and rapidly than through traditional symposia and congresses. Once again, these initiatives – whether

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regional, national or international – are generally organized by university academics rather than by the institutions themselves.

There is good reason to believe, then, that this trend towards the creation of networks will spread rapidly within institutions of higher education. Increasingly, young students will follow courses that will combine with those of the institution where they are enrolled. Thus, in the European context, temporary migrations of students have been fostered by schemes such as the Erasmus programme – today given worldwide extension through the Erasmus World programme.[13]

University networks – an opportunity for the developing countries

This predictable emergence of university networks does not however prefigure the eclipse of universities and academic institutions. There will still be a need for fixed geographical locations, laboratories and teaching institutions, bringing together researchers, lecturers and students, with permanent – and therefore public – sources of funding and hierarchical organizational patterns. However, the expansion and diversification of jobs, of knowledge and of the disciplines underlying them, mean that hierarchical structures must be supplemented by decentralized structures, organized along network lines. This kind of network organization is starting to develop within inherited institutions in both industrialized and developing countries. From this trend, a policy-making lesson for the future may be derived: developing countries that have invested insufficiently in university-type institutions could and – above all, should – think of *investing in network organizations* that anticipate the foreseeable development of academic institutions. This is all the more advisable since the economic costs of academic networks are much less than those involved in the creation of large university establishments. Developing countries should however attain a minimum level of preparation if they are to derive real benefit from these new modes of organization and play an active part in them.

Paradoxically, the organization of research and higher education activities in international regional networks offers developing countries an unexpected opportunity to participate in the new international architecture now taking shape. There is a window of opportunity for the developing countries to participate in the university networks that are going to be set up and developed. In the follow-up to the 1998 World Conference on Higher Education,[14] UNESCO has already contributed to this networking of higher education and research by creating and developing the UNITWIN/UNESCO Chairs Programme. One of these new tasks in the education sector is to contribute to the development and geographical spread of these networks so as to foster the transmission, diffusion and development of knowledge.

Networking enables developing countries to establish a higher education system or to improve its quality without having to wait to secure large investments or to be in a position to make long-term commitments. It is easier for these countries to link up to network structures that are themselves linked to other institutions or existing networks within the framework of regional or international cooperation – public or private. Whenever this is economically possible, the different discipline-specific networks can provide hubs around which durable, geographically localized institutions of higher education can be built.

The new possibilities opened up by the networking of higher education: teaching and teacher networks

By its very nature, innovative or specialized knowledge can only attract a small number of students. If it is localized geographically in a single institution, such knowledge will not be disseminated throughout the "disciplinary" community, which is scattered internationally. Would it not be preferable if, as in the case of summer schools, such educational content were to become – as it were – delocalized, itinerant and concentrated in the span of a few weeks, thereby enabling new and advanced knowledge to be made available to the groups of students concerned, who would not otherwise have access to it in the institutions where they are studying?

Educational networks of this kind make it possible to publish and disseminate online catalogues of

specialized knowledge corresponding to every level of competence and specifying the skills needed to follow the different courses. When such courses are residential in nature (i.e. when teachers and students live together during the period of concentrated teaching), the dissemination of knowledge takes on a very different form from that with which formal lectures have made us familiar – questions can be posed much more informally and the replies adapted to each questioner. Interdisciplinary links and intercultural dialogue can furthermore be strengthened as a result of students from different geographical backgrounds and disciplines living together.

The kind of training offered by such educational networks is thus better geared to changes in demand in terms of employment and knowledge, even if it can also stimulate new forms of "brain drain" from developing countries and countries in transition. It also corresponds to a recent and very remarkable trend: the great mobility of students has led to an unprecedented diversification of the student population living together on campuses in all parts of the world.

It should however be noted that such education networks have costs, which can appear high, particularly for the developing countries. These costs are of two kinds: firstly, economic and financial (financing student travel and living expenses, and teachers' salaries); secondly, cultural and institutional (assessment and qualification systems, ensuring that the courses followed are recognized beyond the institutions in which the students study). However, the economic and financial costs, which are borne by the public or private sectors, can be broken down since they can concern only one course and the commitment they imply is temporary: when the funding of a course is stopped, this does not necessarily jeopardize the functioning of the network as a whole. Thus, the cost of educational and teacher networks is much less than that of European-style universities, since it can be spread out according to the economic situation and the financial resources available, and since these networks can focus on a small number of disciplines. The networking of specialized educational courses would therefore seem particularly suited to countries in the process of taking off economically. It favours the temporary installation of students outside their country of origin, thereby enabling them to complete their training in fields that are not available in their countries of origin, while ensuring that they receive a high-quality education.

The cultural and institutional costs are much more complex and higher, and meeting them will depend on the development of assessment procedures. These concern both teachers, in terms of the quality of the courses provided, and students, in terms of their capacity to assimilate the knowledge imparted during the training then assessment should also measure the extent to which this training meets the needs of society. These procedures, however, come up against obstacles of a cultural and ideological nature, which are much more difficult to overcome than the economic and financial hurdles, for well-known institutions may fear placing their prestige and standing on the line. This is doubtlessly one of the main factors limiting the extension of "summer universities" (which do not issue any assessment of students) to doctoral courses, as compared with other levels of higher education (master's, first-degree courses, etc.).

With the massification of higher education and the constraints on the public funding of higher education, most university institutions – particularly those in developing countries – no longer have the financial or human resources to provide education over the whole range of disciplines or even to cover all knowledge within a given field. The number of specialists is necessarily limited. Academics in poorly endowed institutions may find their time taken up by urgent teaching tasks so that they have to restrict their research work or lower its quality, thereby reducing the appeal to students and the relevance to social needs.

Teacher networks can help to overcome these obstacles, particularly in developing countries. A higher education institution can set up a network of academics in a given specialty, inviting lecturers and/or researchers cooperating with permanent staff members to visit the institution for a few months each year. These visiting academics devote part of their time to teaching and the rest to developing research

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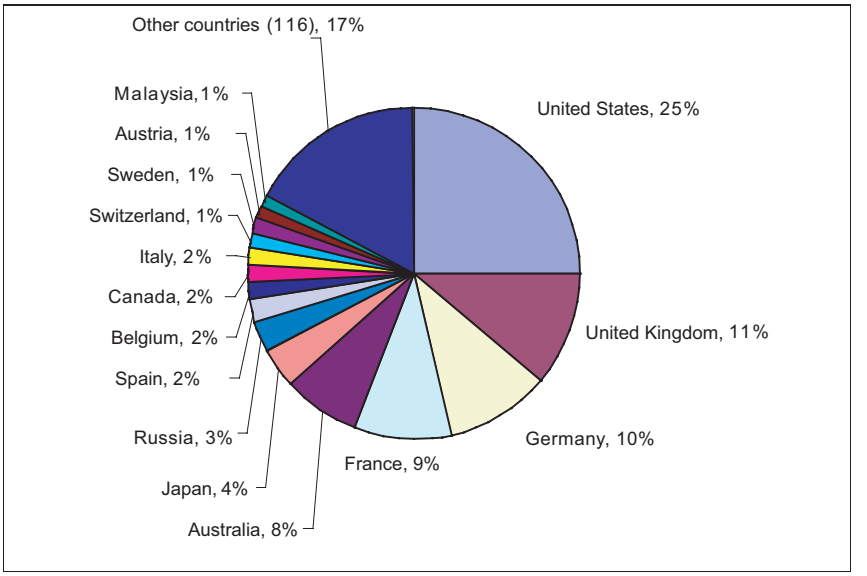
Figure 5.1: Foreign students by host country, 2002/2003



Source: UIS, Education database, July 2005.

activities, in collaboration with the institution's permanent researchers or staff. The exchanges between the visiting professors and the permanent researchers can yield synergies in which the institution can play an active role. The prospect of collaborating with a greater number of colleagues is an additional inducement to teacher-researchers to leave their institutions for a limited period. The presence of a number of outside teacher-researchers necessarily has a positive influence on teaching, research and the prestige of the host institution, and strengthens its appeal to future visitors.

In the case of developing countries, such schemes can help to curb the brain drain, a phenomenon that affects not only students but also teacher-researchers. The phenomenon of the one-way brain drain (from the poor countries and least-endowed institutions to the rich countries and most prestigious organizations) could in this way be partly offset, or even one day replaced, by a "brain circulation" benefiting the majority. Teaching networks moreover help to maintain and promote cultural diversity by enabling persons from countries least endowed in terms of higher education institutions to remain in their countries, and visitors to immerse themselves in the culture of the countries they visit on a regular basis.

The new missions of higher education

Higher education differs from primary and secondary education not only in the age and level of the students but also in terms of the *production* and *development* of new knowledge in the cultural, social and economic spheres. Deprived of these functions of research, discovery and innovation, institutions of higher education are reduced to "tertiary education" establishments, mere extensions of the primary and secondary levels. The semantic confusion between "higher education" and "tertiary education" can have serious consequences in many developing countries, which run the risk, as the result of a kind of international division of labour, of limiting to promoting tertiary education while believing themselves to be promoting higher education. This pitfall needs to be sedulously avoided, which involves developing research activities as a matter of priority, starting with disciplines that do not require heavy and costly equipment.[15]

Universities are, to a certain extent, mirrors of their societies. Each country, whatever its cultural setting and its level of economic development, must be in a position to benefit from the fruits of research and not

simply from tertiary education. It is therefore worrying to see establishments in some developing countries specializing in tertiary education at the expense of research. Such specialization is all the more harmful in that it allows no opportunity for developing local knowledge and, moreover, reinforces the lead of the industrialized countries in terms of university research output and student numbers. Whereas, in 2002 and 2003, the OECD countries on average granted a doctorate annually for every 7,000 inhabitants, in Chile the figure was 1 in 110, 000, and in Colombia 1 in 220,000.[16]

As we have seen, the new "university network" models must be able to ensure both the research function and knowledge development in their chosen fields. Modern societies will have to give a great deal of thought to the evaluation of knowledge, students, teachers and researchers, as well as to the need to introduce more flexibility into the functioning of institutions and to separate the functions of teacher and examiner, with the overall objective of favouring the growth of educational networks. It will be equally essential to analyse the nature of the various forms of knowledge,[17] to distinguish between descriptive knowledge (facts and information), procedural knowledge (concerned with the question "how?"), explicative knowledge (corresponding to the question "why"?) and behavioural knowledge. It will also be necessary to underline the utility, at first sight paradoxical, of abstract knowledge in a society of knowledge professions and jobs.

Focusing on the specific characteristics of the teaching function dispels the illusion that "*virtual* universities" could do away with "teachers" and their cost. Admittedly, the new technologies will play a key role in the emergence of the networks of higher education described above. But the new multimedia tools are not a panacea that will enable us to dispense with teachers, contrary to the calculations of those who hope to economize on their cost. The new technologies make it possible to transmit information instantaneously worldwide but, to transform this information into knowledge, increasing numbers of high-quality teachers will be required.

In the emerging knowledge societies, exponential growth in the quantity of knowledge produces a growing gap between those who have access to knowledge and culture, and learn to master them, and those who are deprived of such access. As we shall see later, it is not sufficient to reduce the "digital divide" (and other inequalities in the access to the world of culture); we must also reduce the "knowledge divide", which is liable to grow exponentially.[18] Training in the new information and communication techniques requires a high level of education, knowledge of English and the art of navigating in an ocean of information. Above all, it must not be accompanied by the temptation of compiling and juxtaposing information rather than using it as building blocks for constructing and organizing knowledge. The future of knowledge societies therefore rests in large measure on the excellence of the training of teachers, whose tasks and functions are destined to become more diversified in pursuit, among other things, of the objective of education for all.

Hence, the importance of ensuring the relevance of higher education systems (Box 5.3) for the promotion of a healthy social and political climate within a country along with economic and cultural development. Political leaders should assign institutions of higher education a small number of crucial missions: producing, disseminating and upgrading knowledge; training teachers; and transmitting knowledge to society at large. Moreover, one of higher education's key functions should be to update knowledge, on a lifelong basis, in the fields subject to constant changes. These objectives can only be achieved globally and fairly if the international community is genuinely mobilized to combat the disparities of all kinds, between men and women, and between social, economic, cultural and national groups. Care must also be taken to ensure that equality of opportunity is universally respected and that compensation is given whenever it is not provided.

Finally, freedom of thought and expression are indispensable conditions for the emergence and growth of genuine knowledge societies, which underlines the importance of academic freedom. For an institution of higher learning is also a place for dialogue and for the confrontation of viewpoints. This is why the new systems of higher education contribute not only to the production, transmission and upgrading of knowledge but also to education for citizenship.

Institutions of higher education should therefore show greater flexibility in adapting to and anticipating

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Box 5.3 The relevance of higher education

As emphasized by the World Conference on Higher Education, the relevance of higher education means:

- being politically responsive: higher education does not fulfil its role when it neglects its function of being watchful and awakening minds, or fails to analyse social issues;
- being responsive to the world of work: it is vital that higher education should gear itself to changes in the world of work, without sacrificing its own identity and priorities, which concern the long-term needs of society;
- being responsive to other levels of the education system: the initial training of teachers and many social workers is, with few exceptions, the task of higher education. The priorities of university research should also include analysis and evaluation of the different levels of the education system, in close relationship with the world of work (without however subordinating itself to it) and with a genuine social project;
- being responsive to culture and cultures: culture is not a given, but is constructed in space and time. Higher education should help to construct culture in its universal dimension and should accordingly be responsive to the diversity of cultures;
- being responsive to all: appropriate strategies should be implemented to increase the participation of disadvantaged groups, notably women;
- being responsive everywhere and all the time: the promotion of lifelong education calls for greater flexibility and greater diversification of training provision in higher education;
- being responsive to students and teachers: institutions of higher education should be conceived and managed not as mere training establishments but as educational facilities, implying better management of teaching careers and the active participation of students not only in teaching activities but also in the management and life of institutions of higher education.

In these circumstances, higher education can truly help to underwrite the generalized spread of knowledge within industrialized societies and in the developing countries.

the needs of society. This applies particularly to the developing countries, where there is an urgent need to establish new university models, better geared to needs and conducive to disciplinary and geographical synergies and to regional and international cooperation. Attempting to imitate the great universities of the North would be a mistake. The challenges facing developing countries are specific: the obsolescence of existing infrastructures, the decline of the quality of higher education, the underdevelopment of research infrastructures, the "brain drain" towards the wealthy countries, the digital divide, the linguistic and cultural barriers, the reduction of state funding and, in certain cases, the lack of genuine public policies in this field. UNESCO should continue to contribute to capacity-building by encouraging international cooperation. In particular, the development of network structures and new technologies could make it possible in these regions to establish avant-garde university models linked to the institutions of the North through various forms of partnership. This would serve to limit the massive flight of brainpower and to favour the transfer of the necessary knowledge and information. These are the prerequisites for the introduction of genuine mechanisms for knowledge sharing.

Background resources

Altbach (2003); Attali (1998); Berchem (2004); Brunner (2001); Burkle (2002); Campbell and Roznay (2002); Conceiçao and Heitor (1999); Courard (1993); D'Antoni (2003); Daniel (1998); De Moura Castro and Levy (2000); Del Bello (2002); Delors *et al.* (1996); Duderstadt (2000); Duryea *et al.* (2001); EFA Global …(2002, 2003/2004 and 2005); El-Khawas (1998); El-Khawas *et al.* (1998); European Communities Commission (2003); Figueroa *et al.* (1995); García Guadilla (1998 and 2000); Green (1996); Gupta (2004); Hansen *et al.* (2002); Haug and Kirsten (2001); Hauptman (2002); Holm-Nielsen and Agapitova (2002); International Association of Universities (2005); Jurich (2000); Larsen and Vincent-Lancrin (2003); Meyer and Brown (1999); Moe and Blodget (2000); Moon *et al.* (2003); Neave (2000); OECD (2001*b*); Patru (2002); Portella (2001); Reichert and Tauc (2003); Schwartzman (2003); Scott (1995 and 1999); Seddoh F. (2002); Singh (2003); Teichler and Sadlak (2000); UNESCO (1998*a*, 1998*b* and 2002); UNESCO-CEPES (2001, 2003*a* and 2003*b*); Van Ginkel (2003); Vandenberghe (2004); Wagner (1998); Winkler (1994); World Bank (2002); World Bank/UNESCO Task Force (2000); Zeleza (2003 and 2004); Zúñiga and Hansen (2002)

Chapter 6

A research revolution?

It is difficult to imagine knowledge societies where science and technology are not accorded due priority. The scientific field will doubtless be one of the main laboratories for the construction of knowledge societies, given the close relationship between developments in digital technology and advances in scientific understanding. This being said, the rise of knowledge societies transforms the stakeholders in the scientific enterprise and the locations where research is carried out. With the emergence of a knowledge economy, the market is seen to occupy a more prominent place in scientific activities. This trend poses a major challenge to the leading players in knowledge societies, whether they belong to the world of science, economics or politics, for they will have the task of establishing, at the crossroads of these three worlds, systems of research and innovation that promote sustainable development.

But will this be a shared and truly universal form of development? Will it benefit everyone? There is a serious risk that the scientific divide between North and South – and even within developing countries and industrialized countries – will become more marked. The fact that science and technology are a source of development and expansion make it all the more impossible to disregard the continuing or widening of such a gap. If nothing is done to close the gap, the anticipated benefits of knowledge societies could well prove advantageous to a small number of countries only.

New research locations

Inequalities in the scientific field

There is a real scientific divide setting the "science-rich countries" apart from the others. Science is by nature universal, but scientific progress seems confined to one part of the planet only. A number of regions suffer from a considerable handicap, which is impeding the development of research. United Nations Secretary General Kofi Annan has spoken out against the perpetuation of such scientific asymmetries, saying that the idea of two worlds of science is anathema to the scientific spirit.

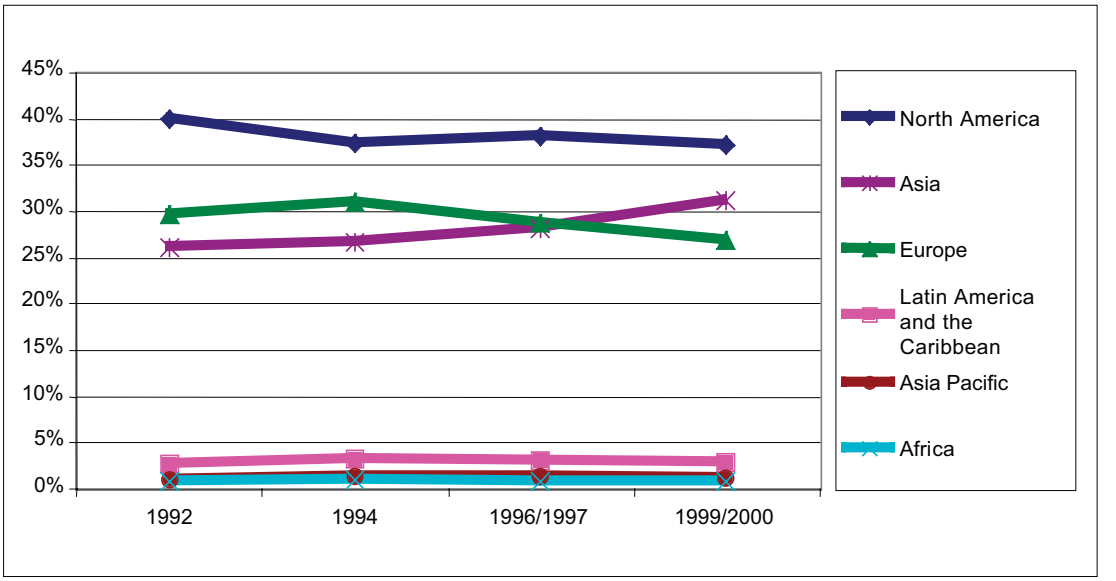
While largely bound up with economic inequalities, the scientific divide is also due to specific institutional factors. The production and spread of knowledge are dependent on national systems of research and innovation, which in turn result from interaction between business, industry, science research and teaching institutions, and government bodies. Typically, the systems held to be most effective are characterized by the closeness of the relationship between these various stakeholders. In developing countries, however, innovation systems do not have the same integrative capacity as in industrialized countries or those countries of the South that have succeeded in putting in place efficient structures.

The notion of scientific divide is not determined solely, by economic disparities. Differing political conceptions of the economic and social role of science

also play a role. The risk of a scientific divide arises when leading decision-makers fail to regard science as a priority economic and human investment. From this standpoint, an indicator such as research and development spending as a proportion of national gross domestic product (GDP) gives a fairly accurate idea of disparities (see Figures 6.1, 6.2 and 6.3). This indicator, in a sense, describes the degree of the national research effort and the capacity of each country to invest financial and human resources in scientific and technological activities. Scientific investment is first and foremost a political rather than an economic choice. In the year 2000, approximately 1.7 per cent of global GDP was devoted to research and development, up from 1.6 per cent in 1997. For the OECD countries as a whole, the rate amounts to 2.2 per cent, with a high for Sweden (4 per cent), while in most developing countries it seldom exceeds 0.2 per cent. In 2000, South Africa devoted 0.7 per cent of its GDP to research and development, a proportion much higher than the 0.2 per cent for the rest of sub-Saharan Africa. The Arab States devote 0.1 per cent of their GDP to research and development, while the corresponding rate for Latin America and the Caribbean in 2000 was 0.6 per cent. One significant fact needs to be underlined: whereas the developing countries' share of global GDP stands at 42 per cent as against the 58 per cent share of the industrialized countries, the disparity is much greater in terms of global spending on research and development, since the developing countries account for only 20 per cent of total spending and the industrialized countries 80 per cent.[1]

While economic power is an important variable, it cannot by itself account for the attitude of a country to scientific production, as shown by the disparities of investment between Europe and the United States and even within the European Union (EU).[2] Political will and civil society commitment, which relate to governance, are crucial elements in a good research and innovation system. This emerges clearly in the case of newly industrialized countries, such as Malaysia or Singapore. It is because these countries have pursued, after the example of China and Brazil, goal-oriented policies in the science and technology field, sometimes in contradiction with the prevailing economic models, that they have managed to establish robust innovation systems conducive to economic and social development. In this connection, the decision by the New Partnership for Africa's Development (NEPAD) countries to invest 1 per cent of their GDP in research is to be warmly welcomed. Were the 1 per cent target to be realized, it would

Figure 6.1 Participation in world gross domestic expenditure in R&D (GERD) by region



Source : UIS S&T database, June 2005.

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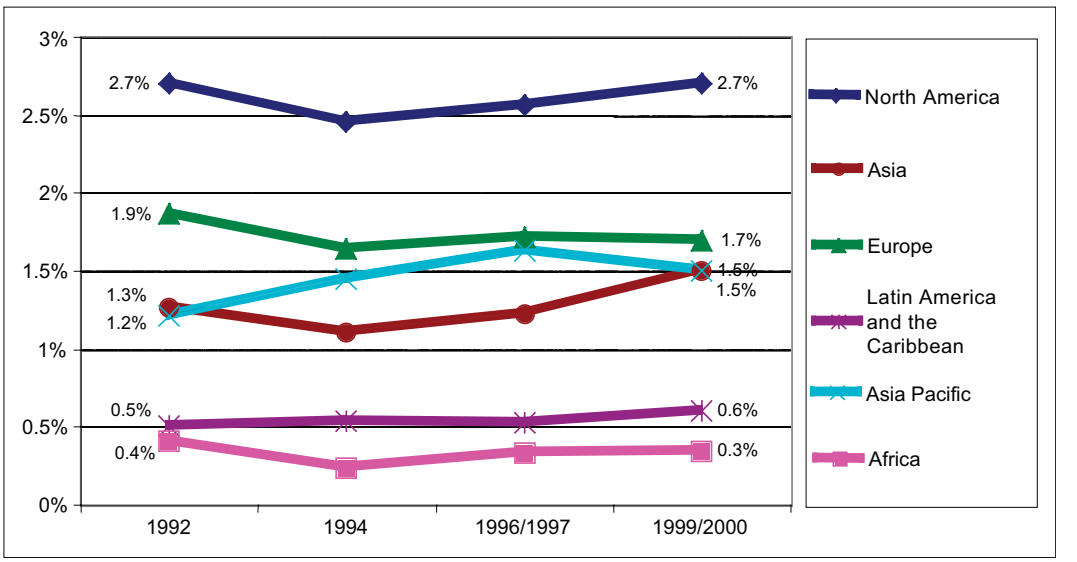
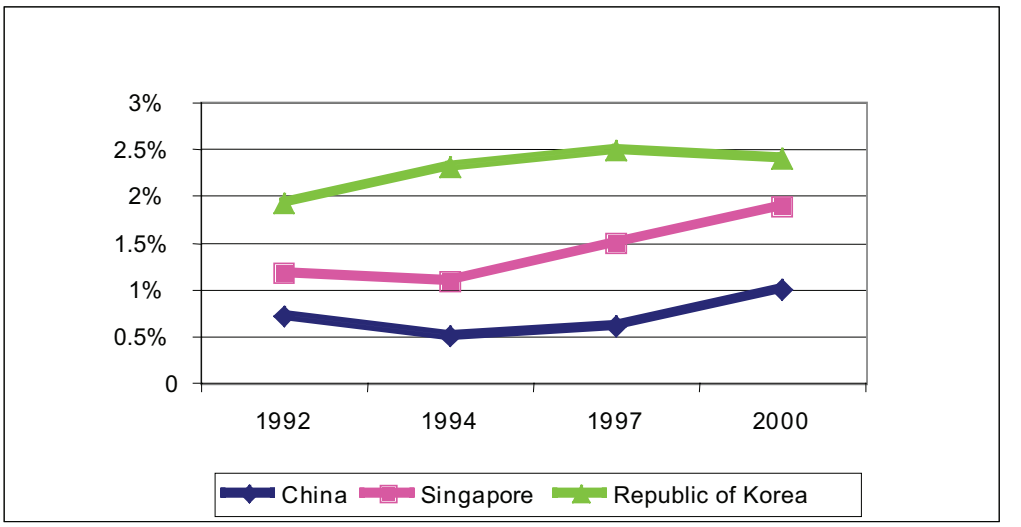
Figure 6.2 GERD as percentage of GDP by region



Source: UIS S&T database June, 2005.

Figure 6.3 GERD as percentage of GDP in China, the Republic of Korea and Singapore



Source: UIS S&T database June, 2005.

constitute a mini-revolution for the African continent, where South Africa is currently the only country to invest a significant share of its GDP in R&D.

Innovation systems, development and knowledge societies

How can countries that are lagging behind in the scientific field successfully establish sustainable research and innovation systems? How, moreover, can they draw on the example of the countries of the South that have succeeded in doing so? The notion of innovation system is of clear interest here since it underscores the role of leaders and decision-makers in the management of the scientific and technological environment. This pragmatic framework of analysis, by approaching science and technology systemically (i.e. in relation with the economy, politics and society), stresses adaptation and local success. We are not dealing here, then, with a model of scientific production intended to replace existing ones, but rather with a framework of analysis designed to highlight the opportunities for practical action. This framework enables us to think of the establishment of knowledge societies on a worldwide scale, while respecting the diversity of choices, and of national and local needs.

The notion of innovation system emerged in the context of studies on the scientific output of the industrialized countries, but it is transferable to other categories of countries, subject to adaptations and adjustments relating in particular to scale. The chief problem in this regard is doubtless that of the time scale of changes and evolution – only consistent policies pursued over the long term can lead to the generally acknowledged successes of countries such as Finland or the Republic of Korea. In both North and South, action plans must be conceived over a span of one or more decades. In the case of developing countries, the need to set these policies within a long-term time frame should be a particular concern of the international community, one of whose roles can be to sustain such an effort, particularly in financial terms.

One may also question whether the national scale is always relevant for effective and consistent action. Centres of excellence or regional strategies are other levels at which action may be envisaged. Again, it must be stressed that these problems arise, all things being equal, in both the North (within the European Union, for example) and the South (e.g. in Latin America and the Caribbean). While it remains essential, the national framework is no longer an absolute reference, particularly for many developing countries not equipped, in terms of their size or their resources, to develop endogenous innovation systems independently. Is it a coincidence that the developing countries that have managed to establish effective innovation systems include such major regional actors as Brazil, China and India? Regional strategies yield benefits with regard to cooperation between countries with similar or complementary interests and needs. The size of a research and innovation system – which is very often that of a market – is a key factor, particularly because a regional strategy enables resources to be shared and distributed. Whether it is a matter of concentrating funding on common projects (such as rice or malaria), organizing international research teams or benefiting from the experience of others, the regional scale can offer solutions advantageous to the scientific strategies of all countries, industrialized or developing.

Finally, the evolution of an innovation system depends on external factors, such as the integration of the country in the world economy, the dynamics of competition internationally and the international legal environment. Regional strategies can also provide leverage in international negotiations, enabling countries with convergent interests to negotiate collectively on more equal terms. Thus, a growing number of developing countries wish to see changes in the international management of intellectual property or international trade, particularly regarding access to the markets of the industrialized countries. To quote just one example, the price of products or processes protected by intellectual property rights currently continues to rise, with potentially adverse effects on the investment capacities of the developing countries. The growing barriers to reverse engineering[3] and copying, which had constituted one of the main planks of innovation policy in the Asian countries, are thereby hampering local competition and learning processes in many countries. Regional strategies, then, can offer effective

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frameworks for action for countries that feel isolated when they act individually in international arenas such as the World Trade Organization (WTO) or the World Intellectual Property Organization (WIPO).

Political investment in research and innovation

Political investment is the cornerstone of any scientific development strategy and the foundation of any knowledge society, which cannot subsist without a political architecture. Such investment is not restricted to the financial dimension – even if any public action has its costs. Account must be taken of other priority tasks for governments, such as providing information to businesses, scientists and civil society, and establishing legal environments and monitoring procedures. Governments also participate in creating and running interface networks ensuring linkages between the key players in research and innovation systems. In other words, the development of knowledge societies involves the implementation of scientific knowledge policies.

However, we are currently witnessing a decline in the relative share of public research. Thus, between 1991 and 2001, the share of public investment in research and development diminished by 6 per cent in the European Union (pre-enlargement, fifteen countries) and by 11 per cent in the United States, while it remained constant in Japan. In 2001, the part of public investment in science and technology expenditure was 34.5 per cent in the European Union (after enlargement) and 27.8 per cent in the United States. This reduction was linked to the combined effect of the end of the Cold War and the budgetary difficulties of the 1990s, which led to concentrating efforts on improving the capacity of businesses to innovate and restricting support for fundamental research.[4] As a result, the orientations of industrial research, with its distinctive management models and its concern with short-term profitability, tended to override the goals of public research. These developments, particularly in the field of information technologies and biotechnologies, give a central role to the market and private initiative in debate on what direction research should take.

The wide range of government responsibilities nevertheless requires caution in analysing reductions in public funding of research. Discussions on the governance of science and technology tend to be dominated by the opposition of linear models, which are inclined to reduce the concept to one of its dimensions only. Depending on the standpoint of the stakeholder, key importance is alternately accorded to technological innovation or fundamental research, and to the public sector/state or the private sector/market. Thus, the 1990s saw the development of scientific and technological policies that, in the choice of priorities, stressed the incentive role of the market and of demand. However, in its assumption that private-sector initiative is the sole driving force of technological advance, this model remains no less linear than that which would have it that fundamental research leads directly to innovation. While private-sector drive may have been essential to the rise of the information technologies and biotechnologies, the case of medicines and orphan plants (overlooked by agricultural research) illustrates the inability of the market to satisfy certain essential needs.

In fact, any research and innovation policy must take account of a complex set of problems. In isolation, neither the public sector, nor the private sector, nor fundamental research, nor applied research embody the essence of "good" research. The debate on the relative share that should be shouldered by the private and public sectors in research is often distorted by the fact that one thinks in terms of substitution, when complementarity should be the framework. An innovation system implies the complementarity of fundamental research and technological innovation. However, there is no lack of support for the view that developing countries need applied research – not abstract fundamental research. Yet, it is difficult to see how, for example, a country or group of countries could undertake research in the field of biotechnology in the absence of institutions of fundamental research in biotechnology. Thus, the Advanced Research Projects Agency Network (ARPANET), forerunner of the internet (with the World Wide Web invented by Tim Berners-Lee),[5] was first developed within the sphere of public research.[6] Likewise, the GPS satellite relies on atomic

clocks originally conceived within the strict confines of fundamental research. It must be emphasized that applied research and innovation cannot represent the totality of a research and innovation system. The development of publicly financed fundamental research is more necessary than ever today. The relationship between applied and fundamental research must not be perceived – above all by stakeholders outside the scientific community – as an opposition between the useful and the useless. The differences between them have mainly to do with the time scale over which the work is envisaged and the intellectual challenges one is ready to address. The innovation timetable establishes a bridge between the short term, in which results are more predictable, and the long term, in which research reassumes its fundamental nature of a confrontation with the unknown.

From this standpoint of complementarity, the role of the private sector in the constitution of an innovation system is not necessarily synonymous with laissez-faire, since it is frequently subject to the overall guidance of the public authorities. The goal-oriented policies pursued by countries such as Brazil, China or Malaysia show that scientific and technological policies develop better if they form part of long-term public strategies. Thus Brazil, under its industrial and technological development, decided in 2004 to focus on the chemical and pharmaceutical industries so as to derive benefit from the country's biodiversity in terms of resources. However, in most developing countries, research and development activities are the virtually exclusive concern of the public sector, which is doubtless an aspect of the scientific divide.[7] This is evident, all things being equal,[8] in the marked disproportion between the share of private funding in the GERD of industrialized countries and that of most developing countries.

In many developing countries, the shortcomings of the innovation system are partly due to the lack of industrial demand for research and development. The local economy is based largely on low-technology firms, most of which settle for assembling and exporting products designed elsewhere, thereby generating very little added value in terms of innovation. These firms often reflect an international division of labour that confines research activities to the richest countries – the host country employs its labour but not its brain power. This results in situations in which scientific research that is fairly well recognized internationally – as evidenced, for example, by the progress of Latin American universities in international publications – has little impact on economic and industrial development. On the other hand, East and South-East Asia (with the Republic of Korea, Hong Kong (China), and Singapore leading the way, followed by Malaysia, Indonesia, Thailand and the Philippines) has managed to gain a foothold in the high-technology sectors by combining selective import policies and aggressive export strategies.

The problem of developing countries is that they are too often not successful in basing their economic growth on knowledge and innovation. In this connection, the *Report on Innovation as a Source of Development,* by the UN Millenium Project Task Force on Science, Technology and Innovation, stresses the importance of infrastructures (roads, energy and telecommunications) that bring invaluable benefits (reduced transport time, flexibility and efficiency of electricity, and rapid communications).[9] Infrastructures make a vital contribution to improved productivity, but it is too often overlooked that these productivity gains are not restricted to the economic sector. The development of infrastructures requires the mobilization of a great deal of scientific knowledge. Their setting up and maintenance at the local level can generate new knowledge. In other words, because they are based on relatively sophisticated technologies, infrastructures are an important vector of innovation and knowledge development.

In many developing countries, infrastructures are scarcely perceived as forming part of a learning process. Infrastructure policies are conceived above all in terms of industrial policy. Generally speaking, decision-makers establish clear-cut distinctions between industrial or agricultural policies, research policies and educational policies. Yet, their interlinking can help to lay the foundations for long-term research and development activities. While the stakeholders in a research and innovation system must have all the necessary autonomy, it is nevertheless the task of governments to create

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an enabling environment. From this standpoint, it is important to offer the private sector incentives to invest in R&D and to encourage the scientific community to direct part of its efforts towards innovation and the market. It is also important that the standards and rules laid down are subject to reliable independent review, in close conformity with international norms, in order to draw on the experience of other countries and to facilitate transparent monitoring and control, and even project reorientation. The African countries associated with NEPAD have expressed their resolve to make their science policies more transparent by submitting them to the African Peer Review Mechanism (APRM) with a view to arriving at effective long-term strategies.

As regards financing, tax incentives are the chief instrument available to governments. These should be visible and adapted to the nature and size of the firm concerned – a young new technology firm does not have the same needs as a well-established company. Innovation can also be stimulated by offering grants to research centres (public or private) or loans geared to the research-investment risk (long-term loans, conditional on the success of the project, etc.). Indeed, innovation is an activity involving a great deal of uncertainty. Investments in this area are risky, particularly since the funding of young high-tech firms requires more capital than for traditional small and medium-sized enterprises. The role of government can therefore be to invest in private venture capital funds, which will in turn assume the task of investing in technology enterprises.

The successes achieved by the newly industrialized countries, particularly in Asia, show that science and technology policies have a key role to play in economic and industrial development strategies. International bodies, particularly development banks, can therefore play an important role in the adoption and financing of innovation strategies in developing countries. In this connection, the World Summit on the Information Society made some specific proposals and the Plan of Action underlines the need to

> Encourage a series of related measures … incubator schemes, venture capital investments (national and international), government investment funds (including micro-finance for small, medium-sized and micro enterprises (SMMEs), investment promotion strategies, software export support activities (trade counseling), support of research and development networks and software parks(para. 8(i).)

It should be emphasized that resource agencies and technological incubators are particularly valuable tools since their structures enable scientists, industrialists, politicians and representatives of civil society to work together.

But funding is only a means. Capacity development is crucial to integrate science in a coherent scientific and technological development policy, to help improve existing technologies and to encourage the assimilation of new and foreign technologies. Furthermore, the establishment of an enabling legal environment calls for intellectual property policies favourable to foreign investors (incentives for partnerships between local industries and high-tech foreign firms, establishment of duty-free zones, etc.). These policies can also encourage the emergence of endogenous innovation, which presupposes the introduction of affordable or cost-free legal advice facilities for budding enterprises. Capacity development and institutional development in fact go hand in hand. Thus, reverse engineering, the focus of a veritable scientific and technological development strategy in countries such as the Republic of Korea and Malaysia, calls for appropriate infrastructures and institutions as well as well-informed stakeholders.

The adoption of an intellectual property system consistent with the norms of the open economy can favour the growth of direct foreign investment by offering guarantees to foreign firms. But in order to ensure knowledge exchange, it is not sufficient to welcome foreign firms – these tend to pursue their research activities in their countries of origin or in association with institutions in countries with a high-tech capacity. What is more, the growing use of patents in the marketing of products or services tends to limit market access by potential competitors. Firms can, in this way,transfer the results of innovation without transferring the capacity to innovate. There is a need, then, for intellectual property agreements to ensure a return on scientific and technological investment. Attention to the nature of the local staff to be employed is also

important. To settle for supplying low-skilled labour is a short-term calculation that exposes the country concerned to the risk of a subsequent delocalization to regions where qualified labour may be even cheaper.

In many developing countries, most universities and private-sector firms do not possess legal teams with expertise in matters of intellectual property rights and the protection of inventions – a situation that is scarcely favourable to innovation. Incubators are a solution to this problem. This kind of interface is vital to enable young enterprises created in an academic context to become players in their own right in the technological marketplace. The incubator can not only help the new firm to benefit from financial and tax advantages, but can also supply it with the legal advice that researchers and engineers often lack. Government action in the form of legal information and advice to firms and all the stakeholders in the innovation system is all the more crucial since intellectual property systems, sometimes highly technical, have for some years been undergoing major and continuous modifications.

The question of legal advice is but one aspect of the more general issue of access to information. A research and information system, whatever its scale, needs periodically renewed information on its socio-economic and international environment, and on recent and foreseeable trends. This presupposes readily available data, statistical studies, predictive analyses, and information on best practices and the pitfalls to be avoided. Access to this whole range of information is particularly important since it is the sole key to effective control and monitoring of the policies being pursued. Such data can then be disseminated through many different means, such as internet sites, seminars, conferences and workshops. To bridge the digital divide, it is therefore necessary to put in place interface and network structures so that firms can familiarize themselves with the logic of science and so that research institutions can integrate the logic of the market and technological innovation in their functioning.

Finally, the provision of information to stakeholders in the system also requires that governments possess reliable and suitable scientific and technological knowledge, above all at the highest decision-making levels. Most countries have science academies, but their role remains primarily linked to traditional forms of scientific exchange at national and international levels. Their main mission is not to diffuse strategic information; moreover, they often remain at a distance from decision-making spheres. On the other hand, governments must ensure that highly strategic information is readily and rapidly accessible to them through a network of agencies, independent councils and ministerial units or government bodies. Finally, it is important that the advice given to decision-makers should be wholly independent, as emphasized by the Science Agenda/Framework for Action adopted by the World Conference on Science in 1999.[10]

It is also the responsibility of governments to ensure that scientific and industrial policies complement one another and that there is greater harmonization of public and private-sector action, fundamental research and technological innovation, and national, regional and international strategies. The interlinking of all these dimensions is the determining factor in the development of knowledge societies. Each country should adapt its strategies to its national, regional and international environment. For developing countries, that means that the examples or models of success, whether they come from the North or other developing countries, should always be measured against the yardstick of their local applicability rather than their past successes. The international community has a duty to remind governments that there can be no genuine and viable development without a coherent and ongoing research and development policy. But that should not lead to dictating an agenda to the countries concerned. Equally, the imperative of local adaptation should not serve as a pretext for legitimizing forms of autarky, particularly when enquiring into local research and development needs among businessmen, scientists and non-governmental organizations that mobilize civil society.

Scientific mobility and the brain drain

This concern with local needs is essential. The scientific divide arises primarily from the conditions under which scientific knowledge is produced, received and

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diffused. The obstacle encountered by many researchers in developing countries arises from the fact that they often find it difficult, through lack of resources, to gain a foothold in the international scientific arena, even when they are producing high-quality work. This difficulty in producing science of an international standard in developing countries doubtlessly explains partly the scale of the brain drain from the South to the laboratories and universities of the North. Before analysing its adverse effects on the capacities of developing countries, it should be noted that the brain drain represents but one aspect of the more general phenomenon of scientific mobility.

Other than in exceptional periods, such as times of war, international mobility of students, researchers and teachers is a normal ongoing phenomenon. Like the medieval scholars, researchers constantly travel as their scientific or economic interests dictate. Such mobility remains the best way of transferring tacit forms of knowledge, which are scarcely conveyed by the codified forms of the manual or the article. It is important for scientists to be able to take advantage of international mobility, which is a guaranteed freedom and one that is expanding thanks to the travel facilities afforded by globalization. In that respect, UNESCO or an international non-governmental organization such as the International Council for Science (ICSU) were fulfilling their role when, during the Cold War, they helped scientists to cross what were highly hermetic borders. The brain drain may thus be described as the abnormal evolution of an otherwise unavoidable and indispensable phenomenon. The mobility of brainpower nevertheless becomes a problem when it increases scientific concentrations in specific areas to the detriment of others, and when it helps to expand or even create new divides.

The brain drain towards rich countries, and among rich countries themselves, is much more marked than the movement from rich countries to developing countries. South-North movements predominantly concern students and researchers in the sciences and technology, while North-South movements essentially concern the social sciences.[11] The brain drain phenomenon, as we know it, arose within the industrialized countries themselves. Between 1949 and 1965, over 97,000 scientists emigrated to the United States, mainly from the United Kingdom, Germany and Canada.[12] But from the 1960s onwards, it also spread to the developing countries as deteriorating living standards, political and social instability, and perennial shortcomings in research and teaching facilities led to a massive flight of the elites. The brain drain phenomenon subsequently became more pronounced in the 1990s, with the rise of the new information and communication technologies, which increased the demand for skilled personnel in the fields of research and teaching alike.

The brain drain takes various forms. It is firstly a problem affecting education, particularly higher education. The most promising students manage to secure training opportunities abroad. The risk of brain drain thus arises when the country of origin fails to reap the benefit of this outsourcing of training, which can place a considerable brake on the overall level of qualification, for there is a general tendency for migration rates to rise as a function of the individual's level of education.[13] This student mobility is particularly marked between developing and industrialized countries, in particular the United States which, with over 600,000 visiting students in 2002, is the world's leading destination for foreign students pursuing their studies abroad.[14]

The United States is also the main destination for a second form of mobility, that of trained researchers. This mobility is no great problem so long as the researchers return to their countries. One can only really speak of a brain drain when these researchers tend to settle permanently abroad, which represents a serious impoverishment for the countries of origin since they have paid for the researchers' training yet export them free of charge. The President of Senegal, Abdoulaye Wade, draws a blunt conclusion about the effects of this phenomenon: "This hijacking of brainpower not only has a financial cost but also creates a void in the planned use of the human resources of developing countries, particularly in Africa".[15] It is indeed questionable whether the poor countries should be expected to finance, without compensation, the secondary and even higher education of skilled researchers whose work will, in the long run,

benefit only the laboratories of the rich countries. The phenomenon can be explained in part if we look at the cost of a researcher annually.[16] Developing countries spend an average of US$98,000 per researcher per year, while the corresponding outlay of industrialized countries is US$191,000. With an annual expenditure of US$238,000, the United States is the country that spends the most.[17] This strategy enables it to attract the best brains in the world by offering them not only high pay but, above all, optimum resources and work environment. The result is an increased concentration of research excellence in its territory, reinforced by the fact that private enterprises tend to locate their most advanced laboratories near high-technology industries. While in the closing decades of the twentieth century the second wave of the brain drain followed a mainly South-North trajectory, we today observe – alongside it – a third wave characterized by a North-North trajectory. A large number of European researchers have indeed been settling for some decades in the United States (about 400,000 en 2004), and this movement seems to be growing stronger as a consequence of globalization and of the difficulties experienced by researchers in some European countries.[18]

For many years the most frequently proposed solution to the problem of the brain drain, once its negative character had been diagnosed, consisted in encouraging the return of expatriates to their country or in discouraging their departure to the rich countries. But such solutions are doomed to failure since they focus on symptoms – the loss of skills – without addressing the cause of the brain drain. Coercive measures would moreover serve to restrict the mobility of scientists in general. However, the rise of knowledge societies offers grounds for hope that lasting solutions are possible, particularly through the establishment of networks. It is now easier to envisage exploiting "brain power" where it resides through expatriate networks. The point will be to encourage not so much the physical movement of qualified personnel as the circulation of "knowledge capital" through the participation of academics and researchers in the socio-economic development of their nations. Remote service provision will be supplemented by initiatives aimed at creating networks of cooperation or supporting networks of existing knowledge between expatriates and their countries. While the Transfer of Knowledge through Expatriate Nationals (TOKTEN) programme launched by the UNDP helps expatriates to maintain their links with their country of origin through short visits, other projects seek to promote the participation of expatriate professionals in national projects, along the lines of Thailand's "Reverse Brain Drain Project". The networks created spontaneously by expatriates, such as ASTA (Arab Scientists and Technologists Abroad) or ALAS (Latin American Association of Scientists), can also constitute sound bases for regional cooperation. The role of the new technologies can be central in the establishment of such networks since they enable much more tacit knowledge to be transferred remotely than other forms of data codification. International collaboration networks, enabling the mobility of individuals to be dissociated from that of knowledge, thus seem capable of providing a partial but lasting response to the problem of the brain drain.

The collaboratory

The development of such networks is part of a much wider movement that is modifying the very way in which scientific and technological knowledge is produced. The effect of electronic networks on traditional science networks means that the laboratory itself – the focal point of scientific research – has already undergone a substantial change. This radical transformation is set to extend even further in the future. The capacity to form networks, or collective research centres linking a number of partners working at sites sometimes far removed from one another, is a way of creating a new dynamic in a research system. Research workers are increasingly called upon to operate in networks linking teams from different institutions under joint projects or programmes, often associating academic and industrial partners. This coordination between numerous teams dispersed in space is today designated by the term "collaboratory".

A collaboratory is a "distributed" research centre or laboratory.[19] By exploiting the information and communication technologies, it enables scientists

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remote from one another to work together on a single project. A fusion of "collaboration" and "laboratory", the term designates the whole range of techniques, tools and facilities enabling scientists and engineers to work with equipment and colleagues situated at distances that previously made collective endeavours difficult. The collaboratory constitutes a revolution in the very concept of scientific work. It is now possible to set up a scientific research programme without being hampered by distances and by relying simply on the strengths of those taking part in it. This form of organization makes it possible to achieve spectacular results, as in the area of health. One of the first major tangible outcomes of the collaboratory concept has been the Human Genome Project (see Box 6.1).[20] The collaboratory is doubtless set to become the dominant model, given that we are confronted by a complexity of projects calling for worldwide cooperation. The collaboration of Europe, the United States, Japan, the Russian Federation and China in the experimental thermonuclear fusion reactor project offers a striking example. Similarly, an object such as the human genome is too complex for an isolated laboratory to assume sole charge of such an undertaking in a reasonable time frame. Through international cooperation, it is thus possible to accelerate research, which otherwise would be liable to squander valuable scientific time and give rise to duplication and overlapping, as generally occurs whenever two teams work on the same subject.

The notion of collaboratory should also influence the organization of scientific disciplines, since it goes hand in hand with the development of interdisciplinarity. Here again, it becomes difficult to contemplate the production of scientific knowledge without the sharing of knowledge and skills of different origins. Many breakthroughs in science have occurred at the frontier of two or more disciplines. The history of molecular biology highlights the fruitfulness of cooperation between biologists and physicists (particularly crystallographers), and it also shows how critical the contribution of specialists in information theory was when the genetic code was cracked in the 1960s. The need for multidisciplinary programmes is obvious in many of the great forward-looking projects. Such projects are inseparably political and scientific, whether they concern climate change, the cities of tomorrow, soil preservation, water management, the protection of coastal systems, early warning systems for disasters or epidemics, or best practices in sustainable development.

To a great extent, the challenge to be addressed is therefore that of mobilizing national and international research institutions in the service of interdisciplinarity.[21] The technological strong points of the collaboratory cannot override decisions of a political nature. It must nevertheless be noted that there are often institutional obstacles to the implementation of projected interdisciplinary programmes. Diehard attitudes in the compartmentalized departments and in projects or researchers evaluation systems often hamper interdisciplinarity. It is probably in respect of the training of researchers that an effort is needed to highlight the importance of interdisciplinary approaches in new fields. Bioinformatics, the nanosciences, urban research, population genetics and sustainable resource management are a few examples of these fields where leading-edge education associating a number of disciplines is necessary. It is therefore a culture of sharing of scientific knowledge that must be fostered if researchers, at both the individual and the institutional levels, are to be able not only to detect phenomena cutting across disciplines but also to create flexible networks around them.

Properly exploited, the collaboratory has the potential to give fresh impetus to scientific exchanges – hitherto uneasy and limited – between the laboratories of the North and those of the South. The collaboratory may become an ideal means of overcoming the traditional obstacles, since it is rooted at the very core of the scientific community and all partners stand to benefit from the operation. The very notion of transfer and sharing of knowledge is thereby profoundly renewed, given the possibility of positive synergies. The nanotechnologies partnership set up between the United States and Viet Nam is thus a promising start to scientific interaction. Under this project, the funding of nanotechnology research and training in Viet Nam has, as its long-term goal, the training of 2 million specialized workers to swell the ranks of the

workforce that will undoubtedly be needed worldwide by the emerging nanotechnology industry. Another form of international partnership, NEPAD, seeks to put Africa into scientific orbit in such areas as health, sustainable development and political stability.[22] Still in Africa, mention may be made of the establishment, in early 2004, of an international research consortium to sequence the genome of the Glossina fly, the vector of the parasite responsible for sleeping sickness. Health is one of the sectors where it is the most urgent to reduce the scientific divide. The position today is that 90 per cent of medical research focuses on the concerns and needs of 10 per cent of the world's population, located in the industrialized countries.[23]

The potential for "collaboratory" research is particularly promising in the areas of health and sustainable development since scientific collaboration is a boon in the implementation of projects permitting the production of wealth alongside the creation of scientific capacities (See Box 6.2). Given the rapid emergence of the networks, one wonders whether the collaboratory, virtual and deterritorialized, will not become established as the model centre for the production and elaboration of science, and even of knowledge in general. However deterritorialization should not cause us to overlook the fact that the collaboratory requires technological infrastructures that remain beyond the financial reach of a great many countries in the world. On this point, the recommendations of the World Summit on the Information Society are quite clear: the international community should encourage and assist in the financing of infrastructures, without which the notions of information society or knowledge societies are liable to be devoid of meaning.

However, such a strategy cannot by itself hope to resolve all the problems created by the knowledge divide and by the digital divide. While it can give visibility to researchers in the developing countries, and thereby consolidate "Southern science", international scientific cooperation, even in the form of the collaboratory, will not necessarily generate "Southern science". Belonging to an international team is no guarantee that there will be an improvement, even in the long term, in the conditions of knowledge production in the developing countries:, and collaboration may be regarded by scientific institutions in the North as little more than international recruiting campaigns. Again, it must be stressed that academic collaboration does not guarantee that international scientific successes, visible in the form of publications or prestigious awards, will lead to industrial-type applications on a local scale. At worst, collaboration strategies can have an adverse effect on the choice of research subjects. Financial resources and scientific prestige being generally linked to the interests of the scientific communities of the North, there is a risk that researchers in the South will cold-shoulder subjects of importance for their countries. The existence of orphan sicknesses and plants

Box 6.1 The lessons of the Human Genome Project for the collaboratory

In future four key principles should guide international scientific collaboration:

(1) Techniques and materials must be standardized as far as possible, so that results can be rigorously compared and repeated. A collaboratory is a decentralized system that can only function if the institutions making it up work in harmony (concept of interoperability);

(2) Research efforts must complement each other. The division of labour between laboratories avoids duplication of effort;

(3) Use should be made of technologies making for more efficient and rapid work;

(4) If such a programme is to serve the public good, there must be a sensible balance between disseminating raw data, validating and reviewing research findings, and identifying and protecting intellectual property.

These four principles are drawn from the article "Stem cell research must go global" by Roger Pedersen, published in the *Financial Times* of 16 March 2003. In a context in which research is increasingly linked to economic investments, it is not insignificant that principles of scientific collaboration should be published in a financial publication.

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is not due simply to the poverty of the developing countries or to the indifference of the pharmaceutical and agronomic laboratories of the North. It is sometimes the result of the lack of interest of researchers in the countries concerned. Those who contribute to scientific and technological decision-making should focus first and foremost on the capacity to generate scientific and technological knowledge. The possibilities opened up by the revolution of the electronic networks or the virtual laboratory are technological assets that will prove disappointing for many countries if they do not form part of long-term scientific and technological development policies and strategies.

The new frontiers of science

Frontiers of information

While it is impossible to foresee exactly the shape of science tomorrow, the directions in which research is currently moving are already providing a number of pointers, partially enabling us to imagine the future. The exercise calls for caution, for, while it may sometimes be possible to anticipate major technological trends, it is much harder to predict what individuals will do with these tools – and the impact that their use will have on the dynamics of science and technology. The approaches pursued here – resulting from a combination of information garnering and intuition – have thus led us to focus on a few domains (informatics, biology and nanotechnology) whose rise is marked by a high degree of cross-disciplinary integration, a distinctive feature of knowledge societies.

Since information technologies have played a key role in the emergence of knowledge societies, it can reasonably be assumed that their very rich innovation potential will remain a source of major transformations. As it is, we know that it will be necessary to pursue informatics research very much further, if only to address phenomena as crucial for world governance as climate change or the evolution of financial markets. These so-called "complex adaptive systems" require enormous calculation power since they embody a multiplicity of variables that must be studied in their totality. But what will the calculators of tomorrow look like? If "Moore's law", formulated in 1965, continues to hold good, it is highly probable that the power of the machines will continue to grow while their size will diminish. But this direction is perhaps not the only one conceivable, and probably not the most effective or sustainable from the economic point of view since it is expensive and means that computers have to be constantly renewed.

These economic limits are compounded by the prospective need to prepare as early as possible to combat "e-pollution". This form of pollution generated by electronic material – from the television screen to the mobile telephone – has to be taken very seriously. The environmental cost of a computer has first of all to do with its construction, which requires ten times its weight in fuel, whereas manufacturing a car demands "only" twice its weight.[24] It is estimated that, between 2000 and 2007, public rubbish dumps in the United States will have to process nearly 500 million "obsolete" computers, which are not easy to recycle.[25] These figures, worrying enough in themselves, become even more alarming if one thinks in terms of extending the electronic infrastructure to the entire world. Are we going to be faced, in the context of knowledge societies, with new difficult choices between development and preservation of the environment?

The answer is not necessarily. Some innovations offer the prospect of solutions to this dilemma. For instance, one of the most recent ways of markedly speeding up calculation is to establish grid computing schemes. Grid computing involves sharing a data-processing task between two or more individual computers forming a network, remote or otherwise. The grid.org network thus centralizes the power of 2.5 million machines, which enables the calculations needed in cancer research, for example, to be considerably accelerated without the need to buy expensive supercomputers.[26] Grid computing is an innovation that could have major consequences since it permits retrieval of the unused power of any computer connected to the internet (the average user employs a mere 10 per cent of the capacities of their machine) to increase the performance of scientific research. It is easy to imagine how far such task-distribution architectures could help reduce the scientific divide while

Box 6.2 The collaboratory and UNESCO

To give practical expression to the virtual laboratory project, UNESCO is making available to researchers in the developing countries a virtual laboratory toolkit containing instructions and free software (http://virtuallab.tu-freiberg.de/). The virtual laboratory is not intended to replace traditional structures but to extend and reinvent them. The example of the Microbial Resource Centres (MIRCEN) networks, the fruit of international collaboration, is the best illustration of the need to ensure the convergence of collaborative projects and virtual tools.

The MIRCEN centres are universities or research institutes in the industrialized countries and developing countries that, in cooperation with governments and National Commissions for UNESCO in the countries concerned, have created a network to harness the technological applications of microbial research for human progress through the vehicle of international scientific cooperation. Since 1975, in partnership with the United Nations Environment Programme (UNEP) and the UNDP, thirty-four MIRCENs have been created worldwide. The MIRCEN World Network of Research and Training Activities aims to provide a global infrastructure, including laboratories cooperating at the national, regional and international levels in the management, distribution and use of the microbial gene pool; to reinforce the Rhizobium gene pools in developing countries with an agrarian base; to foster the development of new inexpensive technologies native to specific regions; and to promote the economic and environmental applications of microbiology and contribute to the training of manpower.

Anticipating future development needs in international scientific cooperation, UNESCO has just launched the International Basic Sciences Programme (IBSP). The main aim of this programme is to strengthen national capacities in fundamental research, training and science education. Particular emphasis will be placed on the transfer and sharing of information and scientific excellence through North-South and South-South cooperation.

Source: http://www.unesco.org/scienc/

limiting the excesses of e-pollution. Such a public structure would make it possible, for example, to allocate calculation time to laboratories situated in developing countries and unable to afford supercomputers. Grid computing is no doubt set to play a key part in constructing knowledge societies.[27] On the technical front, it offers a lever for increased calculation capacity; where communication is concerned, it enables existing networks to be optimized; and in the scientific field it can further the rise of the collaboratory.

Bio-computers and nanotechnologies

Digital technology is furthermore developing at the microscopic level. The most ambitious projects concern the production of bio-computers. Many geneticists have argued that genetics is, in the last analysis, a science for the processing of information by living matter, which would make it possible to treat DNA as a computer. Such a DNA biocomputer would make it possible to process in record time problems of high complexity, starting with those linked to the development of nanotechnologies. In this new stage in biotechnology, researchers are trying to add new letters to the alphabet of living matter – by grafting, for example, "non-natural" elements onto existing processes. This involves going beyond the modification of existing organisms so as to produce completely new micro-organisms, which could help in tackling certain environmental challenges, for example. These micro-organisms could assist in the development of new energy sources (hydrogen production and biomass conversion); they could contribute to the substitution of non-fossil for fossil fuels; or they could enable improvements in air quality (particularly by reducing carbon monoxide emissions) and facilitate waste treatment. This research heralds a transformation in how life is viewed since it ultimately offers the possibility of producing new genetic programmes. For the time being, these are only projects and still Utopian, but the potential they embody – both positive and negative – is the focus of scientific, ethical and political debates well ahead of their becoming a reality. It is to be hoped that they will benefit from the difficult debate over genetically modified organisms (GMOs), which can be seen as just a prologue to the "techno-social" transformations stemming from the control of living systems.

Mastery of the "infinitely small" is also becoming a reality with the rise of the nanotechnologies, made possible in particular by the invention of the "tunnel effect" microscope allowing us to "see" the atom. The ambition of the nanotechnologies is to produce

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microscopic machines that are adaptive systems. The nanotechnologies are of special interest to the medical sciences. Work on a molecular scale is a prerequisite for so-called non-invasive treatment methods, capable of operating without major intrusion where the surgeon's knife has the most difficulty reaching, and more finely than the most precise of hands is capable. Nanotechnology research will lead to what could be termed nanomedicine. In addition to the potential of nanosurgery, research aiming to construct analysis laboratories on a molecular scale capable of providing real-time diagnoses, also deserves mention.

While technology is still a long way from being able to build nano-machines, the scientific community is seeking to develop a veritable "info-nano-biotechnology". The aim is, *inter alia*, to draw on the example of living cells in order to build machines capable of adapting dynamically to their environment by reprogramming themselves. Medicine and pharmacy, the environment, agriculture, manufacturing and mining industries, transport, energy, information and communication, all stand to be revolutionized. Generally speaking, the technologies that lie ahead are going to confer on matter the characteristics normally attributed to complex systems, sometimes termed intelligent. The introduction of nanotechnologies can only be of benefit, however, if researchers, manufacturers and governments back up this technological breakthrough with a genuine forward-looking analysis and in-depth consideration of the environmental and health risks of technologies whose effects are still very far from being known. Being adaptive systems, nano-machines may present risks of uncontrolled or malicious dissemination in nature or in human environments. The most gloomy, doomsday-type foresight scenarios see the possibility of a "global ecophagy" in which all or part of the biosphere would be destroyed by exhaustion of the carbon necessary for the self-reproduction of the nano-machines in question. However, just as in the field of genetics (take the case of cloning), the most urgent risks are ethical, for these new powers given us by the sciences and technologies may cause us to look on nature in its entirety as an artefact and to naturalize, as it were, human choices by embodying them in matter. These developments force us to pose in radically new terms the question of the place of the human being in the universe.

The man-machine interface

The man-machine interface designates hardware and software devices enabling a user to communicate with a data-processing system. The most usual interfaces are the screen, the keyboard, and the mouse of our computers, but they also include the remote controll of our multimedia equipment. The ambition to correct disabilities by constructing cybernetic prostheses (which until recently was only dreamed of in science fiction) rests on the possibility of directly linking the nervous system to automata. This fusion of the body and the transistor is radical in that it has the potential to reduce both motor and sensorial disabilities. The aim would be to "plug in", as it were, cameras and microphones where sight and hearing are deficient. The most spectacular projects are no doubt those that seek, by implanting biochips in the brain, to restore to totally paralysed quadriplegics the ability to communicate by means of computers connected to their nervous system.

When we think of such a prospect, we can see that the complexity of these new technologies does not relate solely to their material feasibility. The prospect of bringing machines closer to people is doubtless one of the main horizons of informatics and biology. But it raises many problematic issues. For instance, are there not grounds for questioning the growing place of technology, not just in the human environment but now also in the human body? Men and women are going to be faced by new enigmas and will have to re-examine the underpinnings of their identity at a level that neither culture nor religion could foresee. Once electronic implants embedded in our very organs optimize their functioning, the frontier between humans and machines will arguably become blurred. How are we to distinguish between ourselves and our own creations? To whom will our bodies and even our thoughts belong?

The only human response to these questions will be to adapt machines to human beings, rather than adapting people to machines.

Research and development: future challenges

Scientific publications

Scientific publications are a major concern since communication between researchers is intrinsic to the very nature of their activity. Publication represents a key instant in the production of scientific knowledge, for it is then that the results are formalized and made public. Thanks to publication, what was informal knowledge, confined to a laboratory, is validated by the peer group and enters the realm of public discussion for examination and debate. Because it ensures transmission and validation of research findings, publication is part and parcel of the knowledge creation process.

The new technologies are a vital technical means of reducing the difficulties of publishing or of consulting scientific research in developing countries (see Box 6.3). But since knowledge – and hence science – is becoming a basic factor of economic activity and the new technologies are simultaneously transforming modes of communication, and with them scientific publication, new questions arise. This crisis of transition towards knowledge societies is reflected among other things in tension between publishers and researchers. On the one hand researchers – seeking to benefit from an impact that is not directly commercial – have an interest in seeing their publications achieve the widest possible circulation and in access to knowledge being free. On the other, publishers – who derive a direct income from the sale of books and journals – tend to limit the diffusion of scientific information to those who can pay for it. Since the role of publishers is not simply to distribute publications but to ensure their quality by organizing peer review, a tension arises between the two essential requirements of science – public accessibility and the validation of information.

While most of the major scientific reviews went digital some years ago, this does not mean that they are easily accessible to the public, particularly because of the cost of consulting them. Reviews are mainly accessible in public, university or institutional libraries. However, the subscription rates are so high, especially when numerous journals are involved, that many libraries, even in the industrialized countries, have been forced to remove titles from their collection. While there can be no denying that publishers require effective commercial strategies, the nature of the goods in this instance is prompting many researchers and librarians to highlight certain problems. Firstly, authors make a large majority of articles available to the journals free of charge and their peers review a large majority voluntarily. Commercial publishers, who control 40 per cent of the titles, therefore find it more and more difficult to justify rates that academic libraries and scientific communities find increasingly at odds with their mission of producing and transmitting knowledge. Moreover, the mode of functioning of scientific publishing, whereby the rights to the article published are transferred to the review in question, raises the problem of the access of the public to public research findings. Generally speaking, there are grounds for concern about the restraints that rising costs could place on research.

A number of strategies have been envisaged to address these new challenges. To end this situation deemed counterproductive in the long run for science, a group of scientists including several Nobel Prize winners launched the Public Library of Science (PLoS).[28] The PLoS home page justifies its approach in terms of an ethical concern with disseminating information:

> The internet and electronic publishing enable the creation of public libraries of science containing the full text and data of any published research article, available free of charge to anyone, anywhere in the world.

The fact of placing the articles in open databases could facilitate the interfacing of findings from neighbouring fields and promote interdisciplinary research by giving researchers readier access to fields other than their own. Another model, the Budapest Open Society Institute, is also seeking to make all research articles freely accessible on the internet and offering a guide for the purpose for non-profit organizations.[29] Prepublication is another way of making material accessible online while avoiding the time lags inherent in bringing out works in print, which are often too long for leading-edge research. We are also seeing the spread of publication self-storage sites, made available to researchers working in a given field.[30]

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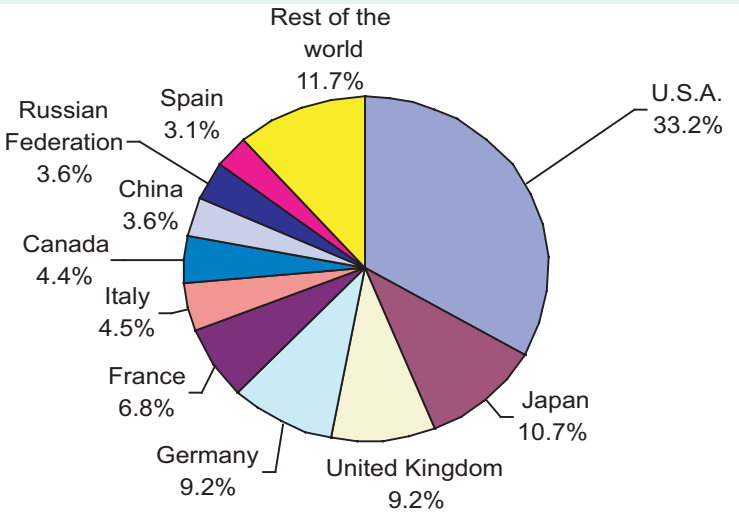
The fact that online journals exist should not cause us to overlook an obvious truth: there can be no journal without a publisher and editors. Even if a journal is free of charge and accessible to all, it still requires editing work. What is more, the emergence of knowledge societies seems likely to increase the supply of publications and this will make sifting out increasingly necessary. This sifting process is what is carried out by publishers, whether in the public or private sectors, when they establish more or less stringent criteria for verifying "scientific quality". The need for such sifting has been highlighted by the recent decision of a number of journals, such as *Nature* or *The Lancet*, to introduce a declaration clause whereby authors of articles are required to make known their funding sources. This clause is not yet compulsory but it certainly points to the changes under way. If the economic world cosies up to that of science, there has to be a guarantee that scientific research is done with all necessary rigour and without any whiff of conflict of interest. By guaranteeing the scientific quality of publications,

Box 6.3 Scientific publications in the *Science Citation Index (SCI)* as a percentage of the world total, 2000

Indicators for numbers of scientific publications measured by the Science Citation Index reveal two major poles: Europe (EU countries and Iceland, Norway and Switzerland) with 38.6 per cent, and North America (United States and Canada) with 37.6 per cent. The two alone represent nearly three-quarters of the citations covered by the Index. The relative importance of these two zones reflects their share of total world research spending. The countries of industrial Asia, notably Japan, account for 11.7 per cent of citations included in the Index and are therefore trailing as compared with their research and development expenditure – the laboratories of the latter countries are in fact mainly focused on technological and industrial research. In the case of the other countries or regional groupings, China accounts for 2.6 per cent of the Index, Latin America and India 2.2 per cent and 1.9 per cent, respectively, with Africa's share coming to about 1 per cent. The world's indisputably very contrasted science and technology geography underwent a marked change in the 1990s. Between 1995 and 1999, the relative importance of North America in the index of scientific publications declined by 10 per cent, while that of Europe rose by 5 per cent, making it the prime zone for such publications according to the Index. Industrial Asia (including Japan) increased its share by 16 per cent and this, today, represents close to a third of that of Europe or North America. China experienced high growth and increased its share by 65 per cent during the 1995–1999 period, while it had already raised its production of scientific publications fivefold between 1985 and 1995 (admittedly from a very low initial figure). The share of Latin America, too, grew significantly (by 37 per cent). On the other hand, the countries in transition, sub-Saharan Africa and India saw their shares decline respectively by 24 per cent, 15 per cent and 6 per cent.



Source: UIS, based on INRS (Quebec, Canada) data.

Box 6.4 Intellectual property and the scientific divide

A patent for an invention is the grant of a property right to the inventor, who receives an exclusive exploitation right (but can obviously grant a licence). In 1999, the European countries filed 45.8 per cent of the patents in the European system (i.e. valid in the territory of the extended European market), North America 33.6 per cent and industrial Asia 16.3 per cent. In the United States patent system, North America accounts for 51.4 per cent of the global total, industrial Asia for 28 per cent, and Europe for 18.7 per cent. It is also observed that in both patent systems the global shares of the other geographical zones are very low (for Latin America, 0.3 per cent of United States and 0.2 per cent of European patents). Globally, all these other geographical zones together file barely 1.5 per cent of the world's patents. Even though Asian countries such as Singapore, the Republic of Korea and Malaysia became exporters of high-technology goods in the 1990s, we can hardly escape the conclusion that, where scientific and technological innovation is concerned, intellectual property remains overwhelmingly in the hands of the countries of three regional or subregional groups representing only a quarter of the world's population.

1999 figures, taken from *Rapport OST 2002* (Observatoire des sciences et des technologies).

publishers represent one of the mainstays of trust in the institution of science itself.

This work, specific to the publisher – whether we are speaking of traditional or electronic publishing and whether access is with or without charge – shows that cost-free access is in no way equivalent to cost-free production of the knowledge in question. In many online journals, the cost of publishing articles is borne by the authors, relying on their research grants. Even in electronic mode, publication involves costs in staff and materials, linked to the work of reading, editing and formatting the texts, site maintenance and long-term record-keeping. A system based solely on cost-free access would thus run the risk of seeing inequalities develop between institutions – and regions – depending on whether or not they are able to offer their researchers the best possible publication conditions. So while the "charge for everything" approach seems a less and less realistic system, it does not follow that the "everything free of charge" approach is the fairest one. On this point, the economic policies of traditional publishers can help to establish a more equitable environment by adopting differential charging schemes to enable less well-off institutions to maintain or take out subscriptions to journals they could otherwise not afford.

In all probability, scientific publication is moving towards a world in which a number of operating systems will coexist. What our thoughts should be focusing on is the diversity and complementarity of roles in this context. Whether or not it is free of charge, diversity of supply makes it possible for more gestating knowledge to circulate, and thus, for more to be produced. For there is no longer just one state of the research article, commercially owned by the publisher and constituting the sole norm of scientific publication, but a plurality of states and norms and hence of ways whereby knowledge can become public. While researchers are bent on access and publishers on control, everyone has an interest in making the production of scientific publications both abundant and diversified.

Who owns scientific knowledge?

The meaning of the changes currently taking place is largely bound up with the importance that industrial and financial issues have come to assume in the production of science and technology. The question of the ownership of knowledge – whether by the public or private sector – represents one of the most crucial issues for knowledge societies (see Box 6.4). As we saw earlier in connection with the challenges that need to be addressed by the developing countries, intellectual property plays an increasing role not only in the planning of much research but also in the use of scientific discoveries and technological inventions. Thus, according to WIPO, it took 18 years, from 1978 to 1996, to reach the 250,000th patent application, but only four years to double that figure between 1996 and 2000.[31] The real problem, today, is that of the overlapping of scientific speculation and the search for profit, in the private and public sectors alike.

The future profile of knowledge societies is already discernible in the interest aroused by debates over intellectual property, for such reflection, necessarily forward-looking, anticipates the form to be taken by the

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governance of knowledge and hence the governance of societies transformed by knowledge. The challenge of the debates over intellectual property is vast since it is no easy matter to reconcile the two requirements of Article 27 of the Universal Declaration of Human Rights, subparagraph 1 of which stipulates that "Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits"; while subparagraph 2 specifies that "Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author". Furthermore, the requirement of subparagraph 1 is recalled in Article 15 of the International Covenant on Economic, Social and Cultural Rights, which stipulates that: "The States Parties to the present Covenant recognize the right of everyone … to enjoy the benefits of scientific progress and its applications" . Thus, the intellectual property systems have a twofold purpose of protecting rightful claimants with respect to knowledge and of disseminating knowledge.

In a sense, what have to be reconciled are the requirements of two markets, that of science and that of the economy. This twofold requirement means dispensing with the idea that a market is simply a structure of industrial exchange. A market is a structure of exchange in general.[32] If the scientific community can be defined as a place where ideas, theories and arguments are exchanged, then it can be defined as a market or exchange where the stock exchanged is knowledge and not industrial goods. That being so, the scientific effectiveness of intellectual property must be dependent on the market it regulates. Excessive coverage of the utilization of knowledge by patents, whether to do with living matter or software, may put a serious damper on research and innovation, for it may distort scientific competition by artificially creating opaqueness. On the contrary, the sharing of knowledge exposes said knowledge to the competition from other actors in the scientific market. To apply industrial market criteria unilaterally to knowledge is to run the risk of hampering competition among scientists, which is one of the mainsprings of knowledge creation – to publish an idea is to expose it to criticism and hence to improvement by others. Protecting investment in the field of knowledge must not constitute a protectionist curb on the expansion of science. A prime concern in the construction of knowledge societies is the synchronization of two different markets, previously parallel and isolated, but whose gains may be mutually reinforcing when made part of consistent networks – the market of scientific ideas, and the economic and financial market. It is no doubt a phenomenon of co-evolution that we are witnessing.

To support this development, normative processes musts be promoted. These will inevitably be multidisciplinary since they involve a field calling for legal and economic tools as much as scientific ones.[33] The need to observe such principles is self-evident when one realizes that, in many cases, it is the professionals in the industrial property field – industrial property consultants and patent examiners – and the industrialists themselves, who have shaped the law, without in-depth consultation of the scientific community. This runs the risk of arriving at a situation in which scientific capital – or even intellectual and cultural capital generally – will be mere variables of economic capital. Such a development would be at odds, technically speaking, with the openness of knowledge and, from an ethical standpoint, with the fact that a human being's capacity for learning is not dependent on economic status. It would be unrealistic to seek to establish a knowledge-based economy and knowledge societies without the participation of all the stakeholders and partners involved, beginning with scientists. The governance of knowledge societies must rest upon the devising of a common approach, by which we mean regulations shaped in common by all concerned.

Background resources

Amsden *et al.* (2001); Annan (2003); Arocena and Sutz (2001); Bangré (2004); Boyle (2003 and 2004); Butler (2004); Callon (1989); Campbell (2001); CERN (2004); Cimoli *et al.* (2004); David (1993); David and Foray (2002); ECLAC (2004); Eco (1995); Etzkowitz and Leydesdorff (2000); European Research Council Expert Group (2003); Forero-Pineda and Jaramillo-Salazar (2002); Gaillard (2004); Gibbons *et al.* (1994); Hariharan (2004); ICSU (2002); InfoDev (2004); Intarakumnerd *et al.* (2002); InterAcademy Council (2004); Jouvenel (2002); Juma (2005); Juma and Yee-Cheang (2005); Kim (2001); Latour (1987); MSF (2001); Mvé-Ondo (2005); NSF (2003); OECD (2003); Okubo (1996); OMPI (2003); Papon (2002); Pedersen (2003); Sagasti (1999); Sagasti (2004*a*); Santoro and Chakrabarti (2002); Sen (1999*b*); Teferra (2000); UNESCO (1996*a* and 1998*c*); UNESCO-ICSU (2000 and 2002); United Nations (2003); Wade (2004*b*); Waga (2002); Westholm *et al.* (2004); World Bank (2002); Ziman (2000).

Chapter 7

Science, the public and knowledge societies

> If every nation gains full access to this broader world community of science and has the opportunity to develop an independent science capability, its public can engage in a candid dialogue about the benefits and risks of new technologies, such as genetically engineered organisms or nanotechnology, so that informed decisions can be made about their introduction into our lives.[1]

Kofi Annan's words raise a fundamental question: how is the general public to be engaged in discussions of science and technology? Economic and social issues play an increasingly important part in guiding research and innovation, and at the same time, the ever greater presence of science and technology in the commonest activities has led to some intense ethical soul-searching. It is no stifling detail that the most animated of international debates in recent years have been about issues such as cloning, the status of the human embryo and GMOs – issues which affect life processes essential to the species: procreation, food and the environment.

Such developments require us all – decision-makers, scientists, concerned citizens – to reassess the relationship between science and society. Indeed, these current debates go beyond the usual scope of science policy (broad lines of research; training and recruitment; international cooperation, etc.). Science and technology are now part of the daily fare of governance in the most general general sense of the word. The governance of science presupposes much work in drawing up rules and standards, the proper task of state authorities and multilateral international organizations; but it also involves ethical capacity-building among scientists and science teachers, and it must not neglect the raising of public awareness, not least by means of effective mediatization of science and technology.

Good governance for science and technology

Mistrust of science: a challenge for scientists.

Our ability as human beings to control what we create is increasingly a matter for soul-searching: science confronts us with radically new questions, ones which leave the traditional authorities (governmental, scientific, religious, community or civic) with no firm grasp on the meaning or direction of these upheavals, and their ethical and social consequences. This lack of certainty undoubtedly explains some of the misgivings about science expressed on occasion by public opinion, such as the consequences its advances may have on the environment and the future of our species. Such mistrust is a fairly recent phenomenon; science was long looked upon favourably, respectfully, and often even with an almost religious fascination. Never before has the human race enjoyed such power over its own health, its environment, and even its existence. But new weapons, industrial disasters (chemical and

nuclear in particular) and ecological catastrophes have induced a concern among the general public about the destructive potential of science and technology for present or future generations, when not properly controlled or used with evil intent. Admittedly, no human enterprise is free of risk, but some now question the very basis on which the risk-taking is justified. Such mistrust of science is clearly rooted in a complex set of questions, not all of them baseless; the possibility of drifting into disaster raises issues on which the scientific community itself is divided.

The need for public proof

The other main development of our age, besides this growing scepticism about science and technology, is the public nature of scientific debate. Science and technology provoke public debate nowadays not only among scientists, but throughout civil society, government and business. Decisions about science and technology were until recently the preserve of an almost exclusive conversation between scientists and their institutional, governmental and industrial impresarios. Society's only role was to adapt to these decisions from on high. But today the growing importance of science and technology in daily life is demanding a less linear, less authoritarian and more complex way of organizing the interplay of science, decision-making and society (see Figure 7.1). This upheaval in the established pattern of decision-making structures is due in particular to the influence of new technology on modes of governance, facilitating the horizontal transfer of information and going some way towards replacing the traditional vertical hierarchies by new horizontal patterns of information traffic that are less centralized and more transparent. These changes, technological and social, are leading to new expectations and new demands, not least from civil society.

It would seem that we are moving towards more complex patterns of governance, regulated by a demand for public proof. The reality of this new requirement is illustrated, for instance, by the national and international debate on whether the laboratory is any place for the human embryo. This public proof requirement means that those involved in any scientific or technical issue (governments, the scientific community, the private sector, civil society and the public in general) are obliged to argue their case not only according to the evidence and proofs that belong to the world of science, but also within the framework of civic debate and public deliberation, where political and ethical principles come into play. The requirement of public proof does not only make itself felt at national or local level. During the international crisis in 2003 over SARS, some governments were forced by international pressure to make public certain epidemiological information which might well have been regarded until then as the preserve of national sovereignty. As globalization raises the frequency and speed of travel, the spread of epidemics becomes an increasingly international problem. We may therefore expect this requirement of public proof to become stronger at the international or even intergovernmental level.

This requirement of public proof entails a new deontology or, if you will, new rules governing the scientific method, that are valid outside the laboratory and no longer simply within it. Scientists and experts must realize that their technical pronouncements are only going to be accepted in the public arena if they can make visible to the public the way these were obtained and explain the issues involved – the argument from authority no longer carries the day. So the policy arena becomes a place of learning, where some minimal familiarity with the technical aspects of scientific issues has to be instilled.

Many see a "crisis of the scientific ethics" in what is in fact an enhanced awareness on the part of a civil society that has become more exacting because it has become better informed. The controversies over GMOs have shown what happens when the need for support among the general public is ignored. Some of the difficulties encountered in the fight against AIDS are likewise due to the ineptitude shown by a number of governments for the task of getting scientific information across in a way that is culturally and socially suited to their citizenry, and conducting policies for prevention that require more involvement from society. The old modes of government no longer work, because they rely on technocratic risk management, which the public often finds obscure, and on authoritarian and one-way communication that can even be conceived

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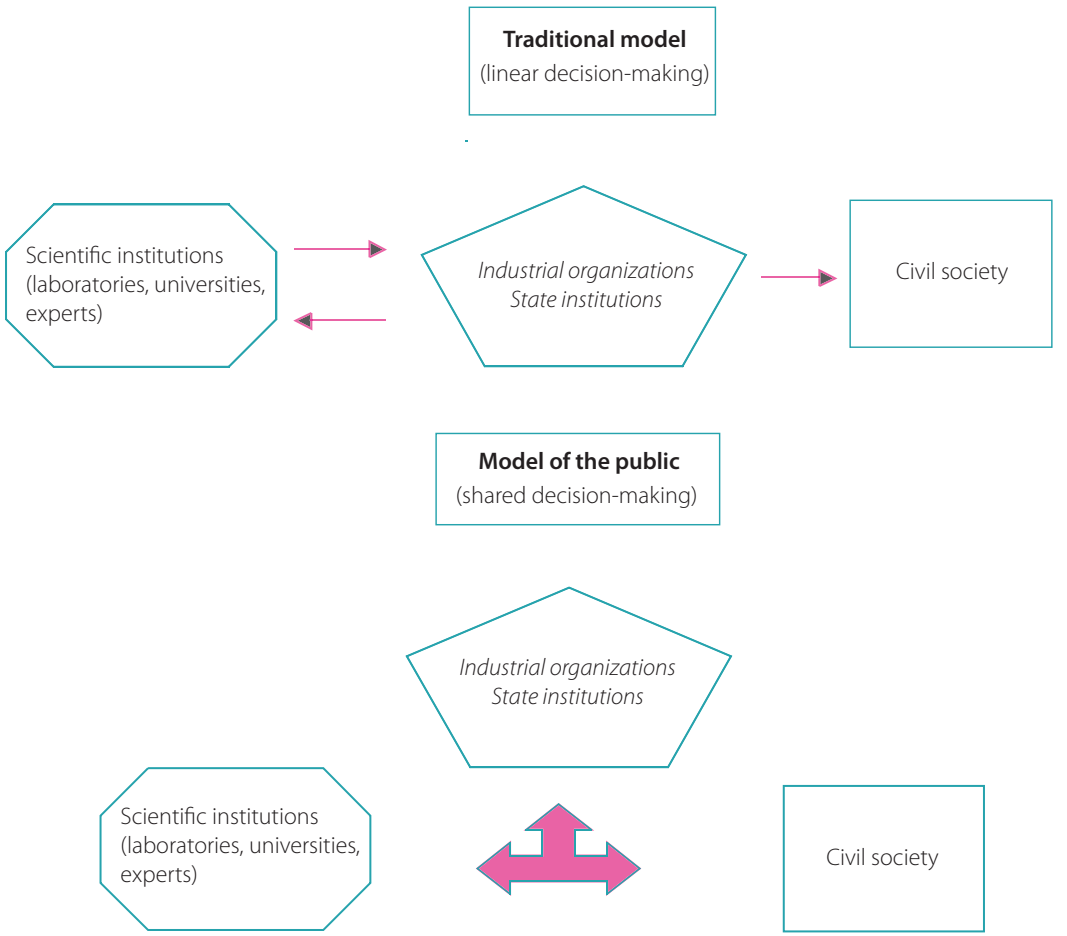
Figure 7.1 A new form of governance for the sciences?



In the traditional model of decision-making, industry and government have a near-monopoly of direct dealing with scientific establishments; civil society and the public have a largely passive role. The arrows go one way and they represent linear, unilateral communication. In the "public" model the relationship is triangular. Industry and government no longer form a barrier between science and the general public. This has become possible largely because of the ICT revolution. Instead of the three unidirectional arrows, we have a composite block whose arrows are meant to show that there is no longer a hierarchical relationship: it represents the public realm of discussion, concerted action and/or confrontation, and in particular it represents that network of networks, the internet.

as a matter of mere instruction, to be delivered to the population from on high. In science policy as in policy generally, governments and the scientific community ought to be aware of civil society's growing demand to be more involved in the decisions that affect it. To meet such demands for participatory democracy, governments are now obliged, alongside the traditional structures of representation and delegated power, and those for agreeing policy with established economic and social interest groups, to encourage the participation of non-governmental organizations in the development of shared standards.

Public proof deals with one of the arguments most often used for excluding the public from any part in decisions on science – its ignorance or its incompetence. The idea of the new approach is not

to set up the public in opposition to the experts but, on the contrary, to encourage arrangements for dialogue wherever possible, conducted in mutual respect among a number of different players. Scientists themselves are the first to be affected here, both as experts and as citizens, for scientists are citizens also. The all-too-widespread image of science as indifferent to moral principles must be countered by recalling that it is itself, by definition, a source of some of those principles. Transparency, impartiality and truthfulness – all essential to good governance – are some of the values that essentially inform scientific practice.[2] It is for the sake of transparency and impartiality, indeed, that governmental and intergovernmental organizations have to guarantee, whenever desirable and possible, the conditions for an informed and democratic debate between opposing views (see Box 7.1). The creation and management of arrangements for this (committees, forums, workshops, etc.) should be a priority for our decision-makers, if we really want our "knowledge societies" to be participatory and inclusive.

Ethics committees: an interface

Since issues relating to scientists' ethical and social responsibilities cannot be dealt with in scientific institutions alone, we have to consider how to ensure that debates on science and technology have the required public exposure. Multidisciplinary ethics committees or commissions that include recognized authorities in the field are one of the most appropriate arrangements for public discussion and agreement, enabling various different points of view to be heard. Such bodies have a crucial interface role in developing a common language and shared criteria with which to debate a given problem. The diversity of existing ethics committees shows how a suitable response can be found for any level of decision-making, type of content or remit.

Ethics committees are instruments that can be established in response to new ethical problems at the national level (national ethics committees), regional level (the Nordic countries, Europe, the OECD) and world level (International Ethics Committee, Intergovernmental Ethics Committee, World Commission on the Ethics of Science and Technology, all set up by UNESCO). These ethics committees offer another kind of diversity – that of subject-matter and spheres of competence, which vary because ethical issues can be universal or particular, and because each field of science or technology needs examining in its own appropriate way. The ethical issues raised by *in vitro* fertilization, for instance, do not call for the same answers as those of sustainable development. Lastly, a committee's remit will depend on its

Box 7.1 The Global Ethics Observatory

UNESCO has just started work on a dedicated worldwide network of databases in bioethics and ethics of science and technology. This Global Ethics Observatory (GEO) is intended to help implementing UNESCO's standard-setting activities, and to provide assistance for policy-makers through networks of experts. It will also support national ethics committees and disseminate information regarding national policies and legislation. GEO consists of four interrelated databases:

- a database of individual experts in ethics;
- a database of institutions, departments, centres and commissions in the area of ethics;
- a database of ethics teaching programmes;
- a database of legislation, guidelines and regulations in connection with ethics.

These databases will be available in the six working languages of the Organization's General Conference (English, French, Spanish, Russian, Arabic, and Chinese) and are intended to serve the general public as well as governments of UNESCO Member States. Most of the work involved remains to be done, but will in the end provide the means for a thorough reflection on ethics in the knowledge society.

For more details please see: http://portal.unesco.org/shs/in/ev.php-URL_ID=6200&URL_DO=DO_TOPIC&URL_SECTION=201.html

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ethical and political objectives: in some cases, it will have an advisory role; in others, it will be called on to guide the making of rules and standards. But a committee's primary role is to be a forum, encouraging the exchange of ideas and information, and its constituencies are the general public, the world of the specialists and the decision-makers, public and private. Bioethics, for instance, has through the action of many committees taken on an essential function by helping to restore society's confidence in the ability of the sciences to enhance the well-being of individuals and populations.[3]

The principle of public exposure and the conscience clauses

Ethics necessarily generates rules and standards: science ethics cannot ignore the matter of codes, and these must be suited to the peculiar requirements of each field. Draft codes of conduct for scientists already exist (for example, the Uppsala Code of Ethics for Scientists)[4] and there is the rich tradition of medicine, where scientific knowledge has been inseparable from its social and ethical implications since ancient times. But the Hippocratic tradition itself needs bringing up to date. Clinical responsibility and the doctor's position have long been seen, on the model of the Hippocratic oath, as a personal relationship between individual doctor and individual patient. However, for some time now this model has been inadequate on its own for regulating the whole of medicine. Public health policies involve collective choices and responsibilities for supervision that concern not only traditional medical professionals but also people who, though they do not work in surgeries, clinics or hospitals, still have an ethical responsibility and a duty of care in relation to the sick. Drug companies that have underestimated the ethical importance and effect of their commercial policies in the past (not least in developing countries) have learned this to their cost.

As issues of biotechnology and medical research – and, tomorrow, nanotechnology – are sure to occupy an increasingly important place in the study of ethics, we need to be careful to identify the questions that are bound to be of concern to all parts of society. One instructive example is to be found in the Ethical Principles for Medical Research Involving Human Subjects, contained in the World Medical Association Declaration of Helsinki (see Box 7.2). Such codes require the protocols of experiments on human subjects to be submitted to an ethics committee set up for the purpose and, more generally, for ethical debates to be given the necessary *public exposure*. Any science ethics worth the name must take the public and its representatives into account. Scientists, who have to reflect on the ethical consequences of their work and, if required, to make their conclusions public, have a particular responsibility here. Without such public exposure, there can by definition be no public debate.[5]

However, calls for public exposure of scientific debates are in danger of futility if they are not accompanied by guarantees for individual researchers and sanctions for employers who prove less than wholly scrupulous. Employers, indeed, do not always stand to gain from making public the possible risks involved in some of their research. Confidentiality may be a strategic resource, a means of hiding an urgent issue, a health problem or an environmental danger from the public. This type of problem has no doubt always existed, but it has now become more acute as a result of the growing mutual entanglement of industry and research, which can lead to an abuse of industrial confidentiality at variance with the scientific imperative to make knowledge public, above all when its application involves risk.

How is one to react to the difficulties that laboratory confidentiality may cause? Some experts have considered the idea of a conscience clause – a body might be set up to which researchers could, without fear of reprisals, report any ethical or legal problems arising from their research. The conscience clause is designed to restore a measure of equilibrium between employers and employees, in private or public enterprises that have functions or tasks carrying responsibilities relating to scientific or technological matters. It would introduce a form of transparency directly inspired by whistleblower regulations such as the *Whistleblower Protection Act* now in force in the United States.[6] The availability of such a clause would make exercising academic freedom to the full easier in

industrial or mixed academic/industrial environments. Admittedly, the conscience clause raises a number of questions but, in proposing to apply a management measure to the world of science, it does undoubtedly speak to the kind of question that knowledge societies are bound to raise. It is in fact an attempt to create regulatory instruments suited to a new age, where the private sector's role in the production and use of scientific and technological knowledge is constantly growing.

How should scientists be taught ethics?

Such instruments will only work effectively, however, if they enjoy solid and responsible support within the scientific community. This particular requirement is at the heart of the principles proclaimed by ICSU's Standing Committee on Responsibility and Ethics in Science: "The ethical responsibility of the scientific community is ultimately borne by the individual scientist".[7] It is she or he who decides whether and how to pursue a given line of research, what to do with the information obtained and so on. The ethical awareness of the individual scientist is of utmost importance. In many cases, it is the researchers who are first exposed to the ethical issues raised by the effects of scientific discoveries or the impact of certain practices, such as pollution. There must indeed be texts laying down the rules to which scientists can refer for guidance and that will provide a reliable framework for any steps they may take. But promulgating codes and recommendations is not enough. Unless they are built into the scientists' training at a very early stage, they are liable to be perceived by those involved as artificial hindrances, and to remain dead letters. Early training in science ethics is therefore necessary if we are to awaken our researchers' sense of responsibility (see Box 7.3). Such training must be systematically included as part of the scientific curriculum at all levels, and must also be properly assessed.

Knowledge societies depend on the requirement of public proof. It helps to guide thinking. Since scientists are used to handling formal demonstration,

Box 7.2 World Medical Association Declaration of Helsinki 1964, (as amended in 2000) Extracts

Ethical principles for medical research involving human subjects

Art. 10 Appropriate caution must be exercised in the conduct of research which may affect the environment, and the welfare of animals used for research must be respected.

Art. 11 The design and performance of each experimental procedure involving human subjects should be clearly formulated in an experimental protocol. This protocol should be submitted for consideration, comment, guidance, and where appropriate, approval to a specially appointed ethical review committee, which must be independent of the investigator, the sponsor or any other kind of undue influence … .

Art. 12 The research protocol should always contain a statement of the ethical considerations involved and should indicate that there is compliance with the principles enunciated in this Declaration.

Art. 13 Medical research involving human subjects should be conducted only by scientifically qualified persons and under the supervision of a clinically competent medical person. The responsibility for the human subject must always rest with a medically qualified person and never rest on the subject of the research, even though the subject has given consent.

Art. 14 Every medical research project involving human subjects should be preceded by careful assessment of predictable risks and burdens in comparison with foreseeable benefits to the subject or to others. This does not preclude the participation of healthy volunteers in medical research. The design of all studies should be publicly available.

Art. 15 Physicians should abstain from engaging in research projects involving human subjects unless they are confident that the risks involved have been adequately assessed and can be satisfactorily managed. Physicians should cease any investigation if the risks are found to outweigh the potential benefits or if there is conclusive proof of positive and beneficial results.

Source: http://www.wma.net/e/policy/b3.htm.

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Box 7.3 Strengthening scientists' ethical capacities

The World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) has recommended including training in ethics as part of the scientist's curriculum. This should cover two subjects: identifying ethical issues and developing the capacity to argue. The primary aim in teaching ethics is to develop the student's capacity to identify and analyse an ethical issue in such a way as to be able to act ethically in consequence. Teaching should begin by making the students more receptive to ethical questions. Against the background of societies' increasing openness to globalization, this raising of awareness should especially stress the multiplicity of ethical approaches resulting from the diversity of political and religious cultures and traditions. These courses would therefore tend to aim at introducing ethical issues in all their complexity and at bringing out the wealth of cultural contexts in which they occur. Next, they should illustrate the alternatives that people face in the light of these problems, and also the consequences, positive and negative, which their decisions can have on other human beings or on the environment. But one of the main aims of this training would be to develop skills of ethical analysis and argumentation in this field.

For further details, please refer to the COMEST report entitled *The Teaching of Ethics*, available at the following site:

http://portal.unesco.org/shs/fr/file_download.php/ebb9544bd71d3b4f0801d4de884afTeachingofEthics.pdf

emphasis should be on discussion and public argument – while avoiding the snares of specialist controversy as far as possible. Let us be clear: by "argument" we do not mean any mere verbal dispute. An argument only deserves the name if it takes account of the rational responses of those taking part. An advertisement is not an argument, nor is propaganda. Such messages are one-sided and do not lead to a situation of dialogue. Distinguishing good arguments from bad and building a valid argument for oneself are by no means natural skills, but ones that must be acquired. The practice of argument is therefore the best possible training in ethics. Its aim is not to proclaim a general and abstract code but to give each individual the ability to formulate a clear judgement, starting from just those practical situations in which existing codes might be found wanting. Public argument is thus a way of communicating one's opinions and judgements so as to construct jointly-accepted positions, a necessary precondition for the ethics of a knowledge society.

Foresight and ethics of the future

The ethics of knowledge societies will necessarily be an ethics of the future, for no real knowledge society can be imagined that does not accept a very real imperative to look forward. This principle is anchored in the observation, which no one is now going to deny, that science and technology can have unforeseen and undesired effects. Most ethical discussions at present concern scientific matters and technological devices that are already, for the most part, accomplished facts by the time they become public. We have to break with the old idea that "science proposes, society disposes". Since we have established that scientific discoveries can lead to new ethical and legal issues, it would be as well to actively anticipate the difficulties and drawbacks that might result from carrying out a scientific or technological project. Under this principle of looking forward, an innovation would no longer be judged viable by technological criteria alone, but also – and indeed primarily – in terms of ethical, cultural and political values and standards. Now, it is impossible, of course, to know in advance what will be regarded as acceptable by the public, but there are technical projects that cannot be envisaged in isolation from the ethical issues they are liable to raise above all when they touch on areas as sensitive as health, privacy or personal freedom.

There is work to be done, therefore, before constructing the scientific or technological problem. For instance, some groups' wariness of GMOs applies not only to the technologies in themselves, but also to their legal status. Are they simply agricultural or commercial products, or are they laboratory products, more akin to drugs that should be subject to formal control by public bodies along the lines of those that regulate the drugs industry? Proper responsibility in science also depends on much preliminary

legal preparation. The task, then, involves aligning science's reasoning with society's, and reconciling private interests with the general interest. With this in mind, it is important to take account of the interests of the greatest possible number of people before making political or business decisions. Applying this "forward-looking principle" would bring the benefit of increasing the transparency of scientific policy – public or private. In so far as the issues in this area very often concern technological innovations that are to be marketed as products, this new forward-looking imperative could not be enthroned without the active participation of the private sector, for which civil society and public institutions will encourage initiatives. This recognition of the general interest might entail a need for the production of reports and arrangements for regular audits. It would also, of course, require wider consultation of civil society and its representatives.

A crisis in science education?

What crisis?

One of the principal forward-looking questions that arise when we consider the building of a knowledge society is the recruitment of qualified staff for science and technology. The mastery of technology is a necessary precondition for the creation of knowledge societies, but it is not sufficient to ensure their sustainability. The use of complex research infrastructures (with computerized and often automated systems) presupposes the presence not only of large numbers of engineers and technicians, with the ability to control and maintain them (and to devise new instrumental techniques as well), but also of administrative staff participating in the management of research centres that are also centres of production. In addition, technological infrastructure and services are demanding engineers and technicians in ever-increasing numbers. We may therefore wonder whether education systems, in industrialized as well as in developing countries, will have the capacity to train technicians, engineers, scientists and even high-level researchers in sufficient numbers to enable the knowledge society to fulfil all its promise.

It is paradoxical to observe that, just as we hail the emergence of the knowledge society, the number of students enrolled in the sciences is falling sharply in quite a few industrialized countries, as is the number of those students who undertake research work at the end of their studies (see Box 7.4). The trend is all the harder to track since no statistical analysis has yet been conducted on an international scale to check the details and determine the exact causes. The lack of detailed figures, however, should not make us ignore the issue but, on the contrary, call for such studies to be carried out, not only in the industrialized countries, but in developing countries also. The present crisis in science education will without doubt have serious consequences. Not only will the demand for qualified scientific staff fail to be satisfied in most of the industrialized countries but, above all, it will become increasingly difficult, if nothing is done, to meet the constantly growing requirements of our innovation-oriented societies.

What explanation can one offer for this crisis in science education, just at a time when knowledge societies are emerging? First of all, it must be recognized that, as early as primary and secondary school, a certain number of young people find science subjects boring. Secondly, as we saw in connection with the ethical and political debates stirred up by scientific research, science's beneficent image is no longer accepted as a matter of course. Lastly, science has a reputation for being poorly paid. This problem leads us directly to the specific subject of this section – recruitment. The problem may seem minor: many scientists have illustrious careers and some become celebrities and may reap prestigious awards. But in societies where people are often judged on the basis of financial and social success, material considerations have considerable weight in the choices made by 20-year-olds. The sometimes insurmountable difficulty of establishing oneself in the world of research is often emphasized. The labs are full of brilliant young scientists who are just

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as concerned with finding a secure job, or at least obtaining a decent income, as they are with getting results and being published. The number of young job-seekers with science doctorates – many of them well over 30 and still living on bursaries or temporary contracts – is unlikely to encourage many people to consider taking up research as a career. Admittedly, that career offers an intellectual freedom which has its own worth, but we should not ignore the pernicious effect of what is often perceived as insecurity – it may well be turning many young people away from a scientific or technical career.

There are three probable dangers that may emerge if science continues to lose its lustre. First of all, there will be shortages of people with scientific and technological qualifications. Secondly, the industrialized countries will continue to poach large numbers of scientists and engineers from developing countries to make up for their own shortage of highly qualified recruits. This is already making the brain drain worse, and its acceleration is liable to affect not only the developing countries but also any of the industrialized countries that allow themselves to be left behind by more advanced ones in

Box 7.4 The crisis in science education

Some figures for Europe[8]

Germany: Between 1990 and 1995, the number of physics students fell by two-thirds

Scotland: Number of universities teaching geology:

5 in 1995

1 in 2002

France: Number of students beginning first-year science studies in university:

1995: 63,400 students

1997: 51,200 students

2000: 50,800 students

Numbers of students enrolled in university:

	1995	1997	2000
Mathematics	56,200	56,400	50,900
Physics	68,200	51,700	36,700
Chemistry	13,800	12,300	10,400

Netherlands: between 1989 and 1994 the numbers of students in Amsterdam Free University fell by:

39 per cent in chemistry

20 per cent in information technologies and physics

Some figures for countries of the South

According to data collected by the UIS for certain countries of the South, the increase, in certain cases, in the number of students enrolled on science courses, cannot hide the fact that the growth in some scientific disciplines is sometimes at the expense of others. In Eritrea, between 2000 and 2001, for instance, though the number of students enrolled in life sciences rose by 40 per cent, the figure for mathematics and statistics fell by more than 6 per cent. Similarly, in the Lao People's Democratic Republic, over the same period the very large increase in physics students seems to have been at the expense of the life sciences.

the domain of research. Lastly, the growing insecurity of scientific research as a career may lead to its abandonment by many of the most brilliant students – the driving force of high-level research. Such professional precariousness ma,y as a result, directly impair the quality and competitiveness of future research, in both economic and scientific terms. Policies for training high-level researchers must therefore be conducted in tandem with policies for properly established careers, both in publicly organized research and in industry. In particular, it would be advisable to encourage businesses and industries to call for these skills, above all in the developing countries where the proportion of national investment in science and technology undertaken by the private sector is often very small compared with the corresponding proportion in the industrialized countries or in those southern countries that have successfully managed to implement dynamic free-enterprise policies for innovation. Government action could therefore be directed towards three priorities: improving researchers' status and conditions, opening up careers in the private sector and institutionalizing bridges between that sector and the public one. Such bridges could benefit the researchers, whose careers would be enhanced in terms of both remuneration and prestige. It could also help reform the research and innovation centres, making them diversify their own sometimes excessively rigid recruitment practices that are liable to produce researchers from a narrowly uniform background at a cost in creativity and inventiveness. Institutionalizing such bridges would also particularly benefit the developing countries where, at present, the private sector's research efforts are too weak for firms to be able to guarantee researchers a steady career once they have left their academic one.

Women and science

The crisis in science education can also be interpreted as one version of the underrepresentation in scientific institutions of certain social groups: ethnic or religious minorities, castes or marginalized social categories. This certainly applies strongly to women in the domain of science. In both industrialized and developing countries, the crisis in science education must also be understood as an expression of gender inequality. It becomes clear that science is suffering from "under-feminization", a situation further aggravated by the "glass ceiling" affecting posts that carry responsibility – a problem encountered everywhere, but particularly important in science.

How can this situation be remedied? One of the first priorities is part and parcel of the general imperative for girls' education, an essential factor in development everywhere and fundamental if women are to become able to choose their destiny. Science education must be the subject of special attention: talks could be organized at primary and secondary schools and outstanding successes by women in science could be widely publicized. Symbolic high-level measures (the creation of specific distinctions or prizes reserved for women in science, for instance, such as the L'Oréal-UNESCO Prize for Women in Science),[9] could also be highlighted; and indeed these have in recent years been receiving greater publicity from the media (science journals, women's magazines and ordinary newspapers).

The essential task here is to use all necessary means, not excluding mass advertising (see Box 7.5), to convince educators, parents and the people most closely concerned – the girls themselves – that women can excel in science just as much as men.

Some aspects of the crisis in science education derive from the unattractive image of the sciences and the teaching methods currently in general use, but responsibility also lies with decision-makers who give insufficient attention to the problem and above all with the difficulty many of them have in appreciating the complexity of the issues involved in science. Ideas for the "knowledge society" clearly make policies for education in science and technology a priority for economic and social investment. The quality of researchers' training, their status and remuneration are now crucial issues for the take-off of science and technology, and political and economic decision-makers should recognize that knowledge is now a particular form of capital which, although it has its own ineradicable peculiarities, should nevertheless be given the same importance as economic capital.

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Fostering a scientific culture

Scientific culture for all and the public

Science and technology play an increasingly large part in everyday life and in public debate. The spread of a genuinely scientific culture is essential for sustainable governance. Unless such a culture becomes general, there will inevitably be greater disparities and inequalities between individuals, genders, generations, social groups and nations according to their endowment of the scientific knowledge needed in the dynamic environments that characterize knowledge societies. Such societies intensify people's need for "scientific literacy" if they are to make up their own minds on personal matters such as health, or collective ones such as the use of personal data. The general public does not necessarily need to have all the science in every textbook at its fingertips, but it must at least be capable of assessing the relevance of arguments put forward by experts and understanding the possible consequences of the authorities' proposed measures on the economy, conservation or health. This applies not only to the general public and civil society, but also to the decision-makers themselves, who must not allow themselves to substitute the technical opinion of experts, even official ones, for political decision-making. Inclusion of a scientific culture in the training of government decision-makers and officers might even prove an extremely beneficial step for developing countries, where innovation is sometimes held back by the difficulty these decision-makers often have in grasping scientific and technological issues and their importance. Training in scientific culture aims not so much to give people a particular body of facts as to make them capable of actively taking part in the governance of societies more and more influenced by science and technology.

This is why scientific culture is not the culture of scientists. All too often it is perceived as a particular form of culture reserved for "academics", but in fact it is the best means of providing a training in interdisciplinary thinking, since it brings individuals face to face with different forms of knowledge. The point is also essential if there is to be any dialogue between the exact or natural sciences on the one hand and the social and human sciences on the other; between these two the bridges are often narrow and there can even be conflict. Scientific culture includes training in interdisciplinary thinking. The scientific culture of scientists

Box 7.5 The National Science Week in South Africa: encouragement to take up science

The National Science Week is an initiative of the Department of Science and Technology of the Government of South Africa. Its aim is to get young people excited about science at an early age and to encourage them to develop an interest in mathematics and science subjects. Though the emphasis is on youth, the idea is also to raise awareness among other members of society with an influence on learners' choices of subject and career.

Key objectives:

- to stimulate learners' interest in following careers in science, engineering and technology;
- to bring together government, educators, industries, the higher education sector and communities to encourage learners to follow careers in science, engineering and technology;
- to broaden national interest in science and technology through media coverage.

Target audience:

- the primary focus is on youth, from pre-primary to undergraduate level;
- The secondary focus is on other members of society with an influence on learners' choices of subject and career, namely: parents and families, educators, politicians and the media.

Source: South African Agency for Science and Technology Advancement

<http://www.saasta.ac.za/nsweek/index.html>

themselves must in future extend beyond their own specialist fields. Scientific culture – that of non-specialists as well as of specialists – is becoming a universal culture, essential for understanding cultural diversity and the variety of human knowledge. Only scientific culture permits the creation of a public forum where any one culture – occupational, political, ethnic or ethical – can enter into dialogue with all the others.

A scientific culture must therefore enable everyone to acquire the skills needed to grasp the issues relating to the main areas of science, particularly where these have an ethical or political impact. It must also make everyone capable of organizing information in a relevant and fruitful manner – proliferating sources of information could become a handicap to those who lack the ability to link them, rank them and discriminate among them.

The mediatization of scientific knowledge

The concept of "science mediatization" is not concerned with the direction of transmission – from a learned elite to an ignorant multitude, for example – but rather with the purpose and means of such communication. It must be recognized that there are some scientists who look down on extension activities as "popularization", or even as pseudo-science and the notion sometimes betrays an elitist vision of science as the sole source and arbiter of knowledge. We must of course distinguish between scientific communication that takes the form of seminars or articles for specialists, and science mediatization whose purpose is to convey the general significance of a scientific issue.[10] Both forms of transmission must be given their rightful importance.

Science mediatization includes books, radio and television, the internet, lectures and other events designed to make the public more aware of various aspects of science and technology.[11] It incorporates both traditional and recent methods of disseminating scientific knowledge throughout society and accommodates the idea that the social and political relationships between scientists and non-scientists, the public at large, decision-makers and journalists are evolving. Communicating with the public with this purpose is a tricky business, for it requires scientists to make an effort of translation – and to have a certain talent. But it actually offers the surest protection against the spread of pseudo-scientific theories, for it offers everyone the means of identifying and dissecting frauds hidden behind a pretence of science.[12] Pseudo-science, often no more than a public relations strategy, thrives when scientists decline to present their work to the general public. Science mediatization therefore has an essential part to play in certifying those findings that the scientific community regards as legitimate (see Box 7.6).

Scientific literature written for the public at large remains a particularly appropriate medium for spreading knowledge of new scientific discoveries as well as long-established science. This form of mediatization is unquestionably the oldest, but the odds are that, whatever future developments may bring, it will remain one of the most worthwhile forms of mediatization, if only because it is equally well suited to both the internet and paper media.

The mass media – television, radio, newspapers, magazines and their recent interactive forms such as the internet – are just as essential for the development and perpetuation of a scientific culture for all. Some scientists complain that they over-simplify, distort or caricature science. But if science wishes to be adequately represented in the media, scientists themselves must take the initiative and become acquainted with the communication techniques used in non-scientific media.[13] Scientific institutions must explore the development of tools for generating scientific awareness not only in the media but also more broadly among the general public, non-governmental organizations, and government and international agencies. We could also mention plans for rolling news channels devoted to general scientific information or linked to current affairs. Such a form of science mediatization would target scientists as well the general public, but would serve, above all, as a reference source for other media and for decision-makers, as happens already with other sources – the ordinary news media, for one. The success of mediatization depends, then, on the expansion of science beyond its boundaries and, above all, on scientists' adoption of new methods arising from recent radical social changes.

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Teaching science in action

Although it is important to achieve coherent and innovative mediatization of science, school will still continue to play its vital role as the means by which knowledge and scientific culture are transmitted. From now on, there will be two forms of introduction to the sciences: that which takes place in the traditional classroom setting and that which relies on the use of networks. In the conventional classroom, teachers should use teaching methods that focus on genuine science-led training, leading to the accumulation of a knowledge base that is self-sufficient because it has been individually acquired. This type of teaching has been experimented with in the United States, Chile, Sweden (Hands On), Brazil, China, France and a number of other countries (see Box 7.7). The most important thing, in this type of project, is the notion of presenting the results as the outcome of a process of research in which the investigative journey is more important than the snap answer. The point is to think of science as a process of interrogation and questioning, rather than as the mere recording of already-known facts.

Beyond the issue of content and methods designed to combine cultures of different forms, it will be far easier for people to acquire a scientific culture if the groups, institutions or firms they belong to are themselves engaged in the process of learning and evolving. This is tending to be the case in all institutions, but in education it has been essential, and still is. One might even speculate that this networking will

Box 7.6 Mediatization of science on the Web: two examples

Ciencia hoy (Science Today)

The virtual publication *Ciencia hoy* popularizes science for the Spanish-language Web. It has the following objectives:

- to publicize the present state and recent progress of scientific and technical endeavour in Argentina;
- to promote scientific exchanges with the rest of Latin America by publicizing scientific and technological research in the region;
- to stimulate public interest in science and culture;
- to produce a daily publication disseminating the work of scientists and engineers from Argentina and elsewhere in Latin America in the natural and social sciences, and their technological applications;
- to promote the establishment of a virtual academy for scientists;
- to promote and organize lectures, conferences and symposia with a view to publicizing the work of Argentina's scientists and engineers; and,
- to contribute to, and collaborate in, exchanges of information with similar organizations from other countries.

Source: http://www.ciencia-hoy.retina.ar

Science and Development Network

The overall aim of the Science and Development Network (SciDev.Net) is to enhance the provision of reliable and authoritative information on science- and technology-related issues that impact on the economic and social development of developing countries.

The project originated in a website set up by staff members of the journal *Nature* to report on preparations for the World Conference on Science (Budapest, 1999). The project's success led to the setting up of a network aimed at ensuring that individuals and organizations in the developing world are better placed to make informed decisions on issues of science and technology.

The network seeks to achieve this objective primarily through running a free-access website, but also by building regional networks of individuals and institutions who share our goals, and by organizing capacity-building workshops and other events in the developing world.

Source: http://www.scidev.net/index.cfm

Box 7.7 Hands On

The approach we recommend primarily stresses the construction of understanding through exploration, experimentation and discussion. It is the practice of science as a collective activity of interrogation, investigation, experimentation and construction that is aimed at, not the rote learning of facts carved in stone.

The pupils themselves design and conduct their experiments, then discuss them to draw out deductions. Learning is by activity and involvement. It progresses through error, through interacting with those who know more about the subject, and through setting out an opinion in writing and exposing it to others, comparing it with other opinions and with experimental findings as a test of relevance, truth and validity.

The teacher suggests (sometimes, but not always, starting from a pupil's question) situations that would allow rational investigation. He/she guides the pupils' actions but does not pre-empt them; invites them to make their opinions explicit and to discuss them, taking great care over the use of language; gets them to draw and express valid conclusions from the results obtained, showing where these fit existing scientific knowledge; and manages learning by degrees. Classroom sessions are organized around subjects in such a way that progress can be made in both understanding and skills, as well as in mastering the language, oral and written. Enough time must be given to each subject to allow for actions to be repeated, ideas to be reformulated and knowledge to be assimulated.

Source: http://www.mapmonde.org

extend to the research and new-product laboratories of some of the big private-sector groups (vehicle manufacturers, aerospace, etc.), that are becoming increasingly involved in raising public awareness of the science of the future and its applications.

In this connection, networking offers immense benefits for science education. Firstly, making each school part of a complex institutional environment will make it easier to approach science as knowledge in action. The purpose of museums, for instance, is no longer merely to preserve knowledge as fixed and unalterable, but rather to facilitate its acquisition and to encourage debate through a dynamic questioning process. Secondly, networking enables each institution to carry out its own mission with greater effectiveness. Libraries (physical and virtual) will have a vital role in meeting future challenges to science education, since there can be no innovation without the preservation and reproduction of already-acquired knowledge. The ultimate aim of such projects is to make knowledge-sharing possible along the model of the collaboratory suggested above, but on a worldwide scale, irrespective of an institution's economic status or geographical position. The first phase of the World Summit on the Information Society stressed the need to network all kinds of institution – schools, museums, libraries, laboratories, etc. – across and between the industrial and developing worlds. Such a project can only develop its full potential if the developing countries are given logistical and financial support as a priority. Diminishing the digital divide and establishing systems for innovation suited to these countries' needs must continue to the true integration of science within the culture of development.

Background resources

Annan (2004); Beck (1986); Benatar *et al.* (2003); Callon *et al.* (2001); Castells (1996); CERN (2004); Charpak (1998); Delacôte (1996); Etzkowitz and Leydesdorff (2000); European Communities Commission (2001); Fukuyama (2002); Gibbons *et al.* (1994); Jonas (1979); Latour (1999); Sagar *et al.* (2000); Sagasti (2004*a*); Serres (2001); Singer and Daar (2000); Sloterdijk (1999); UNESCO (1996*a*, 1998*c*, 2004*b* and 2005); United Nations (2003).

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Chapter 8

Risks and human security in knowledge societies

Will knowledge societies be risk societies? Knowledge resources have become strategic and, if exploited for ill-intentioned ends, could wreak irreparable damage. By making such resources accessible to the world at large, have we not opened up a Pandora's Box, packed with promises but also with unknown dangers? Or should we, on the contrary, see the accelerated spread of knowledge as likely to boost the self-regulating capacity of our societies, confronted by risk but able to produce the antidotes that should enable them to contain it? The new character of the risks that threaten us has less to do with their scale than with the complexity of their interaction and the mechanisms required to cope with them. But does the rise of knowledge societies not constitute precisely one of the most effective means of dealing with this new complexity? Is knowledge not supposed to cure the ills of ignorance and error, to free the individual from the fears and constraints represented by nature, to lessen uncertainty and to enable us to control risk? From this standpoint, knowledge is a source of liberation and autonomy. This promise is inscribed in the Constitution of UNESCO.

Knowledge as a risk panacea? Foresight and disaster anticipation

Confronting the instability and insecurity that are often the social and political consequences of scientific progress and technological innovation is one of the challenges that knowledge societies will have to meet. True, any technological innovation and any technical system – even the most basic – generates risks. But all risks are not equal and some are unacceptable. How shall we distinguish them? What makes certain political risks acceptable is precisely the fact that they are "intentional" – the distinction between risks taken intentionally and risks incurred passively being at the heart of the ethical debate on inequalities with regard to risk.

Knowledge and risk identification

How can we prevent risks if we have not identified them beforehand? All societies have been confronted to this challenge. Of course, knowledge societies seem better armed than ever to undertake such a task. The profusion of all kinds of information and knowledge resulting from the new technological revolution is indisputably a great advantage for researchers, who have access to a vast amount of resources. But such profusion, characterized by excess and proliferation, can also represent an obstacle to risk identification. When it comes to interpreting past experience, detecting the signs of change or making adaptive choices, the more information one has, the more difficult it is to say which particular item may prove significant, not to say crucial. The work of researchers, experts and analysts, while in itself productive of new information, also helps to sift relevant information from the undifferentiated flow of available data. This work of knowledge-based information management illustrates the *reflectivity* at work in emerging knowledge societies.

The implementation of such reflectivity is not only technical. It is also a matter of good governance. Information is of no value if we are unable to gather and use it. Therefore, it is important to underline that risk identification requires the efficient activity of some observatories and agencies whose technical and scientific abilities must be recognized by public and private decision-making authorities, as well as by civil society at large. The terrible tsunami that devastated the shores of the Indian Ocean on 26 December 2004 revealed the shortcomings of risk identification in some countries. In the regions hit by the tsunami, several scientists were quickly informed of the impending disaster, but in spite of their efforts, they remained unable to pass the information up to the decision-makers in time. In many developing countries, the shortcomings in risk identification are partially linked to the relative isolation of the personnel qualified in risk analysis, whether those risks are technological, industrial, or health- or food-related. Risk identification therefore must become a priority mission in scientific policies in order to ensure, through adequate structures (be they independent or linked to specific state departments), that the key information is passed up to the highest decision-making levels and passed down to the populations in time, in particular in case of a disaster.

Observatories devoted to the monitoring of a predefined risk can also be set up at the international level. The international response to the atypical pneumonia epidemic (SARS) in East Asia and North America in the winter of 2003, illustrates the benefits to be gained from this type of organization. The cross-checking of data collected in China, Thailand and Canada, along with the cooperation between research teams in all parts of the world (on the basis of the "collaboratory model" described previously),[1] made it possible to halt the progress of the illness very quickly through appropriate prophylactic measures and to isolate the infectious agent (the coronavirus) so as to study the possibility of developing a vaccine. Moreover, the networking of observatories, as is illustrated by the inter-agency exchanges within the United Nations system, allows data to be cross-checked or compared, thereby improving their quality. Eventually, policies must include efficient monitoring measures, at the national as well as regional and international levels. Such monitoring, whether ensured by observatories or conducted in a more empirical way, will be all the better if it is flexible. Indeed, as emphasized by the father of the mathematics of decision-making, John von Neumann: "The only true security is relative: it lies in the intelligent exercise of judgement on a day-to-day basis".[2] The complexity of risk management precisely lies in the articulation of short- and long-term imperatives. No risk strategy can exist without watches, forward thinking, prevention and preparedness, as was also illustrated by the tsunami of 26 December.

Warning systems and population preparedness

The tsunami that hit the shores of the Indian Ocean on 26 December led to the deaths of nearly 300,000 people and to the displacement of 5 million refugees. This disaster stressed the difficulties linked to risk management and particularly to information strategy, involving relevant data production, quick and adapted data circulation, and population preparedness. UNESCO and its Intergovernmental Oceanographic Commission (IOC) stressed the necessity to set up an early warning system in the Indian Ocean a long time ago. But the small number of tsunamis in the Indian Ocean (85 per cent of all tsunamis occur in the Pacific Ocean), the lack of resources in most states of the region, the many local-based priority conflicts and the difficulty to mobilize international aid, contributed to postponing the implementation of such a proposal. The unpreparedness of the states and populations to the 2004 tsunami revealed that an early warning system was absolutely necessary in the Indian Ocean, as well as in the Caribbean Islands, the Atlantic Ocean and the Mediterranean Sea (see Box 8.1). But the number of victims and displaced people, the death toll and the impact that such a catastrophe has on development, speak for the implementation of a global response. On 19 January 2005, in Kobe, the United Nations announced their intention to set up a global warning system that would allow early warning for all sorts of natural risks, be they droughts, forest fires, typhoons, hurricanes, earthquakes, land-

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slides, floods, volcanic eruptions or tsunamis. Such a system will combine quick information transmission and population preparedness.

The emergency resulting from an impending disaster requires the optimal use of all the technologies available in observation and data analysis, as well as the possibility to pass on information as quickly as possible. The next step in the implementation of these essential technologies will be the setting up of meta-warning systems, including satellite spatial data as well as *in situ* data on ocean and earth movements, ecosystems and the atmosphere. But the efficiency of a warning system does not rely on technical elements only; it also depends on the efficient matching of information with concrete situations or sociocultural contexts, and the preparedness of the populations. In Muslim countries and in countries with an important Muslim population, the loudspeakers of the mosques could be used to spread warnings, as could have been the case in Aceh in Indonesia – the territory most severely hit by the tsunami. Moreover, educating civil populations is essential and regular public information campaigns must explain what should be done in case of a disaster and which lifesaving gestures can help. All this must be taught at school. Indeed, population preparedness is the most essential aspect of any warning policy, as the example of several indigenous populations during the 26 December disaster shows: they knew how to react, because they had learned what to do in case of a tsunami through their legends and traditions.

It should be added that the management of risk-related information can raise specific issues. When integrated in the complex system of an organization, risk identification may itself be subject to a certain *vulnerability*. Expertise doubtless yields a number of certainties, but also many hypotheses and probabilities, and an even greater volume of uncertainties. It is not uncommon to find our knowledge obscuring our perception of those very risks that it seeks to detect. The perception of risks is obviously not unrelated to the type of knowledge involved. Paradigm shifts, be they scientific or organization-related, affect our perception of risks. Since any form of expertise depends on choices of methodology, this dimension of choice necessarily reintroduces risk and uncertainty into expertise itself. Reflective societies are founded on a constant re-examination and reformulation of their social practices. Moreover, since the integration of different strands of knowledge occurs within a complex system, too much knowledge engenders insecurity.[3] The more our knowledge is detailed and contains a large number of parameters, the more the conclusions we draw from it are vulnerable to the slightest error of calculation, however infinitesimal. Here again, an intuitive grasp of situations is essential. We should also underline the importance, in any organization, of a certain form of *tacit knowledge*, which can lead us to hold a hypothesis to be improbable or to underestimate the probability of certain risks simply because they have never been attested previously.[4] Risk identification and prevention are therefore, in themselves, a risky exercise – by

Box 8.1 The Tsunami Warning System in the Pacific Ocean

The International Tsunami Information Center (ITIC) was created in Honolulu (Hawaii Islands) in 1965 by the IOC. Three years later, the IOC created an International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) that today comprises 26 Member States. The operational headquarters of ICG/ITSU is in the Richard H. Hagemeyer Pacific Tsunami Warning Center, which is related to the National Oceanographic and Atmospheric Administration of the United States. The ITIC supervises ICG/ITSU activities by coordinating technological transmission among the Member States wishing to set up regional or national tsunami detectors.

The warning system passes on tsunami information and warning messages to over 100 destinations in the Pacific Ocean. To identify the earthquakes that are likely to trigger tsunamis, the system also uses real-time data from seismic stations. Quick and precise measurements were impossible to take in the Indian Ocean, thus preventing the timely anticipation of the tsunami.

For more details, see: http://ioc.unesco.org/itsu/

trying to do too much, we can unwittingly expose ourselves to greater error. Yet, by trusting too much in experience, we likewise run the risk of being caught unawares by the event. Even in knowledge societies an irreducible threshold of uncertainty, and thus of risk, will continue to exist.

Towards risk anticipation: precaution and foresight

When a proactive prevention of risk is not possible, two other approaches are available to knowledge societies: provision and precaution. Both involve the adoption of conservatory measures in the face of a potential risk. In the case of provision, the probability of the accident/disaster and the nature of the damage can be known or calculated. We cover ourselves in this case proportionately to the potential damage. Provision is an insurance mechanism, applicable when one is dealing with *risks* in the strict sense (that are known and identified). It postulates that it is possible to extrapolate into the future the probability of the occurrence of risks encountered in the past. Such a mechanism is extremely vulnerable to occurrences that do not conform to a set pattern – the terrorist attacks on 11 September in New York placed the reassurers in particular difficulties since the probability of damage on such a scale seemed to them very remote, yet the event nonetheless occurred.

In the case of precaution, it is by refraining from taking a measure that is potentially risky, but where the risks are neither calculable nor precisely identifiable, that we safeguard ourselves against damages (see Box 8.2). The precautionary principle, therefore, must be implemented only in exceptional cases, when human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain.[5] A threat to human beings or on the environment is held as morally unacceptable if it threatens human life or health; if it is serious and effectively irreversible; if it is inequitable to present or future generations; or if it is imposed without adequate consideration of the human rights of those affected. Even if the precautionary principle tends to be integrated to a certain number of pieces of legislation, it is still under debate. In industrialized countries, some experts tend to put forward research valorization and independence, as well as market and entrepreneurial freedom. In the South, the precautionary principle is often perceived as an obstacle to development and contrasted with the necessity principle. These difficulties often arise from the fact that the precautionary principle is often considered – and wrongly so – as a radical obstacle to science and technology.

The precautionary principle is based on the fact that such risks are *potential risks*. Knowledge of these risks can equally well be termed "knowledge" or "ignorance". The precautionary principle amounts to recommending *a proactive approach to ignorance*. Therefore, its vocation is not to block research. Indeed, in a situation of uncertainty, inaction can lead to guilty ignorance. The precautionary principle must rather encourage research by deepening knowledge or exploring new alternatives. In this respect, the precautionary principle is anything but a principle of abstention or of intellectual and moral laziness. It is new for science, because society can play a part in its business. But, conversely, the situation is also new for decision-makers, who cannot do without an initiation – be it a basic one – into science and technologies. Finally, the precautionary principle represents a new stage in the debate on development, for it requires taking into account all the potential consequences of risks – be they environmental, cultural, social or health-related. Such a principle also helps to acknowledge the diversity of cultural contexts and the existence of different sources of knowledge – local traditions being one of them. In this respect, the precautionary principle probably heralds the emergence of knowledge societies open to the diversity of knowledge sources.

A *proactive* prevention policy with regard to risks and disasters, i.e. one involving more than the mere adoption of conservatory measures, demands a genuine will to act. Yet, very often it is after the disaster that we see people being active in all directions or taking a keen interest in the implementation of warning systems, as was the case after the December 2004 tsunami. The role of experience is particularly crucial in the environmental and health sectors. One of the keys to the problem lies in our ability to project ourselves into the future in which the disaster mate-

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Box 8.2 Precautionary principle, a working definition suggested by COMEST

When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.

Morally unacceptable harm refers to harm to humans or the environment that is:

- threatening to human life or health; or
- serious and effectively irreversible; or
- inequitable to present or future generations; or
- imposed without adequate consideration of the human rights of those affected.

The judgement of plausibility should be grounded in scientific analysis. Analysis should be ongoing so that chosen actions are subject to review.

Uncertainty may apply to, but need not be limited to, causality or the bounds of the possible harm.

Actions are interventions that are undertaken before harm occurs and which seek to avoid or diminish the harm.

Actions should be chosen that are proportional to the seriousness of the potential harm, with consideration of their positive and negative consequences, and with an assessment of the moral implications of both action and inaction. The choice of action should be the result of a participatory process.

Source: The Precautionary Principle, World Commission on the Ethics of Scientific Knowledge and Technology (COMEST), UNESCO, March 2005.

rializes. The *foresight* approach offers us this ability to project ourselves into the future and can forearm us against disasters, provided public discussion and decision-making take full account of its lessons. Knowledge societies will necessarily be future-oriented societies, as is illustrated by the evolution of the international community over the past two decades in relation with the global climate change.

However, a distinction needs to be made here between the *foresight* approach and *forecasting*. Shall we recall that forecasting aims at certainty, whereas foresight only indicates potential leads for exploring the unpredictability in an uncertain world? Concerning itself with possible futures, the foresight approach rejects, on principle, the fanciful notion of knowing everything about the future. Last but not least, in the context of growing interaction between science and technologies on the one hand and society on the other, foreseeing will play a crucial role in environments where scientific knowledge becomes one of the main vectors of social and economic activity. The foresight approach is a key to networking, for it implies pluridisciplinary interaction among actors coming from different horizons. The risk of systemic errors is thus reduced, while network efficiency (which mainly depends on the joint production of knowledge by the different actors of the system) increases.

Knowledge societies, a source of new risk? Global risks, strategic risks and new forms of criminality

The borderline between natural risks and technological risks is tending to become blurred today when many so-called natural disasters are suspected of being largely the result of human and industrial activity. The accident in this way divorces itself from nature and in so doing changes its nature: it becomes wholly the work of man, of his inability to master the components of the systems he constructs, of his haste to apply on a large scale processes or products that have not been tested and of his lack of vigilance or failure to act. Accidents become the corollary of the irrationality of our reason, the measure of our lack of measure[6]. These threats that will haunt our projects – and which they

doubtless shape, unwittingly or otherwise – can be grouped under the following headings: global climate change, very rapid erosion of biodiversity, major technological risks, the vulnerability of large systems, terrorism, computer and multimedia pollution, the risk of bio-power supremacy and self-domestication of the human species, and doubts about the future of mankind and of the planet.

As illustrated by major technological hazards (see Box 8.3), the man-machine system has always proved unpredictable and fallible, whereas the nature of the machine, although it is not proof against breakdowns, is to function normally. The drawbacks and risks of progress, which in the machine age could still be passed off as the inescapable downside of the enterprise, have become constitutive components of the technological balance sheet at a time when technology is being applied on an unprecedented scale and when it is propagating itself so rapidly within the social fabric. The paradox faced by our knowledge societies can be thus summed up: at a time when network development gives increasing importance to knowledge at all levels of the social structure, inducing thereby new patterns of technological dependency, it will be the task of knowledge to liberate us from this dependency, by persuading us, through the exercise of reflection and the construction of an ethic for the future, not to accept that all means are acceptable to attain any end whatsoever.

The new prominence of the *terrorist threat* following the attacks of 11 September 2001 also illustrates how the rise of knowledge societies could serve to accentuate risks and threats in the twenty-first century. The free circulation of information and the public character of scientific debate and expert discussion in knowledge societies, which are in themselves

Box 8.3 Chronology of some major technological and industrial accidents

1645 – Explosion of the Boston powder magazine which brought about the destruction of one-third of the city.

1794 – Explosion of the Grenelle powder magazine, near Paris: over 1,000 dead.

1 June 1974 – Explosion of the chemical factory at Flixborough (United Kingdom): 550 dead in one week.

10 July 1976 – Explosion of the chemical reactor of the firm Icmesa near the town of Seveso (Italy). The dioxine cloud contaminated a wide region (1,800 ha): over 37,000 persons affected.

29 March 1979 – Partial fusion of the core of the Three Miles Island nuclear plant, Pennsylvania (United States): evacuation of part of the surrounding population.

2 December 1984 – Gas leak in a pesticide factory in Bhopal (India): over 3,000 dead and 200,000 poisoned.

19 December 1984 – Explosion of a liquefied petroleum gas reservoir near Mexico City: over 500 dead.

28 January 1986 – Explosion of the propulsion system of the American space shuttle Challenger: no survivors among the members of the crew.

26 April 1986 – Explosion and fire affecting one of the four reactors at the Chernobyl nuclear plant (Ukraine): evacuation of 130,000 people within a radius of 30 km of the site; the number of direct fatalities and persons exposed to radiation is still impossible to determine exactly (marked increase in the number of cancers).

29 January 1987 – Evacuation of 30,000 people in Nantes (France) following a fire in a fertilizer storage warehouse.

13 May 2000 – Explosions in a fireworks factory near the town centre of Enschede (Netherlands): 22 dead and almost 1,000 injured.

30 January 2001 – 100,000 m^3 of cyanide-contaminated water from the gold-smelting works of Baia Mare (Romania) discharged into the river Lapsus, wiping out all aquatic life (Romania, Hungary and former Yugoslavia) on its way to the Danube and the Black Sea.

21 December 2001 – Explosion of an ammonium nitrate factory in Toulouse (France): 30 dead and 2,200 injured.

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inviolable principles, can facilitate the misuse of knowledge if this knowledge falls into the wrong hands, such as those of terrorist networks, cyber criminals or crime bosses. The possibility of knowledge being reduced to the state of a mercenary weapon has existed for a very long time in history, as is illustrated by the famous anecdote of Archimedes putting all his knowledge into the hands of the tyrant of Syracuse. But today, the scale of potential consequences is much larger, since we can well imagine that extremely lethal weapons fall into the hands of "war lords", organized crime or terrorist networks with worldwide threat capabilities. The risk of knowledge becoming a mercenary weapon is given greater credence by the actual functioning of research, which favours dual-purpose programmes whereby the same laboratories can develop agricultural research projects or manufacture chemical weapons. There is a great danger that the benefits of science will become hazards in an age characterized by the most important threats.[7] Scientists have a duty to be vigilant in assessing the public-safety implications of the disclosure of their discoveries.

Obviously, twenty-first century geopolitics will be deeply influenced and reshaped by the emergence of knowledge societies. Knowledge and information will increasingly become strategic resources *par excellence*, as is illustrated by the very quick growth of secrecy in the most advanced industrial societies over the past decades. Thus, the crucial political challenge in knowledge societies will concern the struggle for the control of knowledge resources. Knowledge can serve the cause of good or evil indifferently. To say this is not to call into question the ethical trend towards progress but rather to question, in some cases, the very rationality of the scientific enterprise, which can bring benefits or harm to human beings. In view of the value-neutrality of knowledge, it is more necessary than ever to argue the need for the development of ethical and political consciousness in knowledge societies.

Knowledge societies will be increasingly confronted to doubts about the future of humanity and the planet. Mounting dangers linked to the dwindling of natural resources could accentuate existing asymmetries, particularly North-South asymmetries. Most local or international armed conflicts are more or less closely related to struggles for the control of natural resources – whether such conflicts originate in rivalries over raw materials or in antagonistic uses of a same resource by different actors. Would it not be disastrous if the universal dissemination of knowledge within knowledge societies were to be accompanied by a resurgence of conflicts arising from resource scarcity – water wars, energy wars, wars to control increasingly scarce strategic resources? One of the challenges that knowledge societies will have to meet is the creation of sustainable, concerted and peaceful forms of resource uses, in order to prevent conflicts or wars through regulation and mediation. This task will be efficiently carried out only through the joint action of natural sciences and society.

Knowledge societies, human security, human rights and the fight against poverty

New knowledge tools to better define risks and threats

Presented in particular in the 1994 UNDP *Human Development Report* (see Box 8.4) and later developed in the *Report of the Commission on Human Security* (2003)[8] and the work of the Human Security Network,[9] the human security agenda advocates for an enlarged conception of security covering all the dimensions of human life (economic, social, political, democratic, cultural, and legal security – to cite but a few) in order to respond to non-military and non-armed threats to peace. Centred on the needs of the individual and of populations (protection against illness, hunger, unemployment, crime, social conflicts, political repression and natural disasters), the human security concept fully takes into account the transnational evolution of threats. It is a known fact that conflicts, threats to the environment, pandemics and emerging diseases are borderless. This enlarged conception is aimed at enriching and extending the traditional notion of

Box 8.4 UNDP Global Report on Human Development, 1994

The first approach to human security in the United Nations was promoted by UNDP in its 1994 World Human Development Report devoted to "new dimensions on human security":

> There have always been two major components of human security: freedom from fear and freedom from want ... The list of threats to human security is long but most can be considered under seven main categories: (1) economic security; (2) food security; (3) health security; (4) environmental security; (5) personal security; (6) community security; (7) political security.

Source: http://hdr.undp.org/reports/global/1994/en/

security as guaranteed by the state, which is focused above all on the maintenance of law and order and on national defence. According to the Commission on Human Security, the purpose of human security is to create "political, social, environmental, economic, military and cultural systems that together give people the building blocks of survival, livelihood and dignity".[10] This new conception of security presupposes that integrated solutions will be developed to address a whole range of problems that give rise to insecurity. The concept of human security brings together fields that disciplinary specializations have long led to regard as separate. The appearance of new non-military threats to peace and security requires the development of new tools of knowledge and watch to define the impact of each one of them as precisely as possible, above all when the threat concerns the most vulnerable populations. In this framework, essential issues – such as the interactions between populations, environment and food security – must be tackled from an integrated and interdisciplinary point of view. In knowledge societies, such integration of research and policies should be encouraged through the pooling of knowledge resources and the development of transdisciplinarity – it is reasonable to hope that knowledge societies will encourage the promotion of human security through new and appropriate processes.

Education as the cornerstone of human security and knowledge societies

There is a strong connection between the goals of human security and those of education and training. Shall we recall that in the societies of the written word, illiteracy has become a source of insecurity, as developing countries are cruelly aware?[11] Moreover, through education, the battle is joined not only against ignorance but also against other forms of insecurity. Education encourages people to take better care of their health, favours securing employment on the job market and pacifies the everyday violence in relationships between individuals. Education also encourages awareness and thereby the prevention of old and new threats, particularly crucial at a time when many experts consider that we have entered the "risk society" (Ulrich Beck).[12] Indeed, it is important to prepare citizens for better self-protection and risk management. Education is the keystone of the policies on human security and the main tool to encourage the emergence of knowledge societies.[13]

Contributing to the respect of human rights

Human security comprises everything that is "empowering" for individuals: human rights, including economic social and cultural rights, access to education and health care, equal opportunities, good governance, etc. The assumption underpinning the agendas of human security is that all individuals, provided that they are free from the main causes of insecurity, can become the architects of their own well-being as well as that of the community. Indeed, access to knowledge and knowledge sharing can provide individuals with the abilities needed to ensure the conditions for human security. These conditions include a certain number of fundamental rights – freedom of conscience, freedom of expression and information, freedom of association, freedom of the press, and universal suffrage, as well as economic, social and cultural rights, among which is the right to education. Therefore, the free movement of ideas, information and images, coupled with broad access

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to knowledge and information, are prerequisites for the emergence of knowledge societies. If access to political, social, scientific and economic information is an inalienable right, it nevertheless remains important to be aware of the dangers associated with the movement of data concerning individuals. Indeed, threats to privacy have increased, particularly with the advent of new information and communication technologies, and especially when the use of such technologies is presented as security-related. The complexity of this situation shows that, in order to be democratic, knowledge societies will need to strike the right balance between individual freedom and the demands of security.

Human security and normative action

Trust in the everyday environment and the reliability of goods and services are also prerequisites for human security, whether it is the food, health, environment or socioeconomic sector that is concerned. Product and service certification is essential, in particular when related to nutrition and health, which are themselves directly related to the individuals' well-being. Indeed, medicine counterfeiting and the lack of food control entail very important direct risks for health and food security.

The first imperative is to create norms adapted to local realities. But creating standards is not sufficient. Standards must be subjected to positive and negative sanctions,[14] and citizens, companies, and the main actors of civil society must be informed about the existence and validity of such norms and standards.[14] How can prevention policies be efficient if the public does not believe the information they receive?

Normative action and the certification procedures undertaken by the public authorities must be taken over by initiatives within civil society. Companies that abide by these norms and show their validity in practice play a key role. In the same way, non-governmental organizations hold a key position in terms of health, food security and environment, because they can have an instrumental role before the actual certification process takes place, by providing information on the populations' needs, or after this phase, by ensuring monitoring, training and information activities integrating the new norms into the everyday environment and adapting them to local situations.[15]

Box 8.5 Main stages in the construction of the concept of sustainable development

1968 – UNESCO organizes the intergovernmental Conference on the Conservation and Rational Use of the Biosphere. It gives rise to the launching of the intergovernmental Man and the Biosphere (MAB) Programme.

1972 – The United Nations Conference on the Human Environment (Stockholm Conference) results in the creation of UNEP.

1980 – For the first time the notion of sustainable development appears in a document published by the International Union for the Conservation of Nature (IUCN) entitled *World Conservation Strategy*.

1987 – Brundtland Report of the World Commission on Environment and Development: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

1992 – United Nations Conference on Environment and Development ("Earth Summit", Rio de Janeiro, Brazil):

> … we are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can – in a global partnership for sustainable development (Agenda 21, Preamble)

2002 – World Summit on Sustainable Development, Johannesburg (Rio + 10): "We assume a collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development – economic development, social development and environmental protection" (see also paragraph 2 of the Action Plan).

Towards sustainable development societies?

Clearly, it will not be possible to progress simultaneously towards economic growth, social development and the protection of the environment without massive reliance on knowledge resources, scientific research and technical expertise. From this point of view, sustainable development is a project as ambitious as it is essential. It postulates the possibility of an agreement between developing countries and industrialized countries on an agenda of sustainable growth for all that meets the needs of the present without compromising the ability of future generations to meet their own needs, and consequently presupposes the sustainability of resources and ecosystems (see Box 8.5). The need for an international consensus on such a solution is particularly urgent given the disasters that threaten us if nothing is done to forestall the consequences of current modes of development.[16]

The implementation of the sustainable development agenda, which requires taking into account global as well as local impacts within a short-, mid- and long-term study, will depend on the ability of scientists, experts and decision-makers to work together on specific problems and projects without succumbing to the inertia that so often affects structures and institutions. The concept of knowledge societies and the central role played by networks correspond very precisely to these new requirements of collective action, capable of mobilizing all the resources of governance and science in real time as well as in the long term, with a pluralistic international approach in mind (see Box 8.6). In the fields of sustainable development, environment protection and global health, the complexity of the data and the stakes involved exclude any possibility of a single response or a unique viewpoint, particularly where experts are uncertain when confronted by a new issue. The need here is to institutionalize, as it were, the fact that any question on a global scale is, initially in any case, too complex to command unanimity, even in the scientific world. The *raison d'être* of sustainable development lies in the awareness that development is not a linear and uniform process. On the contrary, every problem should be envisaged from a wide diversity of legitimate perspectives, beginning with those of the nations and individuals concerned, whether belonging to present or future generations.

In this respect, it is important to stress how research and research-sharing between the North and the South will be useful to better understand the threats that hang over the human species and the biosphere, and to solve key environmental issues such as global warming, the growing demand for energy, water access, waste eradication, or the preservation of biodiversity (see Box 8.7). Agriculture is one of the fields where research and innovation can be most beneficial in terms of development, while taking into

Box 8.6 Decade of Education for Sustainable Development

UNESCO was designated by the United Nations General Assembly as lead agency for the promotion of the Decade of Education for Sustainable Development (2005–2014).

The implementation of sustainable development requires better knowledge of our environments, whether human or natural. Education and science are thus central to the notion of sustainable development because they offer a means of raising important issues, such as rural and urban development, health care, participation to community life, HIV/AIDS, environment as well as essential moral and legal questions such as human values, bioethics and human rights issues.

The Decade will be devoted to education for sustainable development in all parts of the world, and will give equal footing to the developing and industrialized countries. Sustainable development imperatives are as crucial and urgent in developing countries as in industrialized countries. The effects of overconsumption and waste that characterize some lifestyles speak for closer attention to education for sustainable development. However, there is no universal educational model in this field. Each country must define its own priorities and intervention strategies. Goals, priorities and policies must therefore be defined at a local level to respect the environmental, social and economical conditions of each region and to take its cultural context into account.

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Box 8.7 Knowing and preserving biodiversity

Sustainable development cannot be separated from the international awareness of the importance of biodiversity. Biological diversity – or biodiversity – is the term denoting all forms of life on Earth, as well as the natural characteristics that it presents. The pressures exerted on soils and water resources provoke a considerable decrease in the diversity of plant varieties, animal species, ecosystems and landscapes. Human well-being is threatened because biodiversity is essential to life and is a potential source of food, fibres, medicine and raw material for industries and the construction business. It constitutes an irreplaceable richness for research, education and the development of human beings.

One of the key agreements adopted during the Earth Summit, held in Rio de Janeiro in 1992, is the Convention on Biological Diversity. Through this covenant, most states committed themselves to preserving global ecosystems and protecting biodiversity, as well as to the sustainable use of its elements and the fair sharing of the benefits deriving from the exploitation of the genetic resources of the biosphere.

It is important to recall that as early as 1968, the Intergovernmental Conference on the Conservation and Rational Use of the Biosphere had called for the setting up of terrestrial and coastal zones representing the main ecosystems, where genetic resources would be protected and where research on ecosystems could be undertaken, along with other observation and investigation works related to biodiversity. The MAB Programme, foreshadowing the imperatives of sustainable development, was thus launched by UNESCO as early as 1970 in order to establish a "coordinated global network" of protected zones. Biosphere reserves work as sanctuaries for the protection of samples of the biodiversity of the main biogeographic regions of the world and allow the sharing of knowledge and know-how at local, national and international levels.

account local conditions on the one hand and the aspirations of the actors involved on the other. It is advisable, here, to draw the lessons from the green revolution. The green revolution, which has considerably improved agricultural productivity thanks to the production and distribution of selected seeds, represented, in the second half of the twentieth century, a major example of the way in which science could contribute to development. In a fifty-year span, the productivity of basic crops (rice, maize and wheat in particular) boomed in Asia and Latin America, increasing much less in Africa. The effects of such a revolution were first made possible by the transfer to developing countries of the agronomic knowledge needed to select new varieties of plants. Relying on various forms of scientific cooperation, the green revolution not only mobilized research institutions and centres, and public and international organizations, but also private companies, banks and farmers who contributed in particular to the crop distribution.

Another lesson that the green revolution taught us was the difficulties that had to be overcome, particularly when farmers were made to adopt the new seeds. The problems came not only from seed costs, but also from incomplete information systems and the fact that the new agricultural strategies were not adapted to local conditions and practices. This last point is crucial, for seed productivity has eventually to be measured *in vivo*, not *in vitro* – in other terms, on the spot and not in the laboratory. Of course, one can consider that the farmers' reluctance comes from their so-called "ignorance" and a lack of vertical communication. But this authoritarian and arrogant approach to productivity can trigger only little success for it does not take into account the actors who are most concerned – which is particularly unadvisable in agriculture where local conditions often have important consequences on seed productivity.

The lessons to be drawn from the green revolution can also contribute to the emergence of knowledge societies. If we listen to the farmers, we can obtain more information about their needs and worries. But the increased involvement of the actors can go beyond the conventional association of the citizens to the decisions that concern them. Listening to the farmers is also essential to scientific research. Indeed, it is not rare for farmers to know of varieties, effects and techniques unknown to researchers and selectors, thereby negating the persistent prejudice that they are ignorant. If the first green revolution consisted in establishing international collaboration between governmental institutions and research centres, the second stage will

probably involve better integration of local actors and civil society members in the distribution as well as the development of the seeds.

Fruitful interaction with the farmers is all the more necessary since the next advances in seed improvement will probably go hand in hand with the emergence of biotechnologies and the development of GMOs, for which there is no proof so far that they will be subjected to good ecological control and accepted at the political and legal levels. As far as GMOs are concerned, the states will be responsible for the implementation of standards and tests assessing the risk of ecological contamination in a scientific and independent way.[17]

But it is also the responsibility of the governments in developing countries to anticipate this phenomenon. On the one hand, it is more than probable that the support of non-for-profit organizations will remain essential, even in the present context in which the development of biotechnologies is mostly ensured by the private sector. Agriculture in developing countries is often intensive and rarely corresponds, in terms of profitability and returns on investments, to the market needs, which most of the time encourage extensive agriculture. The GMO issue, as it is raised today, is very closely linked to the issue of exploitation methods, as is attested by the sharp debates (as well as the implementation of moratoriums by certain states) on Genetic Restrictive Technologies (GURTs), whose aim is to prevent non-authorized seeds and sowings from being used again. Unlike their usual practices, these technologies put the farmers under the direct dependence of agrifood industries and prevent them from any local form of experimentation and innovation.[18] Apart from the nature of the seeds (GMOs or not) provided by the big transnational agrifood industries, profitability goals have homogeneization effects that go against the preservation of biodiversity and the exploitation conditions of many developing countries. A comparison with neglected or little-researched diseases can be drawn – many seeds in those countries are now orphan plant seeds.

Nevertheless, the lessons drawn from the green revolution encourage us to become aware that entrusting agronomic research to the public sector will not be sufficient to solve the problem of orphan plants, whether they are abandoned or neglected by research, particularly in poor tropical regions. As regards orphan plants, if public research is carried out without involving the farmers concerned and has no reporting obligation, its impact could be as debatable as that of private research when it is entirely subjected to the market. Agronomic research depends more on the relationship with the farmers than on its financial backing, public or private. It is relevant that, in order to cooperate, many small farmers of the North set up networks with farmers' associations from the South. Consultations between very different actors – states, governmental and non-governmental international organizations, private and public research centres, the private agrifood sector, civil society, concerned farmers and citizen/consumers – will probably constitute one of the most complex challenges that knowledge societies will have to meet in the agricultural sector.

The need to make very heterogeneous actors interact recalls the phenomena studied in previous chapters of this report about the implementation of sustainable research and innovation systems. Indeed, science and technology must develop endogenously and autonomously if we actually want to promote sustainable development. We have seen that a strategy that simply imports knowledge and technologies without generating any "added knowledge value" is not sustainable, because it does not lead to an autonomous scientific, technical and industrial production capacity. Indeed, the scientific gap mostly originates in unequal abilities to produce knowledge. Without an innovation system – be it local or regional – a country cannot have truly autonomous development strategies. Thus, political and financial investment in research and innovation activities is necessary, and it is the responsibility of the international community to support this effort in every way possible, since development relies on a combination of local initiatives and international partnership.

The increase in storage capacities and in the speed of information transmission can but encourage research and innovation, and thereby development. Even so, we will still have to respect the commitments

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undertaken at the World Summit on the Information Society to bridge the digital divide to and develop the infrastructures and physical tools needed. But providing equipment and material capacities is only one stage and cannot replace learning to master these technologies and then adapt them to local contexts. Electronic networks offer a unique opportunity to give everyone access to fundamental scientific knowledge as well as databases for knowledge management in order to discover the experiences (be they successes or failures) of other countries, particularly those of the South. In such a context, the vocation of the international community is to act as a mediator between the different development actors (national and international, public and private, scientific and entrepreneurial). In other words, the international community has a networking mission that will become increasingly crucial in knowledge societies.

Innovation-based development also requires some financial incentives. Indeed, international aid can be allocated or dependent on voluntarism regarding scientific policies. In developing countries, such strategies could encourage decision-makers to better integrate education, research and innovation in their industrial and commercial policies. Indeed, it is important to question the generally accepted idea that a development policy, mainly aiming at reducing poverty, can only consider scientific research as a kind of luxury. Such a way of thinking is wrong because the poverty struggle is long term and requires long-term investments in research, innovation and education. While the responsibility of the states is to promote scientific investment, the role of the international community is to ensure that such investment receives stable and sustainable financing. Allocating a substantial part of ODA to sciences and technologies, would encourage decision-makers of the South to take a keener interest in this form of knowledge-based development.

The emergence of knowledge societies may help realize the intellectual ambition that underpins the sustainable development project (see Box 8.8). Reciprocally, the sustainable development imperative reminds societies founded on the intangible and large-scale networks that they form part of an environmental and global context of limited resources. In opposition to the temptation of "omniscience", characteristic of the use of knowledge and more generally of all forms of technology, sustainable development forces us to address the question of limits. A number of pointers suggest that failing to do this renders the survival of humanity far from certain.

We touch here perhaps on the final point of convergence, where the will to promote sustainable development and the ambition to construct knowledge societies rejoins the ideals fundamental to democracy. For if sustainable development is based first on scientific knowledge (data on global warming or ecology), it is nevertheless the concern of all, like knowledge itself. Sustainable development places us in a context in which the language of science and the language of politics should not contradict one another but should contribute equally to the formulation of a social project. In the absence of such a long-term democratic dynamic of the kind promised by knowl-

Box 8.8 Towards a human, sustainable and shared development

"Shared and sustainable human development could be taken cynically as a mere fashionable slogan. Rather it should be seen as offering a *consistent new vision* for our world where so many spiritual values have been eroded and where the old optimistic ideologies based on progress and the Enlightenment appear no longer worthy of belief – a new vision that would provide a common code of conduct acceptable to all our fellow human beings.

Much more should be said, of course, about the concrete steps which have to be followed to make this happen. Only a couple of points will be underlined here as a kind of conclusion. The first is that we can all act locally and without delay in favour of the proposed scenario, but that the concept of shared and sustainable development has its full meaning only at the world level, since it calls for solidarity and equity not only within each country but among all countries. To move along the desired path, it might be advantageous to start acting at both ends of the scale – the world level and the individual level – although many of the difficulties lie somewhere in between."

(Michel Batisse, "Forefront: the Challenges of Shared and Sustainable Development", *Foresight*, Vol. 5, No. 5, October 2000).

edge societies, there is a real risk that the ambition underlying sustainable development will drift in the direction of a rather vague and consensual ideology, which will continue to be celebrated in major international gatherings but will find no support among economic and social stakeholders.

Background resources

Adam *et al*. (2000); Adant (2002); Agarwal and Narain (1991); Artavanis-Tsakonas (2001); Barabási (2002); Beck (1986); Brundtland (1987); Callon *et al*. (2001); Castells (1996); CERN (2004); Choucri (1993); DaSilva (1999); Dowlatabadi and Morgan (1993); Dupuy (2002); Etzkowitz (2003); FAO (2004); Gibbons *et al*. (1994); Giddens (1990); Govindan (2003); Habermas (1971); Habermas and Luhman (1971); Hassner (2003); Human Security Commission (2003); Kaul *et al*. (1999); Latour (1999); Lessig (1999); Lyon (1988 and 2003); Magalhães (1979); Mansell and Wehn (1998); Nowotny *et al*. (2001); Pakdaman (1994); Parikh and Parikh (2002); Rifkin (2000); Salomon *et al*. (1994); Sen (1999*a*); Shrivastava (1992); Stehr (1994); Swaminathan (2000); UNDP (1990, 1994 and 1999); UNESCO (1996*a* and 1996*b*); UNESCO-ICSU (2000); United Nations (1992*b* and 2001); Von Neumann (1955); Zghal (2000); Zureik (2003).

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Chapter 9

Local and indigenous knowledge, linguistic diversity and knowledge societies

Cultural diversity is in danger.[1] As underlined by the *Universal Declaration on Cultural Diversity*, adopted by the UNESCO Member States, this threat cannot be reduced to its most widespread and most visible manifestation – namely, the tendency towards the homogenization of cultures, previously believed to be the result of development or "progress" and now commonly attributed to "globalization". The erosion of cultural diversity may in fact assume a variety of forms. Everywhere languages fall into disuse, traditions are forgotten and vulnerable cultures are marginalized or even disappear. Is there not a risk, however, that the development of knowledge societies will accentuate the tendency towards the homogenization of cultures noted by a large number of experts? Because when we talk about knowledge societies, what kind of knowledge are we referring to? Are we referring just to scientific and technological knowledge, mainly the preserve of the industrialized countries? The scientific and technological determinants of the information society seem scarcely conducive to promoting that "fruitful diversity of the cultures"[2] that UNESCO is mandated to preserve. Alongside the technological and scientific knowledge that forms the backbone of the information society, what role can be played by other knowledge systems? What is to become of local knowledge, in particular "indigenous" knowledge? It is thus clearly essential, in the context of shared knowledge societies, to ensure the effective promotion of local knowledge as living knowledge and, whenever necessary, to guarantee its protection against all forms of *biopiracy*.[3]

Moreover, it is important to underline that multilingualism[4] greatly facilitates access to knowledge, particularly at school. Building knowledge societies will therefore call for ample reflection on the future of linguistic diversity and the means of preserving it, at a time when the information revolution and the global economy of knowledge seem to be condoning the hegemony of a limited number of lingua francas as the only way of having access to contents that are themselves increasingly "formatted". Is not this standardization one of the main risks incurred by knowledge societies? Of course, the promotion and preservation of linguistic diversity alone cannot guarantee the development of knowledge diversity. Knowledge should not be reduced to a particular language. It has specific characteristics that often go well beyond linguistic barriers. Moreover, in a classroom, bilingualism and biculturalism are clearly two distinct phenomena. But language is an important vehicle of knowledge and the promotion of multilingualism in cyberspace can represent a crucial step on the long path to the preservation of the diversity of knowledge systems and cultures.

And how are we to reconcile the participation of all in *knowledge sharing*, understood as the quest for consensual truth, with the pluralism of values and the proliferation of forms of self-expression? The preservation and promotion of pluralism will necessarily have to accompany the emergence of knowledge societies wherever the world information society has been seen as a potentially one-dimensional model. The building of knowledge societies will not be a

sustainable process unless technological innovations offer a means of renewing what Paul Ricoeur has aptly called "the miracle of translation",[5] attesting thereby to the everlasting capacity of human beings to create a common shared meaning on the basis of differences. In reconciling universality and diversity, translation allows the fashioning of commonalities that preserve and enrich the diversity of each.

Preserving local and indigenous knowledge

Codified knowledge and invisible knowledge

As we have seen, the information revolution clearly reinforces the supremacy of technological and scientific knowledge over other kinds of knowledge such as know-how, indigenous knowledge, local knowledge, oral traditions, daily knowledge and so on.[6] Oral and written abilities correspond to different knowledge systems, and this plurality mainly accounts for the diversity of cognitive cultures. The primary characteristic of these forms of knowledge is not then bound up with some form of geographical distribution of cultures but rather with the ways in which individuals produce, exchange and modify their knowledge – regardless of the culture to which they belong. What gives unity to this apparently disparate bundle of knowledge is its almost *tacit* character, the fact that it is not recorded in writing, since such knowledge is usually transmitted orally, from one generation to the next, and is linked to interaction with nature – whether embodied in agrarian or medicinal practices or in behaviour adapted to environmental change.

Yesterday's folklorists and today's ethnoscientists and even psychologists, in describing these often oral, marginalized and, therefore, *invisible* forms of knowledge, have ensured that a record exists. Nevertheless, although recorded, these forms of knowledge are not codified and remain essentially practical and distinct from scientific and technological forms of knowledge. For instance, the originality of local knowledge makes it most difficult to measure in a systematic way, as can be done with scientific and technological knowledge, as evidenced by articles in major scientific journals.

Moreover, the "great divide" between codified knowledge and invisible knowledge is accompanied in the emerging knowledge societies by new divides. On the one hand, the supremacy of English in the field of scientific and technological knowledge tends to marginalize knowledge expressed in other languages. On the other, the criteria of economic visibility that govern the worldwide information society likewise tend to exclude invisible knowledge, as knowledge-based economies rely first and foremost on the processing of codified knowledge transformed into information. The development of spontaneous and diffuse forms of "techno-*apartheid*" in emerging knowledge societies is a risk that should not be downplayed.

That being so, shall we see science taking the place of traditional knowledge in knowledge societies or, in the contrary, will these two forms of knowledge – knowledge as an expression and source of identity, and knowledge that has a scientific and economic purpose and whose ascendancy is closely linked to the logic of economic rationality – continue existing, living side by side? However, such an alternative does not reflect the rich potential that the future holds in store. Indeed, these two extreme scenarios do not account for the new possibilities of our globalized world in which the different forms of knowledge can intermingle and even interact. May we not, therefore, formulate the hypothesis that new types of *hybridization* will soon emerge, mingling local and technological knowledge?

Local knowledge and sustainable development

The simple substitution of scientific knowledge for local knowledge would have disastrous consequences for humanity, and in particular for developing countries, since scientific production does not suffice to protect certain kinds of vital knowledge. Avoiding the spread of forest fires, preventing the transmission of a virus or optimizing horticultural production while respecting the environment – these human actions are informed by local knowledge that frequently proves vital. All too rarely, however, is such knowledge

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Box 9.1 Taking into account indigenous knowledge in sustainable development projects

The example of the Fiji Islands

The traditional food of the inhabitants of the Fiji Islands used to derive exclusively from their local environment. The traditional calendar of the Fijis indicates which types of products were available at the different moments of the year. Today, new agricultural practices based on traditional experience and old techniques, such as crop rotation, agrosilviculture and seasonal rotation, have been taken up again to fight against the overexploitation of the soils. Moreover, local medicine, which used to be despised, is now widely acknowledged and officially accepted.

taken into account, notably in development projects. Granted, it may indeed be taken into account *ex post facto* (in particular when there is a mobilization of public opinion), but it is still rare for local knowledge to be drawn on from the outset, in the actual planning of development projects. Another factor that militates against this type of knowledge is that the mechanisms which would allow such vital knowledge to be maintained and transmitted, are complex, and often considered too costly or even politically unwise by those in power. Yet, if they could be more effectively integrated into knowledge-based economies, this would offer several kinds of advantage (see Box 9.1). These advantages would be firstly economic, particularly in terms of the environmental viability of development projects; but also cultural, through the valorization of types of knowledge that are often wrongly stigmatized as being linked to forms of self-sufficiency considered obsolete or doomed to extinction; and lastly, political, for governments that wish to promote the active integration of the communities that possess this knowledge.

Such integration of local knowledge into development projects would allow stress to be given to the hybrid dimension of some of these forms of knowledge (related both to the "economy" and to "identity"). This integration is necessary if sustainable development initiatives are to be encouraged. Emerging worldwide awareness of the global character of environmental issues – and hence of the shared responsibilities they imply – is indeed conducive to improved visibility of local knowledge in the management of renewable resources (see Box 9.1). Farming practices in Latin America and Africa, still frequently based on indigenous knowledge, have found their rightful place in development strategies, a situation that would have been hard to imagine 25 years ago. The emergence of new commercial outlets has made for the improved visibility of so-called traditional health practices, such as Chinese or African medicine. The urgent necessity to lay down clear rules for a water policy has also been reflected in the more effective inclusion of local knowledge in the key field of human security.

Obstacles to taking local knowledge into account

There are, however, many obstacles to taking local knowledge, particularly indigenous knowledge, into account on the field. First, most of these knowledge systems are intangible, and one main requirement is therefore to design ways of exploiting them that do not systematically rely on recorded documentation, since few of them are susceptible to be covered by exhaustive and scientific studies – some of these may even lead to acts of *biopiracy* (see Box 9.2).[6]

In knowledge societies, the confrontation of two different systems of knowledge in development projects (scientific knowledge and local knowledge) (see Box 9.3) unfailingly gives rise to a large number of complex problems, particularly in regard to the protection of intellectual property right-holders, the fight against biopiracy or the establishment of fair procedures for profit-sharing. Is the joint management of renewable resources founded on the alliance of scientific and indigenous knowledge possible? Can the conclusion of agreements in this field benefit on an equitable basis the two parties involved?

For a "knowledge policy"

In the light of the benefits arising from the co-existence of local and scientific knowledge in the context of knowledge-based economies, will it be necessary

Box 9.2 Biopiracy

In Amazonia, the idea has gained currency, sometimes with the help of the local authorities, that the sole aim of researchers is to "plunder" local cultures and to profit from them. While it is difficult to suspect the monographs of ethnologists of being put to commercial use, such mistrust is not always unfounded in the case of ethnobotany, ethnomedicine and traditional ecological knowledge. Some pharmaceutical or agrifood companies do not hesitate to lead active "bio-prospection" campaigns that consist in sending teams to make a list of items that could be interesting for future business concern (domestic varieties of plants or species of animals or active principles that could be investigated upon or even patented later on). When the work of an ethnobotanist, for example, is covered by a relatively transparent procedure, there are very often many obstacles to identifying the owners of rights in a plant or product that may be of commercial value. In the case of Chiapas in Mexico, the local communities concerned are clearly defined, organized and structured, and their consent is obtained through a procedure regarded by all the interested parties as relatively fair and transparent. However, traditional knowledge concerning the use of a specific plant often extends far beyond a local community or even a set of communities.

In Amazonia, it seems very difficult if not impossible to identify the exact origin of a plant that may be put to commercial use. Rules as to remuneration are determined by default and de facto through the presence of an ethnobotanist in a given place at a given time. It thus becomes clearer to what extent these procedures may be the subject of conflicts over the intellectual property rights in these discoveries and their use, involving pharmaceutical companies, researchers, non-governmental organizations and local communities. During the World Summit on Sustainable Development (Johannesburg, 2002), it was decided that the 1992 Convention on Biological Diversity could provide an international legal framework for the establishment of legislations related to the sharing of research findings on biodiversity. Negociations are being held to try to harmonize the legal instruments of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) with the provisions of the Convention on Biological Diversity.

for us to implement a "knowledge policy"? This entails, first, a better awareness of the value of the knowledge held by the social actors. Since it is the task of heritage protection to foster such awareness at every level, we shall see how far the idea of *intangible heritage* (see Box 9.4) can help valorize local knowledge. Moreover, a "knowledge policy" also entails, from the economic point of view, a better *capitalization of knowledge*, predicated simultaneously on the methodical assimilation of the international scientific heritage in the public domain, and on a critical and responsible approach to the assimilation attempts of traditional knowledge.

Through heritage preservation, whole swathes of knowledge can be protected, without any distinction being made between knowledge that is not yet economically viable and knowledge that perhaps never will be but that is nevertheless part of our creative diversity and, as such, a source of development. As we have seen, in the emerging knowledge societies the new technologies already offer a new range of ways conserving and transmitting cultural contents, and hence the possibility of better promoting local knowledge.[7]

Such a knowledge policy will be particularly effective if it fits into the context of strong coordination between communities and governments. This is strikingly illustrated by the fight against biopiracy. In New Zealand, Maori medical practices are thus protected by "treaties" that relate both to medical knowledge and to the practical use and development of indigenous plants, within the framework of interuniversity funding and in association with national research and health foundations. However, the different contexts – more or less structured indigenous communities, whether or not benefiting from strong national integration and possessing more or less developed infrastructures – and the wide range of initiatives, which often depend on the goodwill of the stakeholders, may account for the unequal success of the actions undertaken.

Besides these initiatives to preserve and transmit local knowledge, other projects are aimed at selecting certain types of local knowledge so that they can serve economic objectives and contribute to sustainable development.[8] However, although this type of selection is generally based on transparent criteria and subjected to open discussion, it is not without

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risks, since it tends to sift out indigenous knowledge, leading to recognition of "admissible" knowledge on the one hand, and on the other to the non-recognition or exclusion of representations or contents that have not been selected, more or less implicitly equated with "beliefs" or "superstitions".

Linguistic diversity and knowledge societies

The question of the future of languages will also be high on the agenda of knowledge societies. Linguis-

Box 9.3 The protection of traditional knowledge and genetic heritage

Over the past decades, biotechnology, pharmaceutical and health care industries have developed a growing interest in the traditional knowledge held by local and indigenous communities. This knowledge is increasingly integrated to the creation process and industrial production of medicine, chemical products and fertilizers. More often than not, traditional and indigenous knowledge is not sufficiently acknowledged and protected by conventional intellectual property legislation. This issue is therefore under debate in many international institutions, among which are those of the United Nations system (WIPO, UNEP, FAO, UNESCO, the International Labour Organization (ILO) and the WTO.

The Convention on Biological Diversity, adopted by the United Nations Conference on Environment and Development ("Earth Summit", Rio de Janeiro, 1992) provides the first umbrella agreement addressing both the preservation and use of all biological resources. It is also the first international agreement acknowledging the role and contribution of indigenous and local communities in the preservation and sustainable use of biodiversity. The Convention reaffirms the cornerstone principle of state sovereignty over the use of biological and genetic resources, thus granting states the right to exploit their resources according to their own environmental policies. The Convention, however, holds that the conservation of biological diversity is a "common concern for humankind" and that states have the duty to cooperate in the sustainable management of resources found under their jurisdiction.

The Convention also stipulates that all Member States have a duty to preserve indigenous knowledge and practices. In this respect, it provides a general legal framework regulating access to biological resources and the sharing of benefits arising from their use. Over the past few years, different countries and regions have adopted or modified their national and regional legislation over the protection of biological resources and traditional knowledge:

African Union (AU; formerly the Organization of African Unity): A 2000 model law holds that any patent over the genetic sequences of any life form will be rejected.[9] This applies to the biological resources and to the indigenous knowledge or technologies of all the Member States. The phrase "biological resources" includes the genetic resources, populations and any other component of the ecosystem.

Andean Pact: A 1996 decision applies to *in situ* and *ex situ* genetic resources that could be or are already marketed.[10]

Association of Southeast Asian Nations (ASEAN): A 2000 framework agreement defines "bioprospection" as the search for, or the exploration of, marketable genetic and biological resources.[11]

Philippines: The 1995 bio-prospection law identifies and acknowledges the rights of indigenous cultural communities over local knowledge when it is directly or indirectly submitted to commercial use. All biological and genetic resources are owned by the state.

Australia: A 1999 law recognizes the role of indigenous people in the sustainable conservation and use of biodiversity.[12]

Thailand: A law on the protection and promotion of intellectual property protects existing knowledge on traditional medicine.

Brazil: a 2001 provisional measure states that access to traditional knowledge and genetic resources, as well as its shipment abroad, should only be carried out with the consent of the State, via the Genetic Heritage Management Council (CGEN) created for this purpose.[13] The law acknowledges the right of local and indigenous communities to develop, hold and preserve the traditional knowledge associated with genetic resources, particularly in the scientific and commercial fields. This law also protects "genetic heritage", defined as "the information of genetic origin contained in samples of all or part of plant, fungal, microbial or animal specimens, in the form of molecules and substances deriving from the metabolism of such living beings and extracts obtained from such organisms, live or dead, encountered *in situ* or *ex situ* on the national territory".

Box 9.4 Intangible heritage in knowledge societies

One of the specific difficulties of local knowledge is that it cannot be submitted to the criteria of codification under which scientific knowledge is established. In this context, how can we help ensure the identification and preservation of local "contents"? The Convention for the Safeguarding of the Intangible Cultural Heritage, adopted in October 2003 by UNESCO at the 32nd Session of the General Conference, offers a new theoretical and normative framework, which constitutes a major advance.[14] The concept of intangible heritage thus makes it possible to broaden not only the concept of heritage but also that of preservation and transmission.

In addition to extending heritage status to local cultural contents, the concept of intangible heritage may contribute to the preservation of local and indigenous knowledge and enhance the effectiveness of its protection, whether it be a question of therapeutic and food products used for purposes of gain, without acknowledgement of origin, or the unauthorized collection of genetic data. The many complaints lodged in recent years with WIPO in this regard suggest that the fight against biopiracy will perhaps be of strategic importance for the building of knowledge societies. The biopiracy issue is indeed one that touches on the most urgent issues facing the world community such as the protection of genetic data, ownership of living organisms, genetic diversity, cultural diversity, intangible heritage, research policies and the right to health. Such is the complexity of these debates that it is not easy to reach a consensus on them. However, in a future-oriented perspective, the thorny question of biopiracy and how it is to be dealt with is no doubt one of the key areas in which the future of knowledge societies will be determined. For this is a political issue which, as in the case of GMOs or cloning, cannot be resolved in strictly technical terms and to which no valid answer can be found in the absence of a genuine dialogue between all the actors concerned.

tic diversity is under threat. At least half of the 6,000 languages currently spoken in the world are likely to have died out by the end of the twenty-first century. According to some linguists, the phenomenon of language extinction is taking place on an even larger scale with, ultimately, 90 to 95 per cent of languages doomed to disappear. The problem of the disappearance of languages may well become particularly acute in the emerging knowledge societies, given that the new technologies revolution seems, at first sight, to be speeding up this phenomenon of language erosion. In the past few years this risk of creeping linguistic uniformity has been more and more widely recognized, thanks to the research and awareness-raising action of several non-governmental organizations and a number of intergovernmental organizations, in particular, UNESCO and the International Organization of the Francophonie.[15] At the regional level, mobilization in support of languages has led to the adoption of important legal instruments, such as the *Charter for Regional Languages and Minority Languages* adopted by the Council of Europe in 1992. UNESCO, for its part, has not been indifferent to this problem, as is attested by the relevant provisions of the Universal Declaration on Cultural Diversity (2001), the Convention for the Safeguarding of the Intangible Cultural Heritage (2003) and the Recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace (2003).

Why preserve linguistic diversity in knowledge societies?

In knowledge societies, which should in principle promote knowledge-sharing, the values of exchange and the ethics of discussion, is it advisable to encourage the expansion of international and regional lingua francas? Is it advisable to promote the unconditional preservation of full-scale linguistic diversity which, if not properly controlled, might in some cases (in particular for countries where, for example, tens or hundreds of languages are used) check the development and spread of education? Or is it not more suitable to promote balanced policies that allow to reconcile the preservation of linguistic diversity and the promotion of widely spoken languages?

Indigenous languages continue to be the main medium of expression of aspirations, intimate desires, feelings and local life. They are indeed the living repositories of cultures. In the general context of the strengthening of multilingualism, there is not necessarily any contradiction between the promotion of lingua francas (those adopted for literacy teaching and that

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may ultimately be used, like English, to gain access to the new technologies) and the maintenance of a specific use of mother tongues. Would it not be advisable to try to reestablish a balance between lingua francas and mother tongues in knowledge societies, for example through a twofold course of instruction, one strand being based on the lingua franca and giving access to scientific knowledge, and the other provided in the mother tongue and covering what is called, in different societies, the "humanities"? The "Awakening to Languages" initiative described below (see Box 9.5) seeks indeed to encourage this fruitful co-existence of a mother tongue or local language and a lingua franca. This initiative, which remains in the spirit of the Linguapax project, is designed to provide guides and textbooks to teachers and educational policy-makers who wish to incorporate local languages into national education systems.[16]

Moreover, it is important to preserve linguistic diversity in emerging knowledge societies for "cognitive ergonomics" purposes. Indeed, to set limits on linguistic diversity in knowledge societies would be tantamount to reducing the paths of access to knowledge, since their capacity to adapt technically, cognitively and culturally to the needs of their actual or potential users would necessarily be diminished. Preserving the plurality of languages translates into enabling the largest number to have access to the media of knowledge. This is well illustrated by the example of the internet. Basic education and literacy are preconditions for universal access to cyberspace. The exchange and sharing of knowledge call for multilingualism, however, and in particular for the command of at least one widely spoken lingua franca – the promotion of which is not per se incompatible with the safeguarding of mother tongues and indigenous languages.

Among the tools that may contribute to the preservation of threatened languages, the government implementation of universally proclaimed linguistic rights is especially important.[17] For one of the main prejudices from which linguistic diversity has suffered is the idea that the building of nation-states must be based on a single official language. In the name of national unity and cohesion, policies calculated to weaken plurilingualism and to encourage monolingualism have often speeded up the decline of linguistic diversity. However, monolingualism is far from being the rule all over the world. According to some estimates, the number of bilingual individuals is equal to half the world population, and there is no country where bilingualism is not present. Yet, it is not enough to recognize linguistic rights. Even when national policies favour official plurilingualism (as in most African countries), the great majority of the languages concerned, whether their status is that of "national" languages or "indigenous" languages, have only a marginal position in the world. Official recognition of these languages must go hand in hand with the work of linguistic description, which is

Box 9.5 Awakening to languages

"Awakening to Languages" is an initiative that aims to encourage linguistic and cultural diversity and lingualism, advocated by the Action Plan of the 2001 Universal Declaration on Cultural Diversity. It treats linguistic diversity as a field of educational activities designed to increase pupils' knowledge of the "world of languages", to develop in them attitudes of interest and openness towards what is foreign to them, and to foster the acquisition of capacities for observing and analysing languages, with a view to facilitating the learning of those languages in the future.

This type of initiative, supported by eminent linguists and educational scientists, has been introduced in some European countries, in Cameroon and in two of France's *départements et régions d'outre-mer* (Réunion and Guyana). Conducted upstream of the learning of foreign languages in the proper sense, the Awakening to Languages project seeks to give a self-evident dimension to linguistic diversity and to the speaking of different languages, and to rehabilitate languages that are usually thought to be of less value, allowing them to be seen as legitimate subjects of instruction. This initiative also encourages pupils to address the problem of the transition to writing languages that were traditionally oral. Such an approach consequently enables local languages to be quickly upgraded through the use of writing.

a precondition for their utilization. In some cases (such as, for example, Sängö in the Central African Republic, Lingála in the Congo and in the Democratic Republic of the Congo, Guarani in Paraguay and Beachlamar in Vanuatu), this description and utilization is all the more urgently needed since these languages play an essential role in national construction.

Multilingualism has long been regarded as an obstacle to development, and this idea still holds sway in a number of countries in the world. It is crucial to recognize that linguistic diversity is a source of enrichment for humanity and cannot be seen as a handicap when it is combined with cultural diversity. Nowadays, one language becomes extinct every two weeks on average.[18] The disappearance of a language is a loss for all human beings for it generally means the disappearance not only of a way of life and a culture, but also of a representation of the world and of an often unique form of access to knowledge and to the mind. It is then on the basis of a distorted and erroneous conception of knowledge that some people may form the hypothesis that the expansion of knowledge societies should ineluctably go hand in hand with the ever faster disappearance of languages and a radical reduction in linguistic diversity, both at the level of local or indigenous languages and at that of widely spoken international languages. What is more, there is general agreement among linguists that bilingual persons usually possess a greater cognitive malleability and flexibility than do monolingual persons.

In the light of the many challenges presented by the expansion of knowledge societies and the need to recognize that linguistic diversity is a treasure contributing to human knowledge and to the many different ways of gaining access to knowledge, and in the light of the challenge of constructing peace in the minds of men and of the usefulness of promoting mutual knowledge of cultures, what policy should guide education systems? UNESCO considers that the school should henceforth encourage the expansion, within pluralistic education communities, of a multilingual culture, reconciling the requirements of the teaching of a mother tongue and of several other languages. This multilingual education should begin as early as primary level since, according to linguists, age 11 marks the end of the "critical period", the age when "the ear, until then the natural organ of hearing, becomes national". Hence it is important in the twenty-first century to promote an education that is at least bilingual and, so far as is possible, in all countries that have the necessary means, trilingual. This policy could be facilitated by massive exchanges of teachers and language assistants within the same region of the world, or indeed between regions.

Lingua francas as vehicles of knowledge

While the humanities, because of the singular character of the experiences that they convey, serve pre-eminently to promote linguistic diversity and the practice of mother tongues, the situation is quite perceptibly different when it comes to the natural and exact sciences or technological knowledge. Indeed as we have seen indeed, the codification of such scientific knowledge is mainly implemented by the industrialized countries, which reflects their current hegemony over the production of knowledge. Moreover, the history of European domination has largely determined the geography of languages which serve as vehicles of knowledge. However, the range of dominant European languages has been considerable reduced in academic literature, and scientific literature is unquestionably dominated by English.[19] While it may be assumed that in the so-called hard-core scientific disciplines the codification of scientific knowledge has attained a level such that its linguistic medium has become relatively unimportant, the ascendancy of a particular language being the price that has to be paid to guarantee the universality of scientific research and debate. Nonetheless, this dominant position of English is far more contested in the social and human sciences. Indeed In this field, as in philosophy or poetry for example, the linguistic medium proves to have a constitutive role and to structure the act of knowledge. As a consequence, the hegemony of English is far more difficult to justify. In the opinion of a number of experts, it is even in danger of jeopardizing the exercise of descriptive and analytical operations aimed at reporting on cognitive or discursive experiences and practices which, at the

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individual and the collective levels alike, use language as a medium and as a material.

Reducing the erosion of linguistic diversity, discovering ways to prevent the fast extinction of indigenous langauges or promoting the wide use of several common languages, does not mean championing a lost cause for the sake of nostalgia. It means, rather, an acknowledgement that languages are at once cognitive media, vehicles of culture and an enabling environment for knowledge societies, for which diversity and pluralism are synonymous with enrichment and the future.

Linguistic diversity in cyberspace

The issue of linguistic diversity in cyberspace is much debated. Some experts estimate that nearly three-quarters of the internet pages are written in English, while others assert it has lost half of its importance.[20] It should be noted that those studies do not cover e-mails, forums, databases or non-public pages.

The danger that the internet thus presents to linguistic diversity is in fact one of the mainsprings of the digital divide, and it represents a serious threat for the diversity of contents in cyberspace. Indeed, four essential conditions pre-exist to the contents themselves: the existence of a language acting as a vehicle of these contents, the possibility to write in this language, the existence of a code allowing the transcription of this written language in cyberspace and eventually the compatibility of such a transcription with existing softwares. Has the future of linguistic diversity abruptly changed tack with the advent of the new technologies? Several thousand languages are practically not used in cyberspace, thus automatically marginalizing those cultures of which they are the vehicle. Among the many factors that account for this state of affairs, one basic determinant in the case of unwritten languages is the fact that, as such, they simply have no chance of being used as a language of communication on the internet. And around 6,000 of the world's languages are not written but spoken.

In 2000, the number of internet users having a non-English mother tongue exceeded 50 per cent and since then the figure has been steadily rising. In actual fact, the internet helps to bring language communities more closely together – as is most strikingly illustrated by the dynamics of the Spanish-language internet. China should soon outstrip Japan in terms of internet growth. (For an account of the situation in Africa, see Box 9.6.) The domination of English is not always synonymous with cultural homogenization on the Web. India, which also has one of the highest growth rates, is often quoted – rightly – as a counter-example in so far as English, which has been for more than half a century a lingua franca in the subcontinent, also serves there as a vehicle of particular cultural characteristics.

Although the domination of English on the internet seems to be on the decline, only a very limited number of languages are stepping into its place. In their present state, certain technologies, such as webpage referencing methods or search engines, tend to consolidate the position of the most commonly used languages, since they favour the most frequently visited sites. Does this domination of a "select club" of lingua francas constitute the only possible compromise between the hegemony of English and a multilingual cluster of networks that would only be able to communicate among themselves by means of automatic translation? Is this to be regarded as the price that has to be paid for the emergence of a linguistically better balanced internet? However, the risk to be run by knowledge societies is considerable, since oral languages may thus suffer a loss of legitimacy that will accrue to written languages, which alone seem to have some chance of finding a place in cyberspace. Do we fully realize today the acuteness of the problems that will unfailingly be generated by this new linguistic divide?

The preservation of linguistic diversity and its promotion in cyberspace must accordingly take into account the many appropriate levels of action and interventions. Such is the aim of the Recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace mentioned above. Multilingualism in cyberspace, considered to be "a determining factor in the development of a knowledge-based society", must be promoted by states, the private sector and civil society. There are, however, two prerequisites for the implementation of such a recommendation within national policies and legislations, namely – the scientific description

Box 9.6 African languages in cyberspace

Sub-Saharan Africa, with still a very small number of internet users, very great linguistic diversity and usually multilingual national language policies, constitutes a particularly interesting case of the problems posed by the promotion of linguistic diversity in cyberspace.

The findings of a recent survey conducted by Marcel Diki-Kidiri at the request of the *Réseau international francophone d´aménagement linguistique (Rifal)*, concerning the presence and use on the Web of the sixty-five most widely spoken African languages, is however, rather surprising and encouraging. Admittedly, it confirms the predominance of English in African cyberspace, but it also shows the first presence of a number of African languages on the web – 7 per cent of the selected sites (starting from the name of the language sought) are wholly or partially written in that language, 12 per cent give access to texts written in an African language, 19 per cent give a linguistic description of the language (phonological, grammatical and/or lexical outline), and 22 per cent offer fairly good documentation. However, out of the sixty-five languages studied, only twenty-four are used as a language of communication and only twelve in more than two sites (Afrikaans, Kiswahili, Amharic, Hausa, Setswana, Kikongo, Somali, Kinyarwanda, Peul, Wolof, Tsonga and Tamazight).

It is true that 90 per cent of African languages are unwritten languages which, for the time being, considerably reduces their chance of being used as a language of communication on the web. As emphasized by the recommendations of the Bamako meeting (2000) on "The Internet and Bridges to Development", there is a still a long way to go, although some authors make no secret of their optimism in view of the growing use of African languages in cyberspace.

and transcription of unwritten languages, so as to provide them with stable writing conventions. In this respect, several initiatives are to be stressed. The first is the generalization of Unicode,[21] which allows some minority languages to reach a broader audience than it used to. Another is the growing interest of contents industries for new lingua francas, well-illustrated by Microsoft's decision in 2004 to launch a Kiswahili edition of its Office software, Kiswahili being a main East African lingua franca, spoken by over 50 million people.

Pluralism, translation and knowledge sharing

Knowledge societies will only be able to avoid the danger of cultural relativism or cultural homogenization if they highlight the need to assert *shared values*, on whose basis true *pluralism* becomes possible. To say this is to recall the exact nature of the universalistic mission that is vested in knowledge. The advent of knowledge societies cannot be viewed, purely and simply, as a harbinger of the triumph of techno-scientific dogmas in the world – especially since these dogmas usually express no more than the point of view of stakeholders best placed in the world knowledge economy. Keyed to *learning, openness* and *curiosity*, the emergence of such societies should be seen, on the contrary, as an enhancement of our capacity for questioning, or indeed calling into question, our certainties. Accordingly, in knowledge societies, the safeguarding of pluralism should entail an active, critical tolerance towards oneself. As is stated in the 1995 Declaration of Principles on Tolerance,[22] it is important in this regard to take measures to thwart

> the current rise in acts of intolerance, violence, terrorism, xenophobia, aggressive nationalism, racism, anti-Semitism, exclusion, marginalization and discrimination directed against national, ethnic, religious and linguistinc minorities, refugees, migrant workers, immigrants and vulnerable groups within societies, as well as acts of violence and intimidation committed against individuals exercising their freedom of opinion and expression.

It is also vital to promote "respect, acceptance and appreciation of the rich diversity of our world's cultures, our forms of expression and ways of being human" to and encourage "knowledge, openness, communication and freedom of thought, conscience and belief", that are at the ground of pluralism. Such a programme requires a set of shared values that must be underpinned by firm political will.

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Towards translation societies?

In these circumstances, knowledge societies can become true societies of mutual understanding and dialogue between civilizations. Of course, such mutual understanding is not automatic. As has been noted by Paul Ricoeur, it calls for the patient process of translation, which "creates resemblance where there seemed to be only plurality".[23] Translation introduces understanding where only tumult and confusion reigned. However, translation does not spell the end of diversity, since it does not mean sameness but merely equivalence. Translation is pre-eminently the means of mediation between cultural diversity and the universality of knowledge. In this sense, the bottom line is that there is no universal language but only exchanges between cultural and spiritual heritages in quest of a common language. It follows that the *knowledge societies* will have to be *translation societies*, if we are to avoid the snares of fake universalism and relativism, both of which are sources of misunderstanding and conflict.

The spreading of the new technologies in emerging knowledge societies offers promising prospects. Still deficient today, machine translation systems, which have nevertheless made considerable progress, represent a real opportunity for the preservation of linguistic diversity. Research in this field, after being rather slow for want of funding, has in the past few years been given a new lease of life through the globalization of the internet market. Some products are now capable of translating internet pages almost simultaneously into the languages most commonly used on the web. Eventually machine translation systems might be made available to the public at large, or through their direct incorporation into hardware for professionals. This should contribute to greater linguistic transparency on the Web.

Background resources

Ali (2001); Ammon (2002); Appadurai (2001); Bain (1974); Becerra (2003); Candelier (1998); Carneiro (1996); Chanard and Popescu-Belis (2001); De la Campa (1994 and 1996); Dietz and Mato (1997); Diki-Kidiri (2003); Diki-Kidiri and Edema (2003); Dortier (2003); Echevarría (2001); García Canclini (1994 and 2001); Goody (1977); Hagège (2000); Hamel (2003); Himona (2003); Hopenhayn (2002); Hountondji (2003); Leach (2002); Martín Barbero (2002); Monke (1999); Murthy (2001); Nakashima and Roué (2002); Omolewa (2001); Philipson (2001); Ramakrishnan *et al*. (1998); Ricœur (2004); Tu (2004); UNDP (2004); UNESCO (1945, 1960, 1970, 1972, 2000*a*, 2001*a*, 2003*a*, 2003*b* and 2003*f*); UNESCO-ICSU (2000); United Nations (1992*a*); Van der Veken and De Schryver (2003); Wildhaber (2001); Yúdice (2002); Zerda-Sarmiento and Forero-Pineda (2002).

Chapter 10

From access to participation: towards knowledge societies for all

Will everyone one day be able to find their place in knowledge societies, without distinction of any kind – race, sex, language, religion, political or philosophical convictions, income or class? Or will knowledge again be a powerful factor of exclusion, the temptation to acquire it being made all the keener by the advantages it brings in its wake? As early as the end of the nineteenth century, clear-seeing minds had already announced the will to knowledge as an expression of the will to power. The strategic importance of knowledge is fully illustrated today by the acute character of the economic imbalances between the countries of the North and of the South, of which the *brain drain* is both a consequence and a cause, or again by the growing importance attached to *secrecy*, even in democratic societies (defence secrets, industrial or commercial secrets, secret protocols, confidential reports or classified information).

In quite a number of fields, knowledge has already now become a most valuable resource which, in the twenty-first century, will increasingly determine who has access to power and to profit. Can it reasonably be assumed that there will, in the future, be ever-fiercer competition over what is now so strategic a resource? Shall we, one day, see nations seeking to gain possession of it at any price? Will there, in the future, be *knowledge wars* just as in the past there were opium and oil wars? Conversely, the collective bid to knowledge-sharing requires an effort of thinking and understanding, an ability to call into question one's own certainties, an openness to Otherness or to the unknown, a desire to cooperate and a sense of solidarity. Most of the early knowledge societies were based on different systems of exclusion. Knowledge there was largely reserved for the happy few, for a small circle of initiates. In sharp contrast with such an elitist conception, knowledge societies in the twenty-first century will only be able to usher in a new era of sustainable human development if they ensure not only *universal access to knowledge*, but also *the participation of all in knowledge societies*.

From the knowledge divide to knowledge sharing

The aspiration at the heart of the effort to build knowledge societies is underpinned by the conviction that knowledge, as the source of empowerment and capacity-building, may be a decisive instrument of development. In knowledge-based economies, human capital is the main source of profit. But even more important, knowledge, as we have seen, is also the key to a broader understanding of development – whether human development or sustainable development. The worldwide development of knowledge societies therefore offers a unique chance for the least developed countries to catch up with the industrialized countries by taking advantage of the widespread dissemination of knowledge.

Two remarks should however lead us to considerable precaution in advancing this promising hypothesis. First, as we have seen, in the field of knowledge, there are profound inequalities between rich countries and poor countries. One of the vicious circles of under-

development is that it is sustained by the knowledge gap while accentuating it in return. Second, the rise of a global information society has allowed a considerable mass of information or knowledge to be disseminated via the leading media.[1] However, the different social groups are far from having equal access and capacity to assimilate this growing flow of information or knowledge. Not only do the most disadvantaged socio-economic categories have often a limited access to information or to knowledge (*digital divide*), but also they do not assimilate it as well as those who are on the highest rung of the social ladder. Such a divide can also be witnessed between nations. An imbalance is thus created in the actual relationship to knowledge (*knowledge divide*). Given equal access to it, those who have a high level of education benefit much more from knowledge than those with no or only limited education. The widespread dissemination of knowledge therefore, far from narrowing the gap between developed and less developed countries, may help to widen it. Does this mean that knowledge may be a means of developing but not of catching up? Under such circumstances, can the promise held out by the rise of knowledge societies become a reality for all the countries and for all citizens worldwide?

The remarks in the preceding chapters, whether on the development of telecommunication infrastructure, research and development potential, the importance of innovation in national economies, the literacy ratio and the quality of education systems, or the capacity to collect data or to promote local knowledge, apparently lead to the same obvious conclusion – namely that, in actual practice, all countries are not equal before the challenge of knowledge. There is a basic divide overlying all the divides previously described – whether the *digital divide* between the "connected ones" and those relegated to the sidelines of the world information society, the *science divide*, the *education divide* and the *culture divide* (not to mention the divides that affect particular population groups such as the young and the old, men and women, minorities, migrants or the disabled).[2] This fault line is nothing but the *knowledge divide* between those who have access to knowledge and participate in knowledge-sharing, and the others, those relegated to the sidelines of knowledge societies. An adequate description of this knowledge divide might entail a systematic evaluation of the situation of countries in this field, on the basis of a synoptic index (see Box 10.1) that would incorporate all parameters bearing on the production, dissemination, valorization or acquisition of knowledge.

Worldwide knowledge inequalities

Between the North and the South there is worldwide a major knowledge divide. Statistics on patents registered in the world are particularly instructive in this regard.[3] The first lesson to be drawn from them is that such an imbalance in the field of intellectual property tends to amplify the economic imbalance that exists between industrialized countries and developing countries. But there is another lesson too – big differences in competitiveness exist between countries belonging to the same geographic area. The knowledge divide exists, then, on many fronts – alongside the basic North-South divide there are North-North or South-South divides.[4] The existence of such inequalities between countries in gaining access to knowledge has a particularly worrying consequence, namely, the *brain drain,* which affects not only developing countries insufficiently provided with the infrastructure of knowledge, but also countries in transition and advanced industrialized countries.

Because of insufficient public and private investment in the field of research and new technologies, part of the elites of countries affected by the brain drain migrate to countries whose competitiveness relies on a scientific and technological potential of a very high level and on a capacity to bring in qualified foreign workers by offering them better job conditions. Inequalities in relation to knowledge are then likely not only to persist but to grow worse. In this regard, however, the gap tends to widen between poles where cutting-edge knowledge is highly concentrated and vast outlying areas where it tends to become scarce. As shown in Box 10.2, it will not be easy to fill this knowledge gap between countries in so far as the most advanced countries are constantly pushing back the frontiers of knowledge. In the face of this moving target, developing countries are thus engaged in relentless efforts whose outcome no one can yet foresee.

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Box 10.1 Towards a Knowledge Development Index?

Seeking to provide a precise description of the knowledge divide involves being able to measure it and to find it a reliable statistical expression. The index is an often prime tool for gauging how complex fields of human activity evolve, since it incorporates in one item of data a greater or lesser number of indexes, such as the *Human Development Index* produced by the UNDP.

The construction of a knowledge development index has been the subject of national initiatives, particularly in Malaysia,[5] or international projects, such as the Index of Knowledge Societies of the United Nations Department of Economic and Social Affairs.[6] The production of a reliable and robust index is no easy matter, however, for knowledge is an exceedingly complex object, making it hard to avoid a degree of bias.

The Index of Knowledge Societies published by the United Nations is backed by detailed expert analyses devoted to the development of knowledge societies. It synthesizes a broad array of factors distributed over three main axes or sub-indexes and combined to produce a single score. But the theoretical strength of this instrument is also its weakness for, to be precise, the index must take in a large amount of data. Because the final figure derives from the composition of three sub-indexes, it is not always easy to determine exactly what factors enable the scores of the countries compared to be truly differentiated. What is more, because it requires a large amount of data, the study was only able to cover the countries able to provide it – forty-five in all, with just one African country. Such an approach is therefore liable to come up with a poor reflection of its object – in this case – knowledge societies, and to be of little use to many developing countries simply because a consequence of the knowledge divide is the difficulty in generating sound quantified knowledge of their distinguishing features (in other words, the feasibility of a knowledge index depends primarily on the quality and quantity of data that can be collected).

As a national initiative, the Knowledge Development Index created by the Government of Malaysia is based on twenty-five indicators (see Box 10.3) divided up into four dimensions or sub-indexes (informatics infrastructures, education and training, info-structure, and R&D and technology). Besides the fact that the number of aggregated factors is very high, it is difficult to determine their relative importance in arriving at the final figure. Furthermore, examination of the sub-indexes seems to indicate that some countries obtain almost identical marks in each sub-index, which suggests that there was some superfluity in the choice of factors and, hence, that fewer factors could have been selected.

An examination of these initiatives shows that drawing up a knowledge index involves overcoming difficult technical obstacles. The task is made harder in that indexes may sometimes be misunderstood by people who are not statisticians and see in them a mere opportunity to classify countries – and to judge them – rather than to get to know them in their diversity. What is more, this biased reading may have an undesirable effect where countries focus on improving their index score, taken as a rigid reference, instead of concentrating on the actual problems of the fields studied. Taken on its own and without reference to the particulars of the field, an index is of scant value. Yet, this misuse of indexes should not blind us to the fact that their main purpose is to draw attention to fields calling for practical action. The considerable obstacles to constructing an effective knowledge index should therefore not discourage the efforts that need to be continued in this direction, for such an instrument could be of the utmost use to all involved, directly or indirectly, in the production, dissemination, utilization, preservation and governance of knowledge. The feasibility of a knowledge index therefore deserves continued examination.

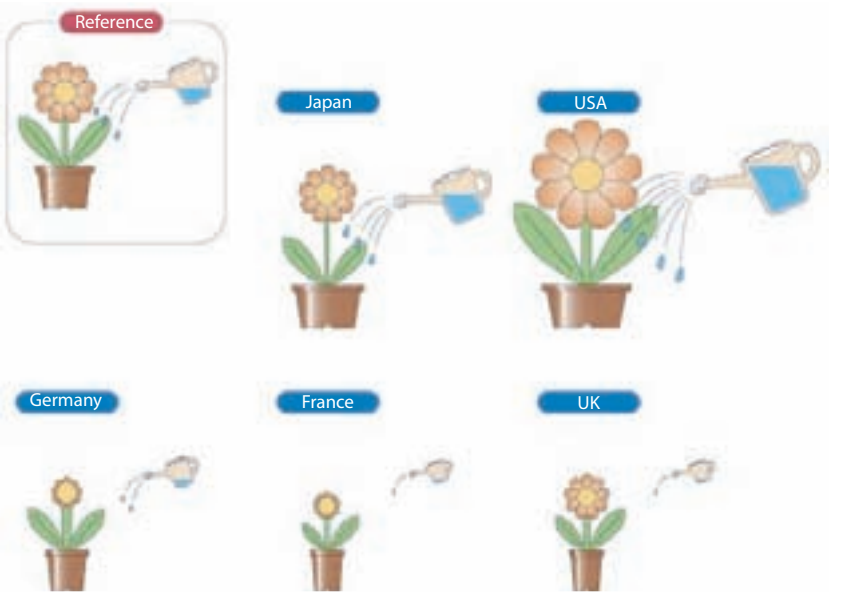
However, any construction of such an index would have to resolve two major sets of problems – scientific consistency and simplicity of interpretation. With these two requirements, measures for advancing knowledge in a given country or region can be contemplated that do not come up with a mere figure but include dynamic presentations and provide an overall picture. The online diagrams (see Box 10.3) allow us, for instance, to take in several dimensions at a glance. A good example of this is to be found in the World Bank's *Knowledge Assessment Methodology*, which enables users to construct their own online diagrams by selecting their variables among eighty indicators arranged in seven groups (performance, economic system, governance, innovation, education, information and communication technologies, and gender-related data).

Japan's Ministry of Education, Culture, Sports, Science and Technology has developed a mode of presentation of a group of innovation indicators, which is of definite interest. Each country is represented by a flowerpot, a flower and a watering can. The size of the flowerpot denotes the country's economic performance, the size of the watering can represents the volume of investment in research and innovation, and the size of the flower matches the results of the research and innovation system. Such a representation has the advantage of showing, at a glance, quantitative aspects together with more qualitative features such as the interactions between the various dimensions measured. Such instruments help us to see that a measurement has no absolute value and that it must always be put back in a given context, as shown in the figure below.

Box 10.1 Towards a Knowledge Development Index?

The measurement of knowledge societies in the form of an index will only be possible with the proviso of reference to the inherent complexity of knowledge activities. Some essential dimensions of knowledge continue to defy classical measurement, such as local or indigenous forms of knowledge. It is above all important to emphasize that a knowledge index is not just concerned with the rank ordering of countries or regions – it must serve to cover and guide their advances in precise and measurable fields.

The innovation model of Japan's Ministry of Education, Culture, Sports, Science and Technology



Category	Parts		Indicater	Japan	USA	Germay	France	UK	Average
Input	• •	Pot	Number of researchers (10, 000 people)	72.8	111.4	25,5	16.0	15.9	48.3
	• •	Quantity of water	R&D expenditures (trillion yen)	16.3	28.5	5.0	3.0	2.9	11.1
Degree of cooperation between industry and academia	• •	Thickness of stem	Percentage of university research expenditure borne by industry (%)	2.5	7.7	11.3	3.4	7.1	6.4
Output	• •	Leaf (left)	Number of patent applications (10,000)	79.2	220.6	60.5	25.9	40.0	85.2
	• •	Leaf (right)	Number of scientific papers	74,050	242,216	66,420	48,006	68,391	99,817
Achievements	• •	Petals	Value of technology exports (US$100 million)	102.3	380.3	28,4	23.2	62.3	119.3
	• •	Centre of flower	Export market shares for high-end products	13.2	25.5	10.0	7.1	8.7	12.9

Source: http://www.mext.go.jp/english/news/2002/08/020801c.pdf

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To fill the ever widening gap that exists between the most advanced countries and the others in the field of knowledge, development efforts, in addition to active policies of knowledge promotion and diffusion, and of efficient protection of intellectual property, will necessarily have to focus at the same time on all the forms of relationship to knowledge, according to scales of priority adapted to the situation of each country (see Box 10.3). Failing that, we are in danger of seeing the perpetuation of an unequal economy of knowledge exchange, with some countries specializing in the production of knowledge and others in turning to account this knowledge produced elsewhere. Such a solution, however, carries the risk of excessive *knowledge dependency* and is bound to trigger a profound identity crisis in the dependent countries. It is meaningless to want to construct a world economy of knowledge on the principle of such knowledge dependency since knowledge is the preeminent means of promoting *empowerment* and contributing to capacity-building. The risk of a specialization of the world that would lead to its being divided into two knowledge "civilizations" (one based on the production of knowledge and the other on its consumption or application) is then one of the main pitfalls to be avoided in twenty-first century knowledge societies. Knowledge cannot be consumed like a "packaged" finished product ready to be used – even when it is transmitted in the form of information. Knowledge societies will be knowledge societies *for all* only on the condition that we can actually get beyond this asymmetric opposition between producers and users of knowledge contents.

It may seem at first sight utopian to raise the possibility of the simultaneous development of all the dimensions that characterize the relationship to knowledge. In actual fact, however, putting forward such a hypothesis means posing the question of the exact nature of the *knowledge-sharing* that UNESCO wishes to see in place. For knowledge-sharing cannot be reduced to the exchange of a scant resource for which nations would vie simply because it would help to create a balance of payments equilibrium or surplus. Such a view, inherited from the mercantilist era, may no doubt momentarily guarantee the superiority of certain countries in respect of research, information or the command of information systems, but it does not take into account the fact that creativity is a natural and renewable resource that is best spread worldwide, and that it needs to be promoted and protected in order to achieve its full potential. Humanity has far more to gain from knowledge-sharing through cooperation between the most developed and the least developed countries. This could indeed allow the diversity of knowledge cultures to flourish worldwide. Such ways and means of cooperation and knowledge sharing are particularly important, for they would enable the least developed countries to become full participants in the rise of knowledge societies, which is still all too seldom the case.

Box 10.2 Stemming the brain drain: the proposal of President Wade

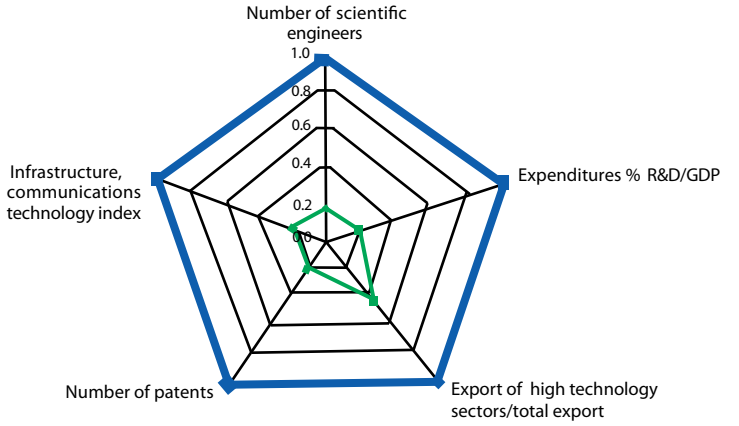
In the context of globalization, the *brain drain* from developing countries to the global poles of the industrialized countries is one of the key challenges in knowledge-sharing worldwide. While the migration policies of Western countries are all marked by a limitation of East-West and South-North occupational and familial flows, which however adds to the brain drain in that notable exceptions are allowed in highly qualified professions suffering from a shortage of personnel (e.g. information science and medicine), it is important to organize a balanced flow of highly qualified professionals and skills, along with true cooperation between nations and networks of experts.

This is what lies behind the proposal of the President of Senegal, Abdoulaye Wade, at the G8 Summit at Sea Island (June 2004), *to organize a counter brain drain*:

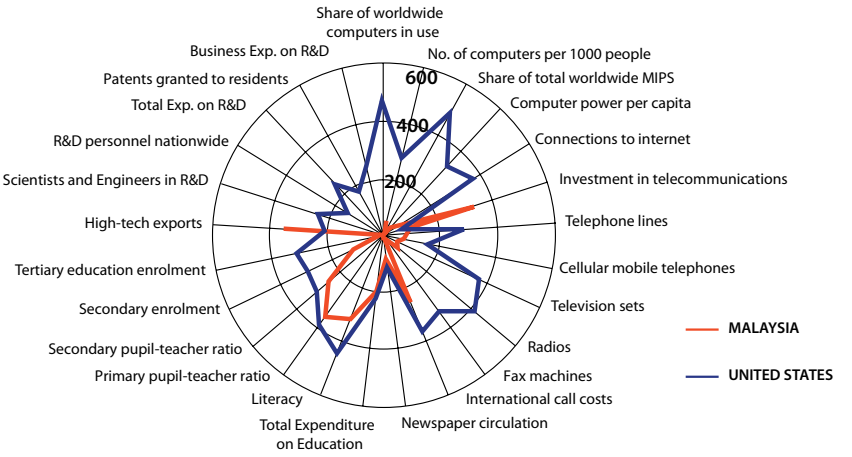
> For decades the developing countries have, either through direct spending or through assistance, been training professionals who, unfortunately, at the end of their studies and their training, are absorbed by the economy of the developed countries. Not only does this rerouting of qualified professionals have a financial cost, but it creates a gap in the use of the human resources of the developing countries, particularly in Africa. For this reason, it is proposed that compensatory measures be taken in the form of transfers in the opposite direction, towards Africa, of experts from developed countries, at their expense.
>
> *Source*: *Le Monde*, 9 June 2004

Box 10.3 Towards a multidimensional development of knowledge societies

The physiognomy of a given knowledge society can be represented, as is proposed by Francisco Sagasti,[7] by showing on a diagram its degree of development in relation to a number of components of knowledge:



As is shown in the *Third Outline Perspective Plan* of Malaysia,[8] this diagram may also be developed in a more complex form, as shown below:



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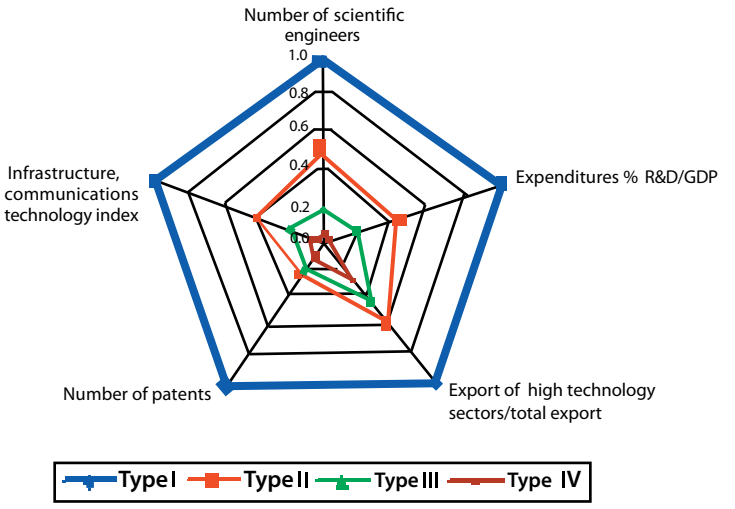
Box 10.3 Towards a multidimensional development of knowledge societies

Such diagrams seek to show the physiognomy of knowledge societies in both their quantitative aspects and their qualitative aspects (more or less balanced development of the different dimensions considered).

These diagrams are useful for several types of study:

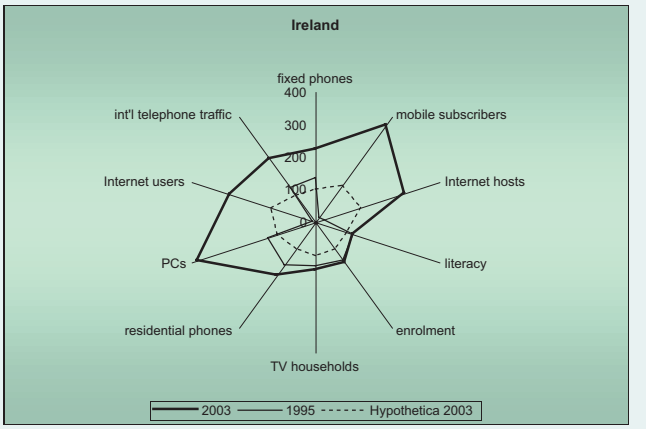
– they easily allow us to visualize the more or less balanced character of the development of the various components of knowledge;

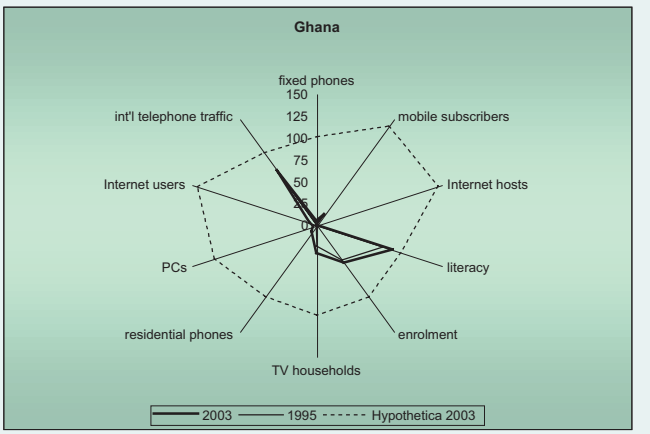
– they enable us to define, as is proposed by Francisco Sagasti, different phases of social evolution, which constitute in his view so many possible stages towards a knowledge society;

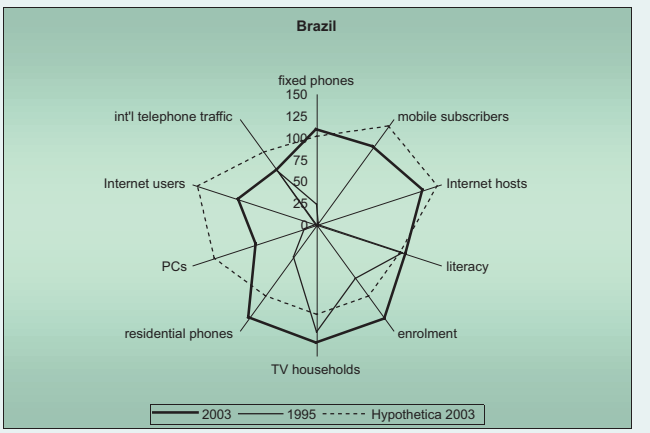


Box 10.3 Towards a multidimensional development of knowledge societies

– and lastly, they help us to visualize diachronically different possible knowledge development models, whether in the case of an industrialized country (Ireland), of a least developed country (Ghana) or of a new industrialized country in the process of catching up (Brazil)







Source: Georges Sciadas, *Monitoring the Digital Divide... and beyond*, UNESCO/Orbicom, 2003 (updated in 2005). See details about the methodology used in this publication.[9]

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The knowledge divide and development in knowledge societies

Does the existence of the knowledge divide constitute an insurmountable hurdle for the development of the least developed countries? Can the emergence of knowledge societies open up more promising prospects? The particular characteristics of knowledge-based economies allows us to foresee some possible scenarios. In order to catch up with the most advanced countries, the developing countries will have to plough back the fruits of their real growth into the building of their knowledge-producing capacities (or *knowledge potential*), as indeed most of the countries of East Asia and many of the countries of South-East Asia have done. A knowledge *gap* is not necessarily a handicap – it can become an impetus for skills development, as is illustrated by the knowledge gap that exists, at least at the beginning, between teacher and pupil.[10] The dynamics of the *knowledge gap*, a source of motivation for development, could then be seen as a powerful remedy against the knowledge divide. However, this will only be true if developing countries increase considerably their investments in building up real knowledge capacities, while improving the conditions for the exchange and sharing of knowledge (good governance, freedom of expression, etc.) and, at the same time, upgrading local knowledge. Under these conditions, the countries of the South will one day be truly competitive on the knowledge market (see Box 10.4). This calls for sustained efforts on their part and, hence, for budget choices that avoid unproductive expenditure, and it presupposes on the part of the international community – in particular the richest countries – further efforts of solidarity.

Box 10.4 The rise of knowledge societies is also accessible to countries of the South

Some promising examples suggest that the building of a knowledge society is not within the reach of the rich countries only – provided that there is sufficient political will. Thus, in the 1980s, Botswana achieved far greater advances in education than could have been foreseen from its income level. The example may also be cited of Kerala State, in India, whose per capita income is 99 times lower than that of the United States, but which, through the quality of its research infrastructure, is largely contributing to making India the eighth nation in the world in terms of science publications. In the field of education, Kerala's literacy ratio in 2001 was 90.9 per cent of the population. Again, one of the most striking examples of the possibility today of fulfilling the promises held out by knowledge societies is that offered by Villa el Salvador, in Peru. In that city of nearly 400,000 inhabitants, which came into being in 1971 in the heart of a shantytown on the outskirts of Lima, a resolute drive in support of participatory development enabled illiteracy to be eradicated under the worst possible conditions. Some 90,000 children aged between 6 and 16 were enrolled in primary and secondary schools there in 1998, and at the same time there were 10,000 students from the city attending university either locally or in Lima.

Women in knowledge societies

Close examination of the role and place of women in knowledge societies reveals another feature of the knowledge divide – it tends to accentuate existing asymmetries within societies. Men and women have equal access to knowledge de jure, but do they de facto? The universalist ambition of knowledge societies seems to come up against the reality of the aggravation of gender inequalities. The initial promise of learning societies in which "neutral agents" might engage in dialogue and exchange their knowledge in a virtual *agora,* has now receded.[11] A great deal of ongoing research in the cognitive sciences is now bringing out the extent to which our gender characteristics influence our ways of knowing and communicating, the diversity of narrative identities enriching modes of knowledge. Furthermore, most of the skills required for activities traditionally considered to be the preserve either of men or of women are in fact identical. That being so, is it not the socio-cultural inequalities between men and women that create the conditions for their inequality in the face of knowledge, and not cognitive differences? Can this heightening of inequalities between men and

women be thought of as transitory, or do knowledge societies create conditions that are unconducive to gender equality?

The gender divide and the knowledge divide

Gender equality is one of the main challenges to the emergence of knowledge societies, for they cannot be true knowledge-sharing societies if they leave out more than half the world population. The fourth World Conference on Women organized by the United Nations (Beijing, 1995) was decisive in raising awareness of the role of knowledge and the new technologies in the mobilization, empowerment and participation of women in the world knowledge economy, particularly for women in developing countries. Yet, it noted that poverty, illiteracy, language barriers, the absence of infrastructure or the lack of computer skills, contribute significantly to impeding the access of women to the world information society and, hence, to the knowledge and data needed to take part in the emerging knowledge societies. But the prospect of the expansion of knowledge societies highlights acutely those problems – more than ever it is essential that women should have access not only to the new technologies, but also to education, research and settings where freedoms can be exercised.

The inequalities between men and women are actually accentuated by the difficulties they encounter in continuing their education. Of the 900 million illiterate people in the world, two-thirds are women.[12] In this field, the difference between men and women is particularly marked in the Arab States, in sub-Saharan Africa and in South and West Asia. Then again, in many developing countries, many customs and values make it hard for women to have access to education, credit or employment. This is also true in some industrialized countries, but to a lesser extent, for, while gender inequality is present, in varying degrees, in almost all societies, it assumes different guises according to countries' level of industrialization. In countries that have experienced rapid development in the field of new technologies, women seem overall to have access to education, work or multimedia facilities,[13] although profound disparities may be noted in certain university courses or occupational fields such as science, engineering or business management.[13] Some studies have shown the persistence of unconscious discriminations, ranging from a narrowing of professional prospects for women from the time of their first pregnancy to the failure of many decision-makers to heed the views of women. Women sometimes refuse to accept the reality of such forms of exclusion, seeking rather to compensate for the discrimination by increasing their efforts.

How can the equality of men and women be restored where knowledge is concerned?

For women to be able to enjoy true equality of opportunity with men in respect of knowledge, it is important for them to have access not only to general education but also to an education specifically geared to the new technologies. This is particularly true in societies where there is strong male domination. It is indeed essential to know how to use the tools of technology, especially in countries that suffer from a shortage of teachers or documentary resources. In addition, the training of women in the new technologies may offer a shortcut to financial independence, enabling them to exercise a large variety of off-site occupations (teleworking). This, then, is a promising new departure in countries where women traditionally tend to stay at home. Efforts should also be made to increase the number of women students and apprentices in the scientific and technical professions, particularly in knowledge societies.

What is more, the rise of knowledge societies may offer women fresh opportunities to improve their situation. How, indeed, could women have ever managed previously to acquire information or knowledge in male-dominated societies when it was hard for them to gain access to the places of knowledge and when they generally remained at home – their role in this respect consisting simply in bringing children into contact with knowledge and the tools of knowledge for the first time? However, in knowledge societies, telephone, television or the internet will bring knowledge more and more efficiently to the very places where people live. That being so, the family hearth could

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become a hearth of freedom for women as much as for men, and a place for further opportunity, supported by advances in lifelong education for all.

In addition, the empowerment of women may be encouraged by cooperative development or microcredit programmes which, in developing countries, are tantamount to a kind of practical education, whose success, however, continues to depend on women's degree of independence and of their control over their resources. The new technologies have made it easier to launch a whole series of voluntary sector initiatives that enable women to emerge from their relative isolation and men to gain a better understanding of the situation of women. The bringing together of women of different backgrounds and origins thus points the way towards a new form of solidarity whereby, as the most advanced women share the experiences of the most disadvantaged, the community as a whole progresses towards a better identification of problems.

What prospects for the status of women in knowledge societies?

In addition to the necessary cultural and social changes that should make it possible to eradicate discrimination against women, it will also be necessary for men to join in the collective discussion on the respective place of women and men in knowledge societies, predicated on a refusal of sexist prejudice and ignorance. The treatment of residual discrimination will not be a politically easy matter. Will recourse have to be had to measures encouraging, whenever appropriate, forms of parity or affirmative action? It is none the less true that the growing place of knowledge in women's lives offers them promising new possibilities to increase their autonomy in knowledge societies. As women are proving more active in the conception of new cognitive tools, teleworking is also an interesting alternative since it allows families where the two partners work to spare one of them, usually the wife, from having to give up all paid occupational activity.

In developing countries, greater participation by women in the knowledge economy would enable them both to catch up with other countries and to reduce the worldwide knowledge divide at a faster rate. In industrialized countries, the more successful integration of women should lead to a number of problems being solved in the coming decades, such as the shortage of qualified personnel or the reconciliation of work and family life. The challenge that knowledge societies will have to take up in order to improve the status of women can be summed up in simple terms: if the conditions are not created for universal and equitable access to knowledge for women as much as for men, there can be no true sharing of knowledge. The promotion of gender equality is crucial for the development of a society. Accordingly, the degree of participation of women in knowledge societies will be an essential indicator of whether the other promises that they hold are likely to be effectively fulfilled.

Universal access to knowledge: knowledge sharing and intellectual property protection

The knowledge divide – of which gender inequality in respect of knowledge is a major example – illustrates the exclusion potential that knowledge societies carry within them, if their development is limited to the expansion of a knowledge-based economy and to the greater reproduction of the old forms of social stratification. Failing the promotion of a new *ethics of knowledge* founded on sharing and cooperation, the tendency of the most advanced countries to capitalize on their advance can only result in the poorest people being deprived of such *basic knowledge goods* as, for example, new medical and agricultural knowledge or educational materials, and in the creation of an environment particularly unconducive to learning. *Universal access to knowledge* must then remain the pillar supporting the transition towards knowledge societies. Its effective promotion presupposes a balance between the interest of producers and rightholders, and those of users of knowledge contents, between intellectual property protection systems and knowledge (or information) in the public domain. In this context, UNESCO has undertaken to "promote free

and universal access to public domain information for the purposes of education, science and culture"[14] and adopted to that end, in 2003, the *Recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace*.[15] Whatever the extent and nature of public domain information and knowledge, it is paramount to ensure that contents are really accessible to all, without discrimination, which is seldom the case. Yet, the public domain contributes to the development of *human capital* and *creativity* in the knowledge societies that are definitely heading towards empowerment and development for all. This shows the importance of the role of states when it comes down to identifying and promoting the pools of public domain information and knowledge or to making accessible public documents dealing with citizens on government websites.

Knowledge: a common public good

Whatever the benefits that can be expected to accrue from the general expansion of knowledge-based economies, knowledge cannot be likened to any other good that can be exchanged or negotiated on the market. Knowledge has two noteworthy features – its non-rivalry and, once the period of protection guaranteed by intellectual property law has expired, its non-excludability. The first of these reflects that property of knowledge, noted by Thomas Jefferson, whereby its use by someone does not prevent its use by someone else. The second means that once knowledge is in the public domain, anyone can use it freely. According to the work of the economist Paul Samuelson, it is generally accepted that these two properties characterize a *public good*. Knowledge, in the strict sense, cannot then be treated as exclusive intellectual property. What can be included in the intellectual property system is the expression of an idea or an invention, never the facts (at source) or the ideas (upstream) that constitute this expression of an idea or an invention. In other words, only knowledge as information can be protected by intellectual property rights, even if it is very often difficult to dissociate knowledge from its formal expression – which is the only one that should benefit from the protection of the intellectual property that stimulates new knowledge.

Knowledge itself, as an inexhaustible commons available to all human beings, is, if not a *global public good* (cf. Box 10.5), at least a "*common public good*".[16] For not only can knowledge not be regarded as a marketable good like others, but also knowledge only has value if it is shared by all. Such a mode of appropriation by way of sharing and making commonly available has long been formally regulated by law. Roman law thus made a distinction between *res communes* (what is owned in common and at the disposal of the public by virtue of a law), *res nullius* (what cannot be owned and is by nature at everyone's disposal) and *res publicae* (what is owned by a civil community as a public body). Unlike information which only has value if it is fresh and little known, knowledge is lasting by nature. It grows and intensifies with time, as it is propagated and shared. To paraphrase an African proverb, knowledge is like love, these being the only things that grow through sharing.

Knowledge-sharing is the cornerstone of the practices and values that should be at the heart of knowledge societies. It cannot be thought of in terms of a distribution – of something like the sharing of booty. Knowledge-sharing cannot be reduced to the apportionment of knowledge or to a parceling out of skills, whereby each person is able to take possession of a field of specialization or expertise. The advance of knowledge requires the collaboration of all. Often the most novel ideas germinate out of older knowledge, when they are not born – as is frequently the case – from the refutation of knowledge previously held to be irrefutable. In network societies, possibilities for exchange and sharing are multiplied. Such societies provide an environment particularly conducive to knowledge in that they offer, in the form of a promise not yet fulfilled on a worldwide scale, the concrete conditions for the possibility of its universal accessibility. In the emerging knowledge societies, this spirit of sharing should go hand in hand with other values such as openness and curiosity. It so happens that the new forms of networking that have developed, in particular on the internet, that lend themselves to exchange, interaction and sharing, are horizontal and not hierarchical. We may therefore legitimately hope that in knowledge societies, each person's capacities

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Box 10.5 May certain types of knowledge be regarded as global public goods?

In some cases, does not the challenge of providing *public goods* extend beyond national boundaries? Are there no *global public goods*? The aim of *Global Public Goods: International Cooperation in the 21st Century*, published in 1999 by the UNDP, is to define what these are. The authors stress that, in the context of globalization, the provision of many goods in the fields of environment, health, education and culture can only be envisaged at the international level. The questions raised by the concept of *global public goods* are numerous, however, which no doubt explains why they have been so hotly debated.

The questions raised by the concept of global public goods

Global public goods denotes goods, services or resources beneficial to a country or region, or indeed to the whole world. There is however disagreement about both the nature of these goods and their scope. Are we talking about the same thing when we refer, among global public goods, to the ozone layer, the climate or biodiversity (environmental goods), the internet, educational services or world heritage, and even peace, health, security or knowledge?

In addition, there are two rival interpretations of global public goods, corresponding to two competing conceptions of worldwide regulation. One considers the provision of public goods at the international level to be a means of making up for market deficiencies (natural monopolies, negative externalities, etc.). From this point of view, the intervention of a public authority is therefore not necessary and it is possible for global public goods to be guaranteed by contractual agreements between agents, externality markets (like the pollution rights market provided for by the Kyoto Protocol), regulating authorities (public or private) or modes of collective resource management. Such an approach nevertheless presupposes that the system is capable of generating almost immediate profits for its protagonists – in turn a source of motivation. The other approach highlights the strictly political character of *global public goods*, both in terms of their features of non-rivalry and non-excludability, and in the light of the intergenerational resource management that they entail. Seen from this angle, it is political decisions and collective choices that define the scope of global public goods, which explains why they may include water and air, but also biodiversity, international security, peace, and so on.

The question of global public goods brings us face-to-face with two major international challenges: that of world governance – with the implicit hypothesis of a world state, whatever its form, that would be responsible for the provision of such goods – and that of the borders between the commodity economy and the non-commodity economy at the international level – the management of such goods calling for collective international action on the part of both public and private actors, and for regulation by independent agencies.

A number of experts have however criticized the concept of global public goods. Some analysts find fault with it on the grounds that it has been too often used as a rhetorical device, that it is out of phase with the actors' actual behaviour, or again that it masks the reality of conflicts or power relations at the international level. The more general question also arises of the financing of the provision of such goods, which could, according to some estimates, represents as much as US$300 billion a year, or about six times the amount of present-day development assistance.

Can some types of knowledge be regarded as global public goods?

The contribution by Joseph Stiglitz, Nobel prizewinner for economics in 2001, to the above-mentioned UNDP publication on Knowledge as a Global Public Good, started off a discussion on whether knowledge should be included among global public goods. It is true that knowledge does indeed meet the two conditions of non-rivalry and non-excludability that characterize a public good. The need, in knowledge societies, to clarify the theoretical and practical arrangements for knowledge-sharing would find in such a solution a no doubt promising line of approach. However, according to some experts, knowledge is a concept that encompasses too many different realities (ranging from inventions subject to copyright to the functioning of education systems, scientific research capacities or certain practices or know-how) to meet the economic criteria that define a global public good. Then again, as UNESCO has always asserted, the provision of educational services cannot be regarded solely in terms of economic theory, for education is not a commodity like others.

It is nevertheless relevant to wonder, when thinking about the development of the least developed countries in terms of knowledge, whether certain types of knowledge might not be regarded as such global public goods. The *World Development Report*, *Knowledge for Development*, published by the World Bank in 1999, emphasizes that the provision of international public goods may be instrumental in reducing inequalities in respect of knowledge. It gives as an example the sponsorship of *agricultural research* by the Consultative Group for International Agricultural Research, which funded the green revolution out of public money.

for knowledge will be developed not just through competition, or even the necessary emulation, but in a spirit of collaboration for the common good – exemplified by "collaboratory" models of scientific research or *Open Source* software.

Such a spirit of sharing and collaboration may seem a far cry from the real conditions of corporate competition on the markets of a global knowledge-based economy. However, the emergence of network societies and the consequent lowering of transaction costs encourage new forms of productive organization involving exchange and collaboration within a single sharing community.[17] The possibility of such an architecture of knowledge production highlights the propensity of networking societies to favour very free modes of cooperative organization, and it is the architecture itself of the networks that creates the conditions for the collective monitoring of the sharing process. The decision to participate in knowledge-sharing requires that certain conditions be met – one of the most essential being that the individuals participating in the sharing community can have confidence in the information exchanged and not feel that they are "losing control". Nevertheless, given the strong current trend towards a radical reduction of the public domain, it is important to note that it is in fact the conceptions and practices of knowledge-sharing that no doubt alone will enable a balance to be struck between the protection of intellectual property rights and the promotion of knowledge (or information) in the public domain.

Access to scientific knowledge

If we accept that scientific knowledge is a "public good", it follows that scientific data and information should be made as widely available and affordable as possible, since the benefits for society will be a function of the number of people able to share them.[18]

There are a number of ICT projects in progress that hold great promise for universal access to scientific information and data. One of these is the *Globalisation des ressources informatiques et des données* (GRID network), a service for sharing computer power and data storage capacity over the internet (unlike the web, a service for sharing information over the internet). There are however also some "invisible borders". These include onerous pricing policies, lack of technical infrastructure and a trend towards tighter intellectual property regimes. Most penalized by these "borders" are developing countries. However, there are also implications for the scientific enterprise in general, as science becomes increasingly reliant on international collaboration.

Scientists are worried that the excessive privatization and commercialization of scientific data and information is undermining the traditional sharing ethos of science by shrinking the public domain and threatening open access to global public goods, with a consequential loss of opportunity at both the national and international levels. What would the consequences have been for global health research if the human genome project had been commercialized, for example? Initiated by the United States Government in the late 1980s, the project was threatened by a corporate rival in 1998. At that point, the Wellcome Trust, a United Kingdom charity, teamed up with the United States Government, increasing massively its investment in the project so that its own Sanger Institute could decode one-third of the 3 billion "letters" that make up "the code of life". Today, the completed sequences are freely available to the world's scientific community.

Whereas there has been a strong focus on new commercial opportunities using digitalized information and on the intellectual property rights issue, comparatively little attention has been devoted to the importance of maintaining open access to the source of upstream scientific data and of information produced in the public domain for the benefit of all downstream users.

On the other hand, authors are also finding it increasingly difficult to protect their work in digital form from uncontrolled access, a state of affairs that is leading to calls for tighter intellectual property protection of information on the internet. The question is, where do you draw the line? How do you preserve and promote access to public science without unduly restricting commercial opportunities and the legitimate rights of authors?

In a world first, the European Union adopted a database protection regime in 1996 extending

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legal protection granted under copyright to original databases to non-original databases under a *sui generis* regime. The European Directive on the Legal Protection of Databases remains a unique case today. ICSU, an umbrella organization of scientific bodies, has expressed serious reservations about the Directive.

The majority of databases and archives are created and hosted in the North. Latin America and the Caribbean, for example, accounted for only an estimated 0.2 per cent of all existing databases in the world in 2001. As Clemente Forero Pineda, from the University of Andes and Rosario in Colombia, points out, were the current trend towards stronger legal protection of databases to prosper, it could be feared that the narrower availability of scientific information would diminish the role of researchers from developing countries in global science.

Increasingly concerned about proposals to WIPO and various national legislators to introduce at the international level this new form of *sui generis* protection to databases that fall outside traditional patent and copyright regimes, ICSU and CODATA have established a joint ad hoc Group on Data and Information. This Group drafted a core set of principles in June 2000 to support full and open access to data needed for scientific research and education (see Box 10.6).

High-cost pricing and additional restrictions, practised by some governmental agencies for access to scientific information and data, constitute another issue of concern to the scientific community, more particularly in developing countries.

This naturally deals a blow to public-interest research that may have the potential to generate knowledge of national, regional or even global importance, such as in the field of meteorology. All information production and dissemination has a cost, but for developing countries, this cost is frequently prohibitively expensive. The question is, how can the cost be tailored to the user ensuring at the same time that information remains affordable, while information production and dissemination attracts necessary investment? Preferential pricing is one solution. Many commercial publishers are interested in providing their works electronically under preferential conditions – or even at no cost to developing countries, as in the case of the Health InterNetwork Access to Research Initiative (HINARI) (see Box 10.7) or the *British Medical Journal* – for science and education, particularly to users in developing countries, provided their copyright is strictly respected.

Like private publishers, professional societies are searching for an optimum balance between open access and financial viability. Some professional societies and other groups have embraced the open access model, although the majority still tends towards a more protective approach.

Scientists have come to realize that they must enter the policy arena if their voice is to be heard on issues of concern to the scientific community. This realization has led the scientific community to prepare actively for the World Summit on the Information Society. It has also led ICSU to submit recommendations in response to a review of the European database protection regime initiated by the European Commission in 2002.

Striking a balance between the protection of intellectual property and the promotion of knowledge in the public domain

Knowledge sharing by no means implies that the question of knowledge appropriation is no longer relevant. According to many experts, it is important to seek a fresh balance between the protection of intellectual property rights and the promotion of knowledge in the public domain, taking into account the recent strengthening of protection mechanisms, whether in the form of copyright or patenting, as well as the rapid spread of new forms of piracy made easier through new technologies. All over the world, the new digital technologies have singularly modified the nature and scale of content reproducibility, a simple click now being sufficient to make a perfect copy of downloaded digital content – reading demands no more than a temporary copy. In addition, since the Napster case, one increasingly witnesses the damages that the proliferation of peer-to-peer exchange interfaces has caused to the defenders of the rights of content creators as well as to cultural industries in charge of the production and the distribution of their

Box 10.6 ICSU's core principles in support of full and open access to data

Science is an investment in the public interest. Through research and education, scientists foster the creation and dissemination of knowledge. This can have profound effects on the well-being of people and the economies of the world. Science is a critical public investment in our future, a resource with extraordinary dividends.

Scientific advances rely on full and open access to data. Both science and the public are well served by a system of scholarly research and communication with minimal constraints on the availability of data for further analysis. The tradition of full and open access to data has led to breakthroughs in scientific understanding, as well as to later economic and public policy benefits. The idea that an individual or organization can control access to or claim ownership of the facts of nature is foreign to science.

A market model for access to data is unsuitable for research and education. Science is a cooperative, rather than a competitive, enterprise. No individual, institution, or country can collect all the data it needs to address important scientific issues. Thus, practices that encourage data sharing are necessary to advance science and to achieve the resulting social benefits. Such data sharing is possible within tight research budgets only when data are affordable. If data are formally made available for scientific access but the prices charged for such access are prohibitively high, the negative impact on science is the same as if access had been legally denied. This is especially the case for scientists in developing countries.

Publication of data is essential to scientific research and to the dissemination of knowledge. The credibility of research results depends on the publication of data that back them up and permit reproduction of the results by colleagues. A restriction on data publication or a requirement that colleagues recompile a database from original sources compromises the ability of scientists to advance knowledge.

The interests of database owners must be balanced with society's need for open exchange of ideas. Given the substantial investment in data collection and its importance to society, it is equally important that data be used to the maximum extent possible. Data collected for a variety of purposes may be useful to science. Legal foundations and societal attitudes should foster a balance between individual rights to data and the public good of shared data.

Legislators should take into account the impact that intellectual property laws may have on research and education. The balance achieved in the current copyright laws, while imperfect, has allowed science to flourish. It has also supported a successful publishing industry. Any new legislation should strike a balance while continuing to ensure full and open access to data needed for scientific research and education.

works. The fact is, however, that the WIPO treaties, revised in 1996, and the TRIPS Agreement, negotiated in 1995 within the framework of treaties creating the WTO, have resulted in precedence being given to the interests of producers over those of users. The term of copyright protection has thus been extended by twenty years (now seventy rather than fifty years after the author's death) (see box 10.8 for a discussion of UNESCO action in this report). Furthermore, new categories of intellectual property rights have been created (for example in the European Union, the fact of "making accessible" certain databases). Lastly, and these are no more than a few examples, systems of Digital Rights Management (DRM) have been developed. It is also clear that intellectual property is tending to become a commodity that can be negotiated on a market (*pay-per-use* practices or non-negotiable licences to be accepted in order to download software). This trend assumes various forms according to the country, depending on the specific features of national intellectual property laws.

Such an imbalance runs counter to the very logic underlying the development of systems for the protection of intellectual property. It is noteworthy that their initial goal was to encourage the creation and production of knowledge and of innovation, by fixing a set term for the protection of intellectual property. Within these fixed limits, authors should enjoy the rewards of their creation. Beyond this term, authors forfeit their rights in their creation and the work enters the public domain for the benefit of all. From an economic standpoint, intellectual property rights, by granting creators temporary exclusive rights, enable them to recover the cost of their initial investment in knowledge. They are then effective means of stimulating innovation, since they valorize the position

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of the first person to enter a market. They also offer guarantees to consumers, who should be able to trust the quality of products once they have been authenticated. However, the protection of intellectual property is not an end in itself – it is simply an incentive that should encourage creators and distributors to produce more knowledge. The existence of a public domain of knowledge is indeed just as essential for the creation of knowledge as is the stimulus provided by intellectual property protection, for it is this that enables each new creator of knowledge to draw on common resources. Excessive recourse to intellectual property protection can be counterproductive, for promoting increased protection of intellectual property

Box 10.7 Innovative models for low-cost access to online scientific information and data

The Programme for the Enhancement of Research Information (PERI), operated by the International Network for the Availability of Scientific Publications (INASP) (itself created by UNESCO and ICSU in 1991), provides low-cost access to more than 8,000 full-text online journals and databases. PERI's online services improve access to local research results, as well as locally facilitated training in internet use and publishing skills for researchers, publishers, editors and librarians. The African Journals OnLine (AJOL), managed by the INASP, provides internet access to the contents of more than 50 journals published in Africa, backed by web links to electronic versions of articles (where available) and a delivery service for document photocopies (www.inasp.info/ajol/) (www.inasp.info/peri/).

Through the HINARI, an initiative of the World Health Organization, accredited public institutions can take advantage of free or very low-cost access to more than 2,000 leading biomedical journals (www.healthinternetwork.org).

The electronic Journals Delivery Service (eJDS) Programme run by the Academy of Sciences for the Developing World (TWAS) and UNESCO's Abdus Salam International Centre for Theoretical Physics (ICTP) distributes scientific articles via e-mail to scientists working in institutions in developing countries, where insufficient bandwidth makes it difficult to download material from the internet (www.ejds.org/).

The Database of African Theses and Dissertations (DATAD) was launched in January 2004 by the Association of African Universities to make dissertations and theses by researchers and students across the continent available online. The move is a bid to increase the worldwide profile and accessibility of research by African scholars. The database will act as a quality-control tool for research conducted in Africa, as other researchers will monitor its contents, and it will also allow gaps in research to be identified and prevent duplication. DATAD will initially include electronic versions of research carried out since 1990. A second phase will see the addition of research from 1980 to 1990 and, in the third phase, research conducted prior to 1980.

The Ptolemy Project is a research partnership between the Office of International Surgery at the University of Toronto (Canada) and members of the Association of Surgeons of East Africa (ASEA). It is a simple model linking an existing end-user community with a large university library. It combines the provision of access to high-quality electronic health information with a process to evaluate its impact on participants. Ptolemy delivers useful, timely and relevant contents to surgeons in Africa, and it has made an immediate and positive impact on their work. It is a simple, practical and replicable model for bridging the digital divide in order to build clinical, teaching and research capacity in East Africa.

The Open Archives Initiative is a forum to discuss and develop common web protocols for e-print archives. It also promotes their global acceptance and accessibility across physical, organizational and disciplinary boundaries. These protocols ensure that various e-print archives can interact, thereby making it possible to access any paper from any computer, as if the materials were held in one virtual public library (www.openarchives.org).

The Global Online Research in Agriculture (AGORA) provides researchers and academics in some of the world's poorest countries with free or low-cost access to scientific literature in food, nutrition, agriculture and related biological, environmental and social sciences. AGORA will provide access to more than 400 key journals in these fields, with the long-term goal of increasing the quality and effectiveness of agricultural research and training in low-income countries. The initiative comes from the FAO, Cornell University Mann Library, the Rockefeller Foundation, the United Kingdom Department for International Development (DFID) and the United States Agency for International Development (USAID).

The Virtual Laboratory CD-ROM Toolkit was developed by UNESCO with the help of the ICTP. The Toolkit provides information and free software tools relevant to the creation of a virtual laboratory. It has been designed in such a way as to facilitate the participation of scientists from developing countries in basic virtual laboratories (www.unesco.org/webworld/portal_freesoft/software/virtual_laboratory).

The Public Library of Science (PLoS) is a non-profit organization of scientists and physicians committed to making the world's scientific and medical literature a freely available public resource. PLoS is an internet and electronic publishing group that allows the creation of public libraries of science containing the full text and data of any published research article, available free of charge to anyone, anywhere in the world. It has immediate unrestricted access to scientific ideas, methods, results and conclusions that will speed the progress of science and medicine, and will more directly bring the benefits of research to the public. To realize this potential, a new business model for scientific publishing is required that treats the costs of publication as the final integral step of the funding of a research project. PLoS is working with scientists, their societies, funding agencies and other publishers to pursue the goal of ensuring an open-access home for every published article and to develop tools to make the literature useful to scientists and the public (www.publiclibraryofscience.org/).

In 2002, *the Journal of Postgraduate Medicine* joined Bioline International as an open access journal. The *Journal* is a quarterly biomedical publication of Staff Society of Seth G. S. Medical College and K. E. M. Hospital in Mumbai, India. This collaboration is an example of the ways in which journals from developing countries can benefit from low-cost shared technology and extend accessibility to their contents.

does not mean automatically promoting innovation. The successes of *Open Source* software or the *Creative Commons* show that other economic solutions may prove just as fruitful.[19]

Development imperatives call for "tailor-made" solutions in the intellectual property field, especially since producers of knowledge generally become very protectionist only once they have staked out their territory whereas, when they are just beginning to move in the direction of growth, the search for innovation, which is knowledge-intensive, inclines them more spontaneously to defend the existence of a public domain of knowledge. Care should therefore be taken always to measure the consequences for the poorest countries of intellectual property protection standards adopted at the national and international levels. Humanity as a whole can only benefit from closer cooperation between North and South that would take account of the needs of developing countries, as well as of the motivating role that intellectual property can play for creators and local inventors.

It is important, then, if we want the rise of knowledge societies to benefit the greatest number, to ensure a balance between intellectual property protection and promotion of the public domain of knowledge.[20] Such a balance does not consist merely in the oft-mentioned opposition between content producers and users, or between those countries most advanced in the field of knowledge and those least advanced – as though it were a "zero-sum game" and the interests of the two parties could not converge. One way of achieving this balance might be, as James Boyle recommends, to assess the consequences for the intellectual environment of any new measure to protect intellectual property. Such an effort to reconcile the interests involved should lead to the balanced development of three domains of knowledge appropriation: the domain appropriated by the private sector, the domain appropriated by the public sector or by the state and, lastly, the public domain in the strict sense, which should be universally accessible.[21]

Promoting universal access to public domain knowledge

As highlighted by the *Recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace*, the public domain of information or knowledge is constituted of

> information publicly accessible, whose use does not infringe on any legal right nor any confidentiality obligation. It thus encompasses all works or objects under similar law that can be exploited by anyone without authorization, for instance because the protection is not ensured by international or national law or because the protection deadline has expired. It also encompasses public data and official information that governments and international organizations produce and voluntarily put at the disposal of the public.

Therefore the question of the appropriation of knowledge and extension of the public domain does not really arise for the public in general, since most of the fundamental knowledge that may serve as a tool

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of development, like mathematics, the boiling point of water, the properties of electricity or basic medical knowledge, is in the public domain. The question of the appropriation of knowledge only becomes a real issue in the international competition that follows on the emergence of a global knowledge-based economy. Nevertheless, universal access to public domain knowledge, while guaranteed in law, is far from being so in reality. It is however a precondition if the rise of knowledge societies is to benefit all human beings.

Without harking back to the technical and political solutions that would help to bridge the digital divide and the necessary promotion of lifelong education for all, we may say that the promotion of universal access to public domain knowledge (or information) could be greatly facilitated by the spread of two practices that, in comparison with the recent strengthening of mechanisms for the protection of intellectual property rights, stand out by their open and cooperative character. The aim is to promote the *fair use* of contents and, secondly, practices of cooperative creation (a well-known example of which is the *Open Source Initiative*). Recognition by laws or treaties of exceptions and limitations to IPR means tolerating certain practices, such as private copying, where there is no commercial end in view and no prejudice to the operator of the protected contents. The fair use characterizes "open" national legislations as regards the

Box 10.8 UNESCO and Intellectual Property Rights (IPR) protection

In its Constitution, UNESCO has set itself among, other goals, to facilitate "the free flow of ideas by word and image" as well as "to give the people of all countries access to the printed and published materials produced by any of them." To this end UNESCO encourages cooperation among nations in all branches of intellectual activity and recommends to the nations concerned the necessary international conventions. It also encourages governments to adopt measures to promote creativity and the production of literary, scientific, musical or artistic works. Thus, the protection of IPR, as a major tool to encourage creativity, innovation and cultural development, has entered the mandate of UNESCO from its inception.

After the Second World War, while many countries were unable, for numerous reasons, to adhere to the norms of protection of the Bern Convention for the protection of literary and artistic works – the oldest international legal instrument in terms of IPR – UNESCO was given the mission to draft a universal convention that would enable countries of different legal traditions to benefit from a common international protection of intellectual works. The Universal Copyright Convention, adopted in 1952 and revised in 1971, enabled the expansion worldwide of IPR through the creation of a common legal denominator and the promotion of the respect of the rights of creators and of the international circulation of works, especially for educational purposes.

Today, information and communication technologies have radically modified the conditions of circulation of works and services, as well as the ways to access and use protected works. The relation between creators, society and users of protected works has deeply changed. If "internet" treaties adopted by the WIPO in 1996 have enabled a real adaptation of the protection of the rights of authors and other right owners, much remains to be done. Authors, singers, cultural businesses, collectively managed enterprises, web and service providers, bookkeepers, scientists, consumers, governments, legislators and international organizations have still a lot to do to reach an efficient legal framework adapted to knowledge societies, in a spirit of mutual understanding. This formidable – though urgent – task must be accompanied by a strong effort to educate consumers, particularly the youngest, so as to promote the respect of the rights of those who contribute by their creative talents to the scientific and cultural progress of the whole community.

IPR is based on the idea that there is a necessary balance between the protection of creative works and creators on the one hand, and the guarantee of public interest and fundamental liberties on the other. Such a balance is the very result of one of the core principles of IPR, i.e. the promotion of progress of science and of the arts and the diffusion of culture. In particular, UNESCO recognizes the importance of a fair balance between the interests of the rightful owners and those of the users when works and performances are exploited in a digital environment, be it education, scientific research, libraries, information diffusion or the needs of the blind.

In that context, UNESCO's policy consists in encouraging its Member States not only to draft efficient IPR policies – that must remain compliant with the international conventions on intellectual property – but also to promote an equal and universal access to information and knowledge, for the progress of science and the generalization of education.

exceptions and the limitations to intellectual property rights and other right-holders, only in very particular cases – that is when the cultural works or performances are used with a non-profit intention, for general interest missions and when the use is not contrary to the normal use of the works. That type of regime is found for instance in the United States. Yet, there are different types of regimes, called "half-closed", such as "fair dealing" in the United Kingdom, or "closed", with a set list of limitations and exceptions authorized by the law, as in continental Europe. Today, new mechanisms of licensing for research institutes in developing countries are endeavouring to propose an appropriate response to the potential reduction of those limitations and exceptions in the digital environment. This limitation could well result from the implementation of technical measures that would restrict the unauthorized access to works and performances, and from the development of systems of digital rights management.

As far as the practices of cooperative creation are concerned, they enable the users to develop the tools they are using, to the point that they encourage users to become knowledge creators. They also illustrate how much contextualized knowledge can be ploughed back into bigger-scale projects extending far beyond the initial local context. The principle behind them is based on the idea of cooperative development that does not involve competition, which we have already seen in connection with *knowledge sharing*. In point of fact, the development of *Open Source* software (see Box 10.9) such as Linux does indeed offer a chance to promote collaborative practices in the field of knowledge and is for this reason particularly worthy of attention.

A distinction should be made between public domain information and information that is subject to obligations of confidentiality or to a control over the use that may be made of it, whether for reasons to do with the protection of privacy, national security, secrecy of trade negotiations, etc. In contrast with this class of information, public authorities can clearly play a basic role in providing public domain information. Of course, as we have seen, this should not lead us to reduce the distinction between public domain knowledge and intellectual property to the distinction between the public sphere and the private sphere. Many public research laboratories register their discoveries, if only because they may contribute to a return from investment or to the power of the State that funded them. However, advances in online administration have opened up promising prospects in terms of the public authorities' contribution to the public domain of knowledge.[22]

The renewal of democratic public forums in knowledge societies

The benefits of knowledge-sharing for society are not confined to the creation of new knowledge, to the promotion of public domain knowledge or to a narrowing of the knowledge divide. The idea of knowledge-sharing implies far more than universal *access* to knowledge from which creators and consumers of knowledge would benefit. As a vehicle for the values of openness, trust, curiosity, exchange and collaboration, and as a source of empowerment and the spirit of initiative, knowledge-sharing calls for each person's active *participation* in society. This being so, knowledge societies will only be able to become knowledge societies for all through the regeneration of universal participation in the life of society. We shall now, therefore, move on from the subject of the sharing of knowledge as a common good (*res communes*) to the question of collective participation in a common cause (*res publicae*). Does not the rise of knowledge societies, however, have major consequences for public life, governance and modes of sociability? Does it not lend itself to a renewal of democratic practices, in the most transparent possible and open societies, where respect for freedoms could be a source of human development for individuals and for the community as a whole? Is not the solid bond that exists between knowledge societies and democracy illustrated by the crucial role that is played by knowledge in democratic life and by the capacity of trained and educated citizens to exercise their responsibilities fully in the public arena and their right to review freely the decisions taken by the public authorities?

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Box 10.9 Free softwares and Open Source

The expansion of "Open Source" (literally "with an open source code") and free softwares, has seen the apparition of new ways of creating and sharing knowledge. A software is said to be "open source" when its source code and the basic elements of its conception are accessible to all, as opposed to the "proprietary" software that was the norm up to now and whose source code is not accessible, considered secret and hence closed. This model of development said "proprietary" is based on the separation of the respective domains of competence between the designer and the user of the software. The great transformation introduced by free and "open source" softwares is the sharing of the source code that allows its study, its revision and its improvement through an iterative process. Anyone familiar with computer programming can then study the source code of a given software and correct it or improve it him- or herself, or in collaboration with others. He or she can then propose and discuss the modification of the software with other developers and users of the software within a sharing community. If the modification is accepted by the community, the modified and improved software becomes the new reference version, which is of better quality and shared by the whole community. Free and "open source" softwares are thus a new way of envisaging innovation as a decentralized and collective enterprise. Furthermore, the sharing dimension of the process of development allows a novel and efficient type of collaboration and collective learning. One of the factors of success of the model lies in the efficient division of the cognitive work that enables all the stakeholders to concentrate on the domains that interest them and for which they have specific competences.

The sudden rise of free and "open source" softwares introduces not only a model of development but also a new economic model, for there is no need any longer for expensive investments in R&D or patenting. That is why it has already been adopted in most associative projects related to the internet, in the form of free open and modifiable programmes (free software).

Generally speaking, the model of development of free and "open source" software can represent a promising track to limit the effects of the definition of restrictive (or closed) standards and for their appropriation in knowledge societies. As we have seen, it is to be feared that the normalization of formats can lead to the production of closed standards (as opposed to the concept of open standards) for the processing of contents, which runs counter to the aim of making the new technologies a space of freedom and of increased potential. Standardization must not be assimilated to homogenization but rather to a quest for a balance between the need to favour creativity and cultural liberties on the one hand, and the imperative of a common code on the other. The model of development of free softwares shows that the problem of homogenization does not lie in the common or even universal nature of codes in force but rather in the way they are designed. It does not oppose standardization and lack of standards, but rather open standards and closed standards. To be really useful, a standard must be accessible to the rest of world and be free of any clause that could limit its use.

Knowledge and power in technical democracies

Knowledge has not only become one of the keys to economic development; it also contributes to human development and individual empowerment. In this sense, knowledge is a source of power because it creates a capacity for action. The slow emergence of knowledge societies has thus led to an unprecedented extension of individual capacity for acting in modern societies, which is in particular exercised within the framework of democratic institutions open to the participation of all. Since the beginnings of democracy in Athens, capacity has been a constituent part of citizenship. Participation in elections, whether based on the payment of a poll tax or in a more or less democratic framework, has always depended on the precondition of capacity, whose definition has considerably changed over time and in accordance with historical circumstances.[23] Universal suffrage only became an effective democratic reality with the spread of education for all and the fixing of an age of majority when men and women acquire the right to vote and gain full possession of their citizenship, subject to the existence of free and independent media. Knowledge indeed is a necessary condition for guiding political choices towards the common good or the general interest.

If knowledge is the condition for the *capacity* of citizens in a democratic society, then care must be taken to ensure that knowledge gaps between citizens in the same democracy do not result in the most knowledgeable of them being vested with excessive authority in public debate, and that the overlap of knowledge societies with a democratic regime does

not lead to tutelary authority being conferred on a limited number of experts specializing in public affairs. The fact is that the authority of experts is far from being always legitimate, especially when they venture outside their area of specialization and claim to exercise moral leadership in public matters that generally turn more around collective preferences and call for common sense. The suspicion that real decisions are taken outside the public sphere, reflecting in particular to the positions of powerful interest groups, and that democratic debate is no more than a purely formal practice may prove for the public to be an easy excuse for not taking an interest in politics. In knowledge societies, however, is not the spread of expertise the best way of protecting oneself not only against an abuse of power by experts but also against the force of pressure groups? For once, everyone is more or less capable of evaluating the authority of the expertise exercised by experts, the experts – become accountable to the public for the impact of their recommendations on collective decision-making.

The rise of knowledge societies could well open the way to various styles of more participatory democracy in which forms of interaction between the different actors would have a decisive influence, without calling into question the methods of selecting legislators and leaders, whose representative legitimacy remains the pillar of democratic institutions. Technical democracy is now characterized by the mixed nature of the actors brought together for the discussion of a technical or scientific matter within hybrid forums. Today, and this will be increasingly true with the rise of knowledge societies, science policy debates (on bioethics, GMOs, nanotechnologies, etc.) are unthinkable without the participation of a variety of stakeholders – including experts, politicians, non-governmental organizations, media, enterprises and citizens. Such a situation moreover encourages learning, since the public will feel itself obliged to become informed in order to take a decision, guided by the views of experts in turn subjected to the free scrutiny of citizens. Knowledge societies therefore create the possibility of democratic expertise within the framework of what political science has called *deliberative democracy*. Knowledge-sharing does indeed make for a shared horizon within which democratic discussion, the settlement of disputes and the possibility of a consensus, may emerge. Knowledge-sharing, thus, not only lends itself to the promotion of public domain knowledge or information, it also opens up a true *public arena*, a meeting place and forum for democratic deliberation, where deliberating about the means always comes down to deliberating about the ends and, ultimately, about values. What this shows is the extent to which, paradoxically, the question of the meaning of and the very prospect for utopia will remain fully relevant in knowledge societies.

In assessing the power effects of knowledge, we should not, however, underestimate the power dimension of knowledge itself or of the knowledge-sharing community. Knowledge is itself a medium for the exercise of power, for knowledge is "embedded" in the inmost core of social structures – as is illustrated, for example, by the double meaning of "collaboratory", denoting both methodology of knowledge production and model of social relations based on collaboration, sharing and cooperation. Some commentators have not failed to emphasize how much science is itself the place of power relations between members of a same knowledge-sharing community.

The promises of e-democracy and e-administration in knowledge societies

The new technological possibilities arising with the emergence of knowledge societies (which are the sign of the rapid development of a global information society) may also help to ensure new and particularly promising tools for democratic participation. Very early on, the dream of democratic participation without constraint or high transaction costs and attempts to rationalize political activity were embodied in the promise of an initially technological then electronic democracy, however it may have been represented. With the earliest computers, the cybernetic fantasy of a rational piloting of societies took shape, which also came to be embodied in planning efforts, particularly in countries with a tradition of state control.

Today, the internet and networking appear in the eyes of a number of experts to be promising instruments of a new mode of more democratic

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relations, although the lessons of history should caution us against a disproportionate cyber-optimism. Each communication revolution has given birth to lyrical illusions and utopias of integral conflictless democracy, that were soon denied by history. However, the new possibilities of electronic administration (e-administration; see Box 10.10) could contribute to the consolidation of modes of *democratic* governance, particularly in developing countries.

Will there be a renewal of democratic practices in knowledge societies?

Is it then recognized that in "connected" countries, the use of the new technologies in the field of democratic participation has really modified democratic behaviour and practices? To answer this question, it is important to see where we stand in relation to three contradictory attitudes that reflect judgements about electronic democracy – cyber-pessimism, cyber-scepticism and cyber-optimism. In fact the latter is currently the target of significant criticism, certain authors considering that the web promotes not so much a civilized space for discussion and argument a source of tolerance and openness, as a pooling of idiosyncrasies that may potentially lead to the radicalization of each person's opinions. It is undeniable the new technologies have, in a number of countries, significantly modified the nature of the "political supply", arousing new expectations in the electorate. It is noted by numerous studies that the new technologies have a positive impact on democratic participation, promoting in particular participation directed towards the defence of great causes or centred on civic engagement. As shown in Figure 10.1, in knowledge societies, use of the new technologies to gather information and form an opinion on major issues of national or worldwide interest, leads to the further development of voluntary sector *activism*, rather than to a real resurgence of conventional forms of democratic participation in the form of voting or traditional political militancy. Is not this substitution of the old contractual solidarity for a new form of solidarity based on an associational bond a striking illustration of the fact that knowledge, just as much as values, may be a reason for association? The figure also shows that correlation between democratic participation and internet use differs according to the type of participation considered.

Is it necessary to recall, in a context of global boom of the associative phenomenon, that associations are at the core of the very principle of democracy? What this suggests is that, in knowledge societies, individual empowerment and knowledge-sharing will perhaps lead to a further rise in *associational democracy* and, concurrently, to the emergence

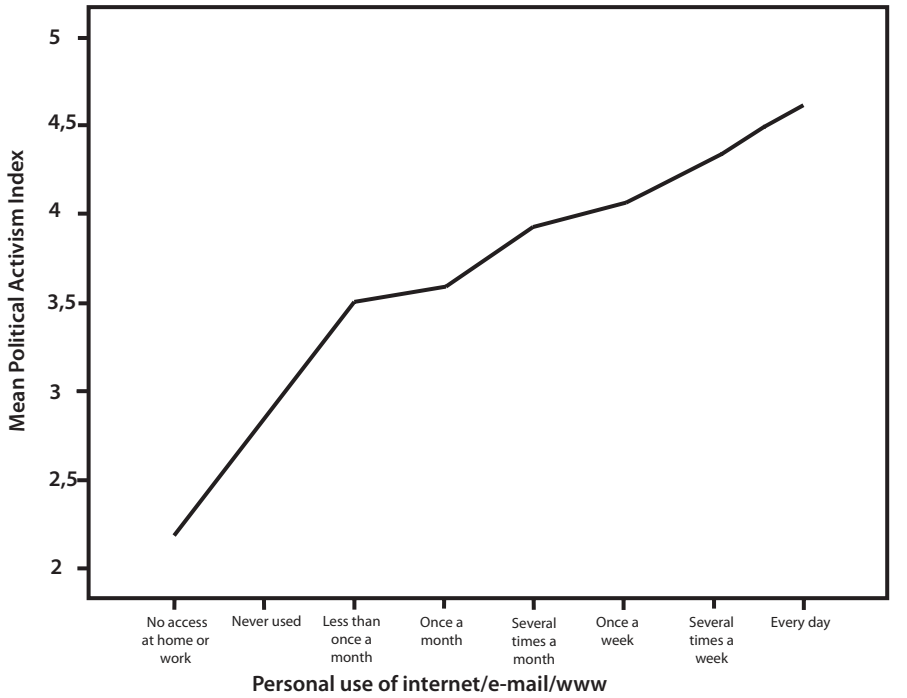
Box 10.10 E-administration in countries of the South

More often than not, the strengthening of electronic administration capacity is a result both of the growing demand of citizens for improved quality of public services and of the economic pressure of private sector operators (such as public management consultancy firms) that find a commercial advantage in it. Such models of e-administration facilitate interactions between government and citizens (G2C), between government and the business world (G2B) or between different government departments in the same state (G2G). It is interesting to note that some countries of the South, such as Chile, Brazil or India, have played a pilot role in this field and have been rewarded by remarkable gains in terms of governance or of the relationship between government and citizens. The satisfaction of citizens is considered to be illustrated by the fact that, even in countries where per capita income is rather low, they seem willing to pay a modest contribution towards keeping up the online administration service. In addition, the provision by the public authorities of public domain knowledge or information is facilitated by the solutions offered by e-administration. These are also believed to have offered a means of introducing greater transparency into the workings of the administration and indeed of combating corruption. Through the modernization that inevitably results from e-administration, this could therefore speed up the processes of democratization.

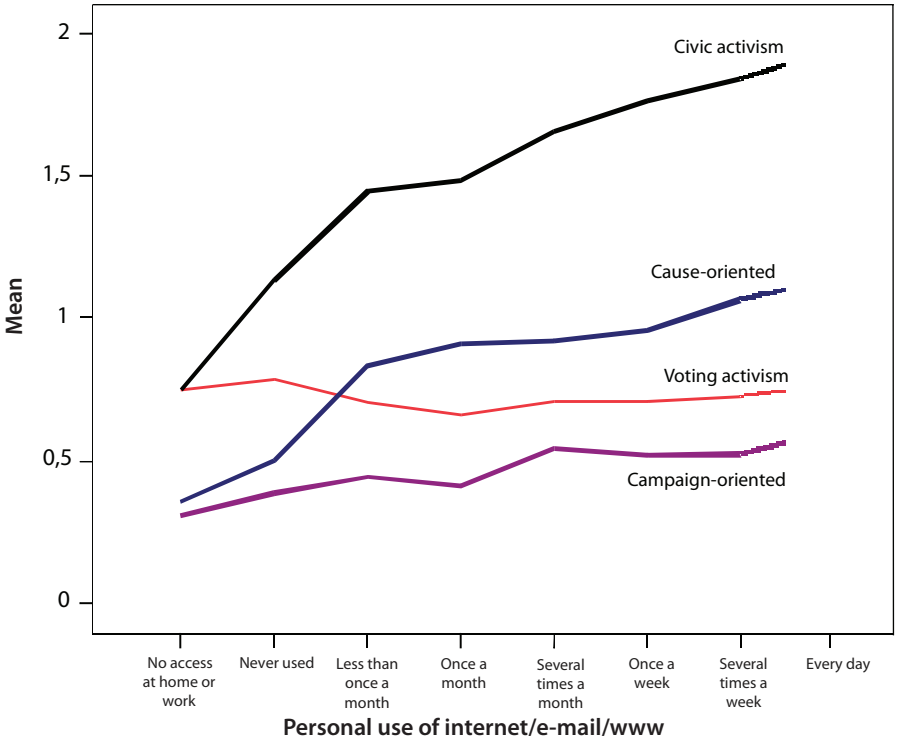
It is true that priorities will be different according to circumstances. In Africa, the priority is to ensure the long-term development of infrastructure whereas, in Asia or Latin America, efforts should focus more on site maintenance or content quality. In all cases, however, the emergence of knowledge societies seems to be raising real expectations on the part of citizens, expectations that can be met through the technical solutions offered by the world information society.

Figure 10.1 Impact of the new technologies on democratic participation in the European Union

As shown by Pippa Norris, correlation between democratic participation and Internet use...



...differs according to the type of participation considered.



Note: These data, drawn from the *European Statistical Survey*, only concern European countries.

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of a *relational individualism*, consisting in a continual negotiation with others that resembles neither liberal individualism nor the temptation of communalism. This finds its place on the narrow line that we have traced between the two dangers of false universalism and relativism.

New awareness of global risks such as climate warming or the erosion of cultural diversity, together with the advances made by the concept of sustainable development,[25] point to the emergence of a global citizenship whose mobilization potential is increased by the new technologies and the possibilities of transnational organization that they offer.[26] Knowledge societies might thus be able to succeed, where the information society has in part failed, in promoting a true sharing of meaning, a dialogue between cultures and new forms of democratic cooperation.

If it is true that the current disaffection with politics can be explained by the absence of projects in contemporary societies overtaken by indifference and a loss of interest in the common good or collective action, then the emergence of knowledge societies could well plead for a new relationship to time based on the idea of an *ethics of the future*. For knowledge, which caters for the long-time span and is itself patiently assembled over time, cannot by definition be tied to the short term. Turned towards the most ancient past and the most distant future, in a twofold cultivation of hindsight and foresight, the labour of knowledge requires the horizon of the long term, which allows us to stand back and to take a critical distance from the flood of information with which we are swamped. Not that knowledge should drive us into ivory towers. On the contrary, in knowledge societies, consideration of the long term will lead us to question more our present choices and decisions in the light of their possible consequences. Democracy in knowledge societies should then be a *future-oriented democracy*. This should be more participatory and open to universal free speech and to increased opportunities for exchange and local forums. If such a trend is confirmed, then we may legitimately hope that knowledge societies will be the context of a regeneration of forms of solidarity. For these will no longer be able to make do with defining a social contract continually renewed in the present, taking little account of future generations. What will take its place will perhaps be the form that is assumed by a contract when it is time-oriented – the joint implementation of a project.

Background resources

Azcueta (2001); Backus (2001); Barber (1998); Bourdieu (2004); Boyle (2003); Boyle (2004); Braga *et al.* (2000); Callon *et al.* (2001); Cohen (2004); Correa (2003); Delamonica *et al.* (2001); Evers (2002); Ewing (2003); Fischer (1996); Flichy (2002); Forero-Pineda and Jaramillo-Salazar (2002); Frederick (1993); Gibbons *et al.* (1994); Giddens (1986); Giddens (1990); Goetz (2001); Golding (1996); Graziano (1988); Habermas (1971); Hariharan (2004); Hugenholtz (2000); Karlsson (2002); Kaul *et al.* (1999); Knorr-Cetina (1998); Kollock (1999); Lascoumes (1999); Lessig (2001); Longworth (2000); Minges and Kelly (2002); MIT (1999); Moynihan (1998); OIT (2001); Persaud (2001); PJB Associates (2003); Poster (1997); Rivière (2003); Rodotà (1999); Sagasti (2004*b*); Sagasti (2004*c*); Salomon (2001); Sciadas (2004); Sooryamoorthy and Shrum (2004); Stehr (2004); Stiglitz (1999); Sue (2001); Sunstein (2001); Tuomi (2004); UNDP (2003 and 2004); UNESCO (2001*c*, 2003*g*, 2003*h* and 2004*a*); Vedel (2003); Viswanath and Finnegan (1996); Wade (2004*a*); Wiener (1948); World Bank (2003).

Conclusion

To conclude, let us advance a hypothesis and make a wager: what if twenty-first century societies, deeply transformed by the growth of information and communication technologies, were bound to become knowledge societies because they will be knowledge sharing societies? But how can such a relationship be established? It is important to recall that the new technologies are network technologies. Within them knowledge is a fact because the members of a single network are interdependent. In such a context, interdependence requires sharing knowledge in order to be effective. Consequently, are there still any grounds to set ethics against performance, and solidarity against efficiency? One of the major advantages of knowledge sharing is that it cuts costs by achieving economies of scale and avoiding useless duplication.

Bearing that in mind, the notion of "knowledge societies" holds out fresh possibilities for human and sustainable development because it summarizes, while standing apart from them, approaches as varied as those offered by the ideas of "information society", "knowledge-based economies", "learning societies", "risk societies" and lifelong education for all".

However, two stumbling blocks may impede the growth of knowledge-sharing societies. The first is the risk of promoting a *single model,* based exclusively on the requirements of the knowledge economy that is already prospering in the most advanced countries. This single model would widen existing divides and lead to the emergence of new forms of exclusion, not only between the most developed countries and the rest, but also within each country. True, at this point the knowledge economy merely characterizes the convergence of a set of transformations, including a rise in knowledge investments, the spread of new technologies and institutional changes fostering access to knowledge. However, in the long term, this trend might lead to the spread of forms of organization based on the development of a competitive private market, and a privatization of invention and innovation processes could challenge freedom of access to information itself. The growing confusion between knowledge and information highlights this potential danger. Moreover, is there hope for a large number of developing countries to accede to the knowledge economy, given the huge investments that the most advanced countries have had to make to get there, the current extent of the digital and knowledge divides, and the persistence of development gaps?

Furthermore, UNESCO must avoid the appearance of putting forth its own vision of the building of knowledge societies as another model that would alter the advanced countries' "knowledge economy" and "information society" models. When it comes to development, only "tailor-made" solutions have a chance of succeeding. The successive sets of recommendations made to developing countries on the use of new technologies or the integration of scientific research and its findings into development policies have often been unrealistic. There is still a long way to go towards taking into account the seriousness of the growing asymmetries separating the most advanced countries and the overwhelming majority of the rest

of the world, and whch increasingly widen the knowledge divide even within nations. In some countries with very high growth rates, rural populations, which often make up the majority, may be the first to bear the brunt of a forced march towards the achievement of knowledge societies.

The knowledge economy cannot alone form the basis of a knowledge society project, for it fails to cover all the dimensions of knowledge, which involve a number of values that cannot be reduced to a commodity exchange. Among them, a particular focus has been put on the importance of promoting effective knowledge-sharing, without which some Southern countries might find themselves relegated to the rank of mere consumers of global knowledge. The brain drain, which has intensified in the past few years, especially in the areas of information technology and health care, has stripped those countries of many of their skills and scientific capacities. Genuine knowledge-sharing requires changes that reach well beyond network access to databases in the key sectors of agriculture, health care and information sciences. The international community must truly give itself the means to meet such major challenges as biotechnology applications for agriculture and the fight against infectious diseases such as HIV/AIDS, tuberculosis and malaria – areas in which investments are still modest. That is the price to pay to be able to rightfully speak of knowledge societies for all and for all the countries in the world.

Another stumbling block must be avoided: the nearly widespread tendency to give into technological determinism when imagining the stages of growth of genuine knowledge societies. Innovation is unpredictable by nature, and a mechanical vision of it would fail to take that characteristic into account. A genuine shift towards knowledge societies can only result from the definition of long-term societal goals based on democratic consultation widened to encompass all the social players. However, today those debates remain largely restricted to a limited number of social and institutional players or to the countries that are the most involved, in various ways, in the logic of economies that are based on knowledge, but that remain essentially elitist.

Does the world have the means to promote knowledge societies?

The aims associated with the desire to build knowledge societies are ambitious. Providing basic education for all, promoting lifelong education for all, encouraging the spread of research and development efforts in all countries of the world (with the help of technology transfers, the regulation of the worldwide flow of skills or increased digital solidarity) – all these efforts towards the participation of all in knowledge-sharing and the establishment, even in the most disadvantaged countries, of a true knowledge potential, represent a considerable undertaking. Are such ambitions within reach? Is the international community really giving itself the necessary means and political will?

For the time being, it is not possible to estimate exactly the cost that would be entailed, for the international community, of all the efforts by all countries in the world towards the development of knowledge societies. Suffice it to mention the considerable potential of knowledge that could be made available, in the countries of the South, through greater promotion of local knowledge. The means of ensuring such promotion still remain to be defined, however, and for that reason it is as yet difficult to quantify the cost of such an initiative.

Nevertheless, certain indicators may enable us to form an idea of the efforts remaining to be made if the promise that they hold is some day to be fulfilled. Public spending levels directly influence results obtained in terms of schooling enrolment. While developing countries had 26 million teachers in primary education in 2000, the number of additional teachers required by 2015 is estimated to range from 15 to 35 million (including more than 3 million for sub-Saharan Africa), which represents a considerable increase in budget expenditure.[1] What is more, it is unlikely that economic growth will generate sufficient resources to enable developing countries to attain the goal set by the Millennium Declaration of

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achieving universal primary education by 2015. In Africa, this would require annual economic growth of more than 8 per cent, which seems scarcely possible to envisage for the time being in most of this region's countries. According to UNESCO, achieving universal access to primary education by 2015 in developing countries and countries in transition would cost at least an additional US$5.6 billion a year. Such a figure would require increasing eightfold the amount that those countries currently allocate to education spending.[2]

Even if each country were to rely on its own strengths – this option being hardly practicable for the least developed countries because of the magnitude of the international flow of skills and the particular nature of intellectual property protection systems that favour those who are first on the innovation market – do current trends hold out the hope that knowledge societies will emerge on a global level in a reasonable timeframe? In that perspective, governments are not the only players on the field. The contribution of civil society, as is illustrated in the example of BRAC in Bangladesh,[3] and of the private sector at the country level, also plays a crucial role in that respect. Of course, the growth of knowledge societies also entails clear budget choices as to the priorities decided upon, failing which there would be a risk that the reality of governmental action would not match stated goals. But what solutions are available to developing countries to increase the education budget other than curbing other spending, in particular military expenditure? The experience of Senegal which, in the recent past, reallocated a large share of its budget to education (up to 40 per cent in 2004), is worthy of attention. Military expenditure trends in developing countries and countries in transition, compared with education budget trends, may therefore appear to be an interesting key indicator of the credibility, for some countries, of the stated goal of building knowledge societies and of achieving the MDGs. In the 1990s, military spending declined worldwide to US$780 billion in 1997.[4] From that year on, it soared to US$839 billion in 2001 and US$1,000 billion in 2004.[5] It is also important to note that, besides possible savings on defence budgets, substantial funds could be released to promote education and the rise of knowledge societies by bold reform policies aimed at reducing expenditure, improving the productivity of public services, streamlining government departments, abolishing a number of ineffective subsidies and fighting corruption. The bulk of the resources that would make it possible, on a wider level, to eradicate poverty and to move towards knowledge societies can be found through a reorganization of existing budgets.

In the past few years, a number of political initiatives and innovative methods have been developed and introduced to boost aid to developing countries. Such modalities may also serve to strengthen some of the key components of knowledge societies. Debt swaps are one such tool by which creditors – governments, multilateral development organizations and private sector banks – forgo the repayment of debt stock against firm commitments by recipient countries to invest the funds in specific activities relating to human and sustainable development, often through non-governmental organizations. Among those activities, basic education, environmental management and specific aspects of health policies could be mentioned. While representing investment in social infrastructure, such mechanisms also help to reduce the burden of these countries' foreign debt.

New national planning tools can also contribute to a focus on the key sectors of knowledge societies. They include sector-wide approaches (SWAps), an instrument allowing prioritized and focused assistance and interventions in areas of strategic importance, rounded out by dialogue with all the development partners (government, civil society, the private sector and leading outside donors). SWAps have been used especially in the education sector but can equally serve the health, science and culture sectors. Another increasingly used modality is direct and targeted budget support by donors for specific sectoral activities, in return for an obligation of result.

The regionalization of development initiatives in favour of building knowledge societies is noteworthy because it highlights the importance of focusing

particular attention on the specific features of local situations and on the interdependence, within a given regional area, between the various driving forces behind development. That is the goal of the European Union's 10-year Lisbon strategy adopted in March 2000.[6] In the cases of African countries, the NEPAD, an African Union programme, is also an innovative initiative, based on the desire for an endogenous appropriation of development and the improvement of governance through the implementation of new political and economic approaches promoting peace as well as economic, educational and cultural development. NEPAD also aims at a better integration through regional and subregional partnerships and introduces peer review mechanisms and the support of international solidarity.[7]

ODA itself is key tool for the construction of knowledge societies. But given the decrease in efforts by the donor countries observable today, the outlook is hardly bright. In 2003, ODA dropped to US$69.03 billion, accounting for 0.25 per cent of the GNP of donor countries – falling far short of the goal of 0.7 per cent of the donor countries' GNP recalled in the Monterrey Consensus and at the Johannesburg World Summit on Sustainable Development. What do some tens of billions of dollars represent in 2003, as compared with the some US$200 billion annually spent on tobacco consumption or the US$879 billion of military spending in the world,[8] spending which increased by 11 per cent over 2002? In the field of education, total donations in 2003 stood at US$6.7 billion (of which only US$3 billion was earmarked for higher education).[9] In the 1990s, bilateral assistance to education fell from US$5 billion to US$3.3 billion, thus dropping to only 7 per cent of ODA. In 2003, it was back to US$5 billion, i.e. 7.5 per cent of total bilateral aid. The US$954 million of ODA that multilateral institutions allotted every year, on average, to education between 1996 and 1998, dropped to US$799 million in 1999–2001 and then increased up to US$1.35 billion in 2002–2003.[10] Does this mean that the international community no longer has the means or the political will to promote the development and global growth of knowledge societies?

Three pillars of knowledge societies

In the face of these challenges, the international community, including governments, international governmental and non-governmental organizations and the private sector, should focus on three sets of initiatives that could be viewed as the pillars on which genuine knowledge societies for all can be built:

- a better valuation of existing forms of knowledge to narrow the knowledge divide;
- a more participatory approach to access to knowledge;
- a better integration of knowledge policies.

First pillar: a better enhancement of the value of existing forms of knowledge to narrow the knowledge divide

All societies possess a rich range of knowledge and make use, in their daily lives, of various levels and types of knowledge that they produce and pass on using a wide variety of means, practices and tools. They are a base on which the capacities necessary for their development can sooner or later be built. One of the main stakes in the new phase of globalization that is changing the planet, is to hold on to existing capacities, largely diminished by an outflow of skills, which is on an upward trend.

However, many developing countries, today, are experiencing difficulty in identifying the types of knowledge they possess, in boosting their value and in making their potential work for their development. It is therefore important, first, to raise each society's awareness of the richness of the knowledge it possesses. Those assets should then be better taken advantage of by more precise identification, which in turn would help make the most of the multiple dynamics of globalization. It would also be a good idea to thoroughly identify each society's weak points, in particular with regard to access to information and knowledge. Education and science policies should shift their focus

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accordingly, especially in order to meet urgent needs in the areas of agriculture, water and environmental management, health, industry and services, with the ultimate goal being the strengthening of human security.

Enhancing the value of existing forms of knowledge should involve assessing skills and turning all available assets, no matter how modest, to good account in the areas of education, scientific research and technological development. That might result in a different approach to international negotiations on the liberalization of trade as well as to development and poverty-reduction strategies. As has been observed in the past, disregarding the development potential that knowledge offers can result in serious errors that have, for example, led to the present higher education crisis in Africa and to poverty-fighting strategies dominated by macro-economic orientations, often at the expense of investments in education and health, and without a genuine participatory public debate being able to influence the choice of priorities.

Second pillar: more participatory knowledge societies

Raising awareness of the wealth of available knowledge requires a mobilization of all players in society. It should not be limited to identifying what today is conventionally known as "local or indigenous of knowledge" or "traditional knowledge" in order to increase their value or preserve them. Knowledge societies will not really be worthy of the name unless the greatest possible number of individuals can become knowledge producers rather than mere consumers of already available knowledge.

Nevertheless, there is growing disagreement in international civil society on the very project at the core of knowledge societies, as regards the participation of all. A number of key players associated with the emergence of knowledge societies – teachers, researchers, artists, designers, journalists and non-governmental organization officials – are casting doubt on the justification of political decisions taken on the national, regional and international levels in the areas of research, the environment, health, risk and crisis management, and the growth of new technologies, in particular biotechnologies and nanotechnologies. Consequently, disagreement is surfacing in the circles that care most about the development of knowledge societies. A case in point is the GMO issue. Likewise, in many societies it is becoming increasingly difficult to reach a consensus on the future directions of research and higher education. Settling such disagreements will be crucial for mobilizing all the key players of knowledge societies to meet the challenges of the twenty-first century. Clearly, the debate over future knowledge societies must take place on a more democratic basis in the coming decades in order to more effectively connect the progress of knowledge, the growth of technologies and the need for participation in the perspective of genuine future ethics.

Furthermore, new development and poverty-fighting needs have emerged that illustrate the growing aspirations towards access, inclusion and participation, which continue to be the focus of intense debates on the international level. The modalities of participation, access and inclusion of citizens in emerging knowledge societies needs to be completely rethought. They should not be imagined only from the standpoint of sharing profits that would be defined upstream in a very general way, or as the simple result of new forms of economic growth made possible by an intensive use of new technologies and applications of scientific research. The various players must decide on the models they would like to choose for their development together and in consultation with each other. New institutional forms – hybrid forums, citizens' conferences and debates associating decision-makers, lawmakers, the private sector and civil society – should therefore encourage the growth of future knowledge societies.

Third pillar: a better integration of knowledge policies

The diversity of areas in which the changes that make it possible to diagnose the rise of knowledge societies has been observed can create a certain amount of confusion that will only be dispelled by a better integration of knowledge policies and by a clarification of the end goals underpinning the very idea of the "knowledge society".

In the final analysis, the formulation of long-term policies depends on the definition of those end goals and on the formulation of such a project of society, which will make it possible to confront the challenges of globalization, to meet the needs of knowledge-based development and to achieve the MDGs. The formulation of such policies requires a deepening of research that is still fragmentary (despite the proliferation of local and national projects) on the social impact of various knowledge policies adopted, including educational policies, transformations of access to scientific information, the use of the latter by a wide range of social players and the possible consequences of the progress of e-democracy (e-governance).

Narrowly sector-based policies cannot be relied on if the growth of genuine knowledge societies is to be fostered. Given the goal in question, it is important to vigorously achieve all six goals of the Dakar Framework for Action in the area of basic education. Broader consultation is also required in the area of higher education. At the present time, do we really have adequate tools to accurately measure the magnitude of the challenges facing us?

Is increasing the budgets of education and research systems, including as many people as possible on the local level through the growth of information infrastructures and, on the global level, through an effort of solidarity with the least developed countries, and raising public development aid a dream or a policy? After years of giving intense thought to better understanding the reality of the changes under way, the time has come for the international community to act. The ten recommendations at the end of this report should be read with that in mind. For, if the various knowledge society players, from the public or private sector and civil society, agree on fulfilling that dream and on implementing the necessary policies and conditions, knowledge societies can become the reality of development for all.

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Recommendations

In light of the observations contained in this report and of the possibilities for reflection and action that it explores, UNESCO would like to call the attention of governments on all levels, of governmental and non-governmental organizations, and of the private sector and civil society to the need to implement the following recommendations, which throw into relief the ethical dimension of knowledge societies and propose specific initiatives to spur their growth.

1. Invest more in quality education for all to ensure equal opportunity

Commitment to the expansion of knowledge societies is a matter of global concern. It is indispensable for the reduction of poverty, the implementation of collective security and the effective exercise of human rights. That commitment must translate into not only stepped-up efforts on the part of all the world's countries to reinvest, depending on their means, the fruits of their growth in strengthening the productive capacities of knowledge, but also an increased mobilization of resources in favour of education for all through a better partnership between developing countries, donor countries, civil society and the private sector. In particular:

- Countries should earmark a substantial share of their GDP for education spending and confirm the commitment made at Dakar that "no countries seriously committed to education will be thwarted in their achievement of this goal by a lack of resources".
- Donor countries must significantly raise the percentage of ODA intended for education and, in partnership with the beneficiary countries, make that assistance more reliable, flexible and sustainable. More specifically, they should pledge to provide countries with the additional resources required to achieve the goal of primary education for all.
- The international community should also encourage innovative education and research funding methods, including debt-swaps, and debt and debt service remission, in order to release the resources needed for basic education.
- Governments, the private sector and social partners must explore the possibility of gradually setting up, in the course of the next decades, an education "study time entitlement" that would entitle people to a certain number of years of education after the completion of compulsory schooling, usable by all depending on their personal choices, paths, experience and timetables.
- The contribution of institutions of higher education to lifelong education for all must be encouraged by adopting diversified class schedules and designing relevant formulae.

- All of these steps must benefit in priority the poorest and most marginalized populations, as well as vulnerable groups such as orphans and people with disabilities.
- Access to education and quality education must be thought of as interdependent and inseparable needs and rights. Education must teach learners how to cope with the challenges of the twenty-first century by encouraging, in particular, the development of creativity, the values of good citizenship and democracy, and the skills necessary for everyday and professional life. Education investments must aim to improve the learning environment and the status of all the teaching professions (see Chapters 1, 2, 3, 4, 5 and 10).

2. Increase places of community access to information and communication technologies

To facilitate universal access to networks, it is important to build on the success of certain experiments currently under way in this area. Places of community access, in particular *Community Multimedia Centres*, that promote the spread and sharing of knowledge, and make information and communication technologies new vectors of socialization, should be increased on the national level, especially in developing countries. To strengthen the learning and handling skills of digital tools, the spread and use of freeware and inexpensive computer hardware should be stimulated in communities and countries that lack sufficient resources, and software designers and access providers should be encouraged to produce culturally adapted contents that contribute to the growth of freedom of expression (see Chapters 1 and 2).

3. Widen the contents available for universal access to knowledge

The promotion of the public domain of knowledge is predicated on the notion that it is truly and easily accessible to as many people as possible. The main knowledge centres, such as institutions of higher education, research centres, museums and libraries, should play a greater role in the production and spread of knowledge through better networking made possible by low-cost high-speed connections. The availability and spread of knowledge in the public domain, especially in science, must be integrated into respective policies and laws. The creation of portals of protected works unavailable on the market should be encouraged – subject to the agreement of publishers and copyright-holders – by any entity interested in investing in them: libraries, companies, administrations, and international and non-governmental organizations (see Chapters 3 and 10).

4. Develop collaboratories: towards better scientific knowledge sharing

Collectively managed scientific cooperation networks and infrastructures accessible to researchers from several countries and regions, including those working in developing countries, should be set up. These collaboratories, which enable scientists separated from each other by huge distances to work together on specific projects, such as the study of the human genome or AIDS/HIV research, offer an outstanding way of sharing and spreading knowledge more effectively (interoperability and meta-data standards, facilities, databanks, large information technology centres and possibly larger infrastructures). Setting up collaboratories might lead to the creation of sustainable platforms for sharing knowledge, research and innovation between the planet's different regions, especially along the North-South and South-South axes (see Chapters 6 and 8).

5. Share environmental knowledge for sustainable development

The pursuit of sustainable development goals requires sharing environmental knowledge between industrialized and developing countries. Global environmental monitoring instruments based on local knowledge as well as on scientific and technological knowledge should be developed and the conditions for their implementation should be created. An example is the January 2005 United Nations proposal to create a global warning system for all kinds of natural risks. Such instruments will be indispensable for ensuring the follow-up of major environmental recommendations and could contribute to the creation of a

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genuine public space of Earth information, a source of safety for present and future generations. Environmental knowledge sharing in the framework of new types of partnerships proposed at the Johannesburg World Summit on Sustainable Development should also be encouraged (see Chapter 8).

6. Making linguistic diversity a priority: the challenges of multilingualism

Linguistic diversity is an essential factor of cultural diversity in all its manifestations. Knowledge societies must be based on a "double multilingualism" – that of individuals and that of cyberspace. In addition, it is advisable to encourage bilingualism and, insofar as possible trilingualism, as early as primary school. Furthermore, the creation of multilingual digital contents must be supported, especially in the teaching field. Lastly, the promotion of linguistic diversity in cyberspace must take full advantage of the opportunities offered by the internet as well as other information and communication technologies, for preserving, transforming and raising the value of "minority" languages. Appropriate technologies relied upon for this effort should receive increased research and development investments from the public and private sectors, such as Unicode, automatic translation software, development of international domain names in languages using non-Latin alphabets, etc. (see Chapters 2 and 9).

7. Move towards knowledge certification on the internet: quality labels

It is important to promote thinking about the technical and legal feasibility of knowledge certification norms and standards with the aim of ensuring users' access to a certain number of reliable, relevant contents, especially in the area of scientific information. With regard to the internet, now a major information source, it would be advisable to encourage the setting up of norms and objective guidelines enabling web users to identify sites whose information is particularly reliable and remarkable because of its quality. The definition of norms and standards, necessarily a multidisciplinary task, could unite the efforts of public and private educational, scientific and cultural institutions, as well as the relevant international non-governmental organizations. For example, it could lead to the introduction of quality labels covering a very wide range of knowledge (see Chapters 1, 2 and 8).

8. Intensify the creation of partnerships for digital solidarity

The creation of innovative partnerships bringing together representatives of states, regions, cities, and of relevant international governmental and non-governmental organizations, the private sector and civil society must be stepped up to achieve digital solidarity. This working framework, which emphasizes decentralized initiatives, would be based on mechanisms of solidarity between industrialized countries, newly industrialized countries and developing countries, and within single countries: "digital twinning arrangements" between municipalities and local governments, project "sponsorship" and a more effective use of computers (see Chapters 1, 2 and 6).

9. Increase women's contribution to knowledge societies

Gender equality and women's empowerment must be at the heart of the constituent principles of knowledge societies. The public domain of knowledge must include the contribution of women's specific knowledge. It is important to facilitate women's acquisition of skills and abilities that meet their specific development needs. It will also be important to work towards eliminating gender disparities with targeted measures, such as creating scholarships for girls, setting up special times to allow women in developing countries to become familiar with the internet, increasing the number of female teachers, promoting continuing training opportunities for women and taking steps to encourage their access to scientific research and technological engineering. The creation on a national level of *ombudswomen* (mediators), in charge of hearing cases of confirmed discrimination and monitoring the achievement of these goals over a set period of time, could improve the monitoring of progress achieved in women's participation in positions of responsibility in national and international public organizations and in the private sector (see Chapters 1, 2, 4, 7 and 10).

10. Measure knowledge: towards knowledge society indicators?

The various players concerned could study the feasibility of knowledge society indicators that could contribute to establishing a better definition of priorities with the aim of narrowing the digital divide on the national and international levels. Reliable measuring instruments are indispensable for any policy and action, whether they involve the public sphere, the private sector or civil society. It is therefore advisable to forge, as far as possible, the statistical tools that can be used to measure knowledge by gathering data that involve not only economic variables. Such a monitoring system requires partnerships between governments, international governmental and non-governmental organizations, private businesses and civil society to arrive at a quantitative and qualitative improvement of statistical capacities. In addition to the production of science and technology indicators, in particular in developing countries for which data remain by and large sketchy, this measuring effort should focus on the other constituent dimensions of knowledge societies, such as education, culture and communication (see Chapters 6 and 10).

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Notes

Introduction

1. UNDP *Human Development Report 2001*, *Making New Technologies Work for Human Development*, New York/Oxford, Oxford University Press.

2. As illustrates, for example, the decline of malnutrition in South Asia in the aftermath of the 1960s Green Revolution and the appearance of new vaccines (such as the one against hepatitis B) in the early 1990s.

3. Cf. Manuel Castells, *The Information Age: Economy, Society and Culture,* Vol. 1, *The Rise of the Network Society.* Malden, Mass./Oxford, Blackwell, 1996.

4. Manuel Castells gives the following definition of information: "data that have been organized and communicated". He recalls the simple but relatively open definition given by Daniel Bell: "a set of organized statements of facts or ideas, presenting a reasoned judgement or an experimental result, which is transmitted to others through some communication medium in some systematic form". Information and knowledge are therefore two quite different ideas, yet they share common features, including the organization and communication of data. A knowledge society puts more emphasis on the ability to produce and integrate new knowledge and to access information, knowledge, data and a huge range of know-how. See Manuel Castells, op. cit., p. 38, Note 28.

5. Amartya Sen, *Development as Freedom,* New York, Alfred Knopf, 1999.

6. Since the first United Nations conference in 1963 on making science and technology work for development, there has been scant progress towards significantly integrating the sciences into development in the perspective of sharing knowledge. Hopefully, that integration will be achieved as soon as possible, after the urgent appeals of the 1996 World Conference on Science in Budapest and the publication in 2005 of several reports on the issue by, for example, the World Bank and the Task Force on Science, Technology and Innovation of the United Nations Millennium Project, all of which stress the urgent need to take action – this is the direction in which the development agencies of the main donor countries, such as the United Kingdom, the Netherlands and Canada, seem to have reorientated their actions.

7. See Peter Drucker, *The Age of Discontinuity, Guidelines to our Changing Society,* New York, Harper & Row, 1969.

8. See Robin Mansell and Ulrich Wehn, *Knowledge Societies: Information Technology for Sustainable Development,* New York, United Nations Commission on Science and Technology for Development, Oxford University Press, 1998.

9. See Nico Stehr, *Knowledge Societies: The Transformation of Labour, Property and Knowledge in Contemporary Society,* London, Sage, 1994.

10. Cf. Manuel Castells, *The Information Age: Economy, Society and Culture,* Vol. 1, The Rise of the Network Society, op. cit.; Vol. 2, *The Power of Identity* (1997); Vol. 3, *End of Millenium* (1998). Malden, Mass./ Oxford, Blackwell.

11. UNESCO, Paris, 5–9 October 1998.

12. UNESCO/ICSU, 26 June – 1 July 1999.

13. Johannesburg, 26 August – 4 September 2002.

14. Development agencies focus on the areas of information technology and biotechnologies, by the creation of *poles of excellence*, without always sufficiently taking account of the fact that existing successful poles of excellence, such as Silicon Valley in the United States, Singapore and

Bangalore, India – to mention the most commonly cited examples – have a long history dating back not years but decades.

15. Abilene is an American initiative, launched in 1998, for "advanced networking for leading-edge research and education". See http://abilene.internet2.edu

16. The defense sector's importance in the creation of new forms of knowledge is illustrated by the Advanced Research Projects Agency Network (ARPANET), forerunner of the internet.

17. See UNDP, *World Human Development Report 2003*.

18. See Chapter 10 of this report for more information about the knowledge divide.

19. This is the *knowledge gap* hypothesis. Studies show that the impact on certain types of public of the same knowledge content may vary according to the kind of media used (such as television or print media).

20. As this report is being released, the international community and civil society are planning to hold the second phase of the World Summit on the Information Society, which will take place in Tunis from 16 to 18 November 2005. The purpose of the event will be to assess the progress made in the implementation of the eleven key principles of the Declaration of Principles and corresponding recommended Action Lines in the Plan of Action adopted at the Geneva Summit, and to examine how states can better take into account the positions of civil society, in particular on freedom of expression, the right to privacy, and the right to access to public information and to the public domain of knowledge.

21. For complete references for all background resources sections, please see References.

Chapter 1

1. Communiqué of the Ministerial Round Table "Towards Knowledge Societies", organized during the 32nd session of the General Conference of UNESCO, Paris, 9–10 October 2003 (document 32 C/INF. 26, para. 3), http://unesco.org/images/0013/001321/132114f.pdf.

2. The first phase of the World Summit on the Information Society, organized by the International Telecommunications Union (ITU), took place in Geneva, 10–12 December 2003. The second phase will be held in Tunis, 16–18 November 2005.

3. See the reference document *From the Information Society to Knowledge Societies*, setting out UNESCO's contribution to the preparation of the WSIS, available at the following address: http://portal.unesco.org/ci/fr/ev.php-URL_ID=13775&URL_DO=DO_TOPIC&URL_SECTION=201.html. See also document 166 EX/19 submitted to the 166th session of the Executive Board of UNESCO, available at the following address: http://server_bps.hq.int.unesco.org/Archive/Executive%20Board/English/166/166-EX/166-EX-19/019.doc.

4. See *From the Information Society to Knowledge Societies*, op. cit.

5. Communiqué of the Ministerial Round Table: "Towards Knowledge Societies", op. cit., para. 2.

6. Constitution of the United Nations Educational, Scientific and Cultural Organization, adopted in London on 16 November 1945 and subsequently amended by the General Conference, Preamble, para. 5.

7. See the communiqué of the Ministerial Round Table "Towards Knowledge Societies", op. cit., para. 5.

8. Ibid, para. 11.

9. See Chapter 2 of this report.

10. See Chapter 8 of this report.

11. See http://www.un.org/english/milleniumgoals/index.html.

12. See Cuneo, C., *Globalized and Localized Digital Divides along the Information Highway: A Fragile Synthesis across*

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Bridges, Ramps, Cloverleaves, and Ladders, paper presented at the 33rd Annual Sorokin Lecture (University of Saskatchewan, Canada), 31 January 2002.

13. *Ibid.*

14. One might cite various initiatives such as the diffusion of wireless technologies in Bangladesh towards women of the countryside. Cf. Bhatnagar, Subhash and Dewan, A., *Grameen Telecom: The Village Phone Program: A Case Study for the World Bank,* (http://poverty.worldbank.org/files/14648_Grameen-web.pdf).

15. For more details, see Chapter 10 of this report.

16. See Kaye, S. H., "Disabilities and the Digital Divide", *Disabilities Statistics Centre,* Abstract No. 22, July 2000.

17. For maps shown in Figure 1.1, 1.3 and 1.5, with 2002 data for countries for which 2003 data were not available.

18. This initiative followed on from the establishment, at the July 2000 Kyushu-Okinawa Summit, of a group of experts, the "Digital Opportunity Task Force (Dot.Force)".

19. DSL: Digital subscriber line.

20. According to World Bank data, in 2002 the number of personal computers for 1,000 inhabitants was under 1 in Burkina Faso, 27 in South Africa and 38 in Chile, while it reached 172 in Singapore. See Jensen, Mike, *The African Internet: A Status Report*, July 2002, available at http://www.3.sn.apc.org/africa/afsat.htm.

21. This is actually one of the advantages of the digital network: it costs less than a communication from one point to another. The speed of information transmission, thanks to a modem (20 to 30 pages per minute), is far higher than that of a fax, and far cheaper, for it usually costs the price of a local telephone call.

22. For maps shown in Figures 1.5 and 1.6, some 1999-2001 figures have been used for countries for which 2002 figures were not available.

23. In certain regions that are not yet connected to the internet, although the supply of digital data on a CD-rom sent through the postal mail can look archaic in the age of high-speed internet, it can prove a pragmatic solution half-way between an "old" technology of information diffusion (the post) and a new material for information (digital).

24. On the question of the diversity of contents, also see Chapter 9 of this report.

25. Press crimes committed on the Web tend to become "continuous" infractions. The author of a contested article can be sued as long as it is online, contrary to other media that benefit from a so-called "reduced" prescription (as in France, for instance, where the 1881 Act on the freedom of the press stipulates that press crimes – libel, offence and since 1972 incitement to racial hatred – are forsaken three months after the first publication). Therefore, journalists seem relatively protected from judicial harassment, whereas web users, who are harder to retrieve, seem overpenalized. Let us note however that the mere removal of the accused article from the website could put an end to the tort.

26. This causes technical difficulties. The internet is not a bookshop and does not broadcast programmes at a set time. Therefore it is neither possible to book a restricted space for restricted access in order to keep away certain types of audiences (young children for instance) nor to broadcast some contents at late hours.

27. See Chapter 10 of this report.

28. A detailed table of the different national regimes of exceptions in freedom of information legislation is to be found in Annex II of a publication available on the internet site of the Article 19 of the Centre for Policy Alternatives, Commonwealth Human Rights Initiative, Human Rights Commission of Pakistan, *Global Trends on the Right to Information: A Survey of South Asia*, July 2001 (http://www.article19.org/docimages/1116.htm).

Chapter 2

1. See UNDP, *Human Development Report 2003*.

2. Before the information revolution, if shopkeepers, librarians, contractors or entrepreneurs wanted to be informed of the state of their stocks, they were obliged to take note, as they went along, of every detail of the incoming and outgoing movement of stock, and to keep an up-to-date inventory. With present-day technologies, beginning with bar-code readers, the collecting of this kind of information is carried out automatically with every movement of stock, thus providing information that is more immediate, more complete and more reliable than when it depended on the mental work of individuals.

3. According to the jurist Stefano Rodotà, any privacy protection system should be based on four fundamental principles: the right to oppose, the right not to know, the right to question the finality of knowledge and the right to oblivion. See Rodotà, S., *La démocratie électronique: de nouveaux concepts et expériences politiques*, Rennes, Apogée, 1999.

4. Originally, this right referred particularly to personal information on the health of individuals such as knowing one's state of health or having access to certain genetic information that determines the fate of individuals can indeed be the cause of major traumas.

5. This project called "Autonomic Computing" is the offspring of the philosopher and mathematician Alfred North Whitehead, for whom the progress of civilization can be measured by the number of important operations that one can make without thinking.

6. Those processes are said to be "cognitively distributed": the resources necessary to the accomplishment of a task are shared out between several individuals, even between individuals and artefacts. The theory of distributed cognition takes off from the finding that many cognitive tasks that cannot be resolved by an individual on his own are easily resolved by a network of agents, each possessing limited knowledge. Limitations of memory, time, attention and calculating ability all have considerable effects on our cognitive performances, effects which can be overcome by envisaging cognition as a distributed process.

7. The importance of the promotion of multilingualism will be examined in Chapter 9 of this report.

8. A study by the University of California, Berkeley, puts the amount of digital material at 1.5 billion Go, i.e. an annual average of 250 Mo per person (clearly theoretical, given the digital divide).

9. In 2001, for example, the data sent from Mars by the Viking probes of the National Aeronautics and Space Administration (NASA) in the mid-1970s were lost because the magnetic tape used 25 years previously by the computer was in a format that was no longer readable (*Memory of the Information Society*, UNESCO, 2003).

10. See Chapter 3 of this report.

11. Relevant here are the activities of UNESCO's "Memory of the World" programme – Likewise the work of the IFLA/IPA network: *Preserving the Memory of the World in Perpetuity: A Joint Statement on the Archiving and Preserving of Digital Information* (2002).

12. As observed in Yemen, internet users mainly frequent entertainment sites (45 per cent), followed a long way behind by information sites (23 per cent) and religious sites (19 per cent). A very low percentage of academic research usage was reported (5 per cent). This is attributable, according to the UNDP study, to a number of reasons: Yemeni educational institutions have not integrated the internet into the education system; specialized internet training for academic research is virtually absent in most of the state and private academic institutions and knowledge of English is not very widespread. It should also be noted that online activities such as academic and scientific research, online shopping and e-commerce, and internet governmental transactions are either underutilized or non-existent. In comparison, an enquiry carried out in Peru for the Food and Agriculture Organization of the United Nations (FAO), the ITU and the Inter-American Development Bank (IADB) on users of *cabinas publicas* living in low-income and fairly remote areas shows that the internet user public is mainly made up of students. The type of services provided by these tele-centres seems to indicate that the internet plays a mainly educational role in this context and that the research carried out is either imposed (39 per cent of connections) or independent (12 per cent of research). See Norman, H., *An Overview of the Demographics and Usage Patterns of internet Users in Developing Countries: Yemeni internet Population as a Case Study*, UNDP, 2002 (http://www.undp.org.ye/ict.htm) and Proenza, F. J., Bastidas-Buch, R. and Montero, G., *Telecentres for Socioeconomic and Rural Development in Latin America*, Washington, DC, FAO, ITU, IADB, 2001.

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Chapter 3

1. See, among others, Robert Hutchins, *The Learning Society*, London, Harmondsworth, Penguin, 1968; and Torsten Husén, *The Learning Society*, London, Methuen, 1974. Much work is also being done on this subject in the developing countries.

2. Peter Drucker, *The Age of Discontinuity, Guidelines to our Changing Society,* New York, Harper & Row, 1969.

3. Under this new view of things, Françoise Héritier has put forward an anthropological definition of "innovation" that might be worded as follows: a massive phenomenon making possible the replacement, in a given field, of an old order by a new one that steadily becomes dominant.

4. For a discussion of the ergonomics of knowledge, see Chapter 2 of this report.

5. In Schumpeter's analysis, the entrepreneur acts as an intermediary between the comparatively self-contained worlds of technology and the economy. The degree to which these were self-contained was overestimated by classical economics even in its own time. In the knowledge society it can only be nil.

6. Conceived as a process of creation, transformation and organization of information into knowledge networks.

7. In the context of lifelong learning, the term "teacher" encompasses parents and teachers, of course, but should also ideally comprise all the actors in the individual's life.

8. *Index Translationum* (www.unesco.org/culture/index), the *UNESCO Catalogue of Representative Works* (http://www.unesco.org/culture/lit/rep) and the Library of Congress collections (http://www.loc.gov/) are but a few examples.

9. There are examples in every continent. In France there is the Bibliothèque nationale de France (BNF) (http://www.bnf.fr/), in Quebec the Grande bibliothèque nationale (http://www.bnquebec.ca/), in Egypt the Bibliotheca Alexandrina (http://www.bibalex.org/English/index.aspx), etc. Some people are not happy about this. The philosopher Michel Serres, for instance, considers that the cost of such projects, as compared with the possibilities offered by the internet, makes a project like the BNF a hangover from a bygone world, continuing to function by way of accumulation rather than contributing to dissemination. (Cf. for example the interview given by Serres to the journal *Quart Monde No.* 163, March 1997, "La rédemption du savoir", available at http://agora.qc.ca/textes/serres.html)

10. For further information, one may consult the site of the *Bibliotheca alexandrina*: http://www.bibalex.org/newwebsite.

11. It is estimated that, at the end of 2005, an individual will need an average of 100 Go of personal storage each (this estimate applies of course to the industrialized societies; worldwide, the figure would be lower).

Chapter 4

1. For more details on the Dakar Framework for Action and the achievement of the goals of Education for All, see http://www.unesco.org/education/efa/ed_for_all/dakfram_eng.shtml

2. *EFA Global Monitoring Report 2005. Education for All: The Quality Imperative*, Paris, UNESCO, 2004.

3. There are many parents who, for various reasons, take their children out of school or simply do not enrol them – high enrolment charges or school fees, the extra remuneration often demanded by teachers, the poor performance of education systems and their irrelevance to socio-economic realities, lack of safety and security in schools (affecting girls in particular) and financial difficulties inducing parents to make their children work, either on the informal job market or in the household economy. To all this must be added the problem of civil wars and "failed states". The quality of education systems cannot therefore be separated from the issue of human safety, as we will see in Chapter 8. UIS Figures, Education database, May 2005.

4. See the text of the Salamanca Statement and Framework for Action on the site: http://unesdoc.unesco.org/images/0012/001211/121147f.pdf

5. The most widely accepted definition of information literacy is that of the American Library Association: "To be

information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information." It is worth noting, however, that there is a growing competition between the terms "information literacy" and "information culture". For more details, cf. http://www.ifla.org/IV/ifla70/prog04.htm.

6. The statistics that follow are taken from UIS (Education database, May 2005).

7. Cf. OECD/CERI, *Schooling for Tomorrow. What Schools for the Future?*, Paris, OECD, 2001, Chap. 3, pp. 77-98. The six scenarios have been analysed by Alain Michel, a CERI expert, in *Futuribles*. (Cf. Michel, A. Six scénarios sur l'Ecole, *Futuribles*, No. 266, July–August 2001, pp. 67-74).

8. On the question of general culture in the knowledge societies, see also Chapter 7 of this report.

9. The contents and arrangements for this third period also vary a great deal according to whether the training system in question is focused on preparing people for the labour market (for example in countries where the apprenticeship system predominates) or whether the systems are more mixed, with a stronger academic component.

10. UIS (Education database, May 2005).

11. More information on APPEAL's activities can be found in its online newsletter: http://www.unescobkk.org/ips/ebooks/subpages/apelbul.html

12. Although some research has sought to prove that the level of public spending has no impact on the results obtained in terms of educational indicators, UNDP has reached the opposite conclusion. See Public policies to improve people"s health and education in UNDP, *Millennium Development Goals: A Compact among Nations to End Human Poverty, Human Development Report 2003*. See also the *EFA Global Monitoring Report 2005*. *Education for All: The Quality Imperative.*

13. On the new technologies and distance education, see the section in this chapter on "E-learning": new technologies and distance education.

14. Cf. Morin, E., Seven Complex Lessons in Education for the Future, Paris, UNESCO.

15. *Learning: The Treasure Within*, *Report to UNESCO of the International Commission on Education for the Twenty-first Century*, Paris, UNESCO, 1996.

16. Recommendation of the participants to the Education for All International Forum in Amman, Jordan (16-19 June 1996).

17. See on this question Chapter 10 of this report and the *EFA Global Monitoring Report 2003*. *Gender and Education for All: The Leap to Equality*, Paris, UNESCO, 2003.

18. In the countries hardest hit by the pandemic, it is estimated that the virus could cause the death of up to 10 per cent of teachers. (Cf http://www.unesco.org/education/efa/ed_for_all/PDF/10sidaed.pdf). On the impact of AIDS on the education sector, see Impact of AIDS on People and Societies, UNAIDS Fourth World Report, *2004-Report on the Global AIDS Epidemic*, http://www.unaids.org/bangkok2004/GAR2004_html_fr/GAR2004_04_fr.htm.

19. This is one of the lessons learned from the *Virtual High School* (Box 4.6), where it can be seen that it requires quite a large number of trained staff.

20. In an interview with *Education Today* (UNESCO) published in January-March 2004, Cristovam Buarque, then Minister of Education of Brazil, stated: "It is the last profession parents think of for their children. The salaries are low and teaching has lost its social status. It has to get this back".

21. See Chapters 6 and 7 of this report.

22. Cf. Chapter 5 of this report.

23. See http://web.mit.edu/is/courseweb/courses.html#5

24. See http://www.ngfl.gov.uk/.

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Chapter 5

1. Thus, in countries with a strong university tradition, such as the United States, France, Belgium or the Netherlands, where approximately 70 per cent of a given age-group are enrolled in higher education, the trend is rather towards modernizing higher education by means of the new technologies and the introduction of quality control aimed at ensuring the relevance of research output. Other countries, such as Mexico, are engaged in a wide range of commercially-oriented experiments in higher education, in which large traditional institutions (such as the Autonomous National University in Mexico City) can play the role of regulator or even counterweight.

2. UIS Education database, May 2005.

3. Projections by Merrill Lynch. See Moe, M. and Blodget, H., *The Knowledge Web: People Power, Fuel for the New Economy,* Merrill Lynch and Co., Global Securities Research and Economic Group, May 2000.

4. Source: UIS Education database May 2005 and García Guadilla, C., The Institutional Basis of Higher Education Research in Latin America with Special Emphasis on the Role Played by International and Regional Organizations, in Schwarz, S. (ed.), *The Institutional Basis of Higher Education Research – Experiences and Perspectives* Dordrecht, Kluwer Academic Publishers, 2000.

5. The reorientations in the World Bank's agenda on higher education in Africa have been quite remarkable: from a policy of "human resources development" in the 1960s, intended to provide African countries with an autonomous development capacity in the space of a few years and recommending strong public support for institutions of higher education, the Bank moved a decade later to a "return on investments" policy, decrying the fact that public expenditure on higher education primarily benefited graduates, subsequently liable to leave the country, rather than the community as a whole. This situation represented poor resource allocation and should be redirected towards basic education and was followed by a policy aimed at reducing the cost per student, increasing admission fees and privatizing institutions. It was only in the 1990s that, faced by the deterioration of higher education systems in Africa, focus was again placed on the importance of public financing, without however reversing the trend towards the increase of admission fees and the privatization of institutions. However, it should be noted that a higher education policy is particularly necessary in Africa since the training of teachers, essential to the promotion of education in this region, is largely dependent on efforts made to develop tertiary education.

6. See García Guadilla, C., *Access to Higher Education: Between Global Market and International and Regional Cooperation*, UNESCO Forum on Higher Education, Research and Knowledge. Colloquium on Research and Higher Education Policy, 1–3 December 2004.

7. Ibid.

8. Ibid.

9. In a recent study by the International Institute of Educational Planning, UNESCO distinguishes other models of virtual universities: newly created institutions on the model of the wholly virtual campus (like Unitar in Malaysia, the Universitat Oberta Catalunya in Spain or the Dakar French-Speaking Campus in Senegal); those that have simply modified their organization to include distance learning (e.g. the Universidad Virtual de Quilmas in Argentina, the Atabasca University in Canada, the African Virtual University-Kenyatta University in Kenya, University of Maryland-University College in the United States, etc.); the model based on a consortium of partners with a view to developing distance education; and, lastly, commercial enterprises specialized in educational services, which often develop in the distance education niche, like NetVarsity in India.

10. See Hazelkorn, E., *Accessing the Knowledge Society: Intended and Unintended Consequences of Higher Education Policy Reviews, 2004*, UNESCO Forum on Higher Education Research and Knowledge Colloquium on Research and Higher Education Policy, 1-3 December 2004 (http://portal.unesco.org/education/fr/ev.php-URL_ID=36312&URL_DO=DO_TOPIC&URL_SECTION=201.html)

11. See also Chapter 4 of this report. Other variants had been proposed previously, such as the notion of "rights to post-secondary education".

12. For more details on changes in the modes of knowledge production, see above and Chapter 6 of this report.

13. The Bologna Process, launched in June 1999 in the city of that name, provides for a further stage in this programme involving the harmonization of higher education systems in Europe by 2010.

14. For more details on this conference, see http://portal.unesco.org/education/fr/ev.php-URL_ID=7148&URL_DO=DO_TOPIC&URL_SECTION=201.html. One of the recommendations of the World Declaration on Higher Education for the Twenty-first Century may be singled out: "Developing entrepreneurial skills and initiative should become major concerns of higher education …" (Art. 7(d).) Furthermore, higher education institutions should "take all necessary measures to reinforce their service to the community, especially their activities aimed at eliminating poverty, intolerance, violence, illiteracy, hunger and disease, through

an interdisciplinary and transdisciplinary approach in the analysis of challenges, problems and different subjects;" (Framework for Priority Action for Change and Development of Higher Education, para. 6(e).)

15. Although research is one of the vital functions of higher education, this topic will be developed at greater length in Chapter 6 of this report.

16. Source: UIS Education database 2005. Those figures only include the doctorates delivered in the universities of the countries. They do not take into account the doctorates nationals receive from foreign universities (for example, the figures on Chile do not include the doctorates of Chilean students attending universities in the United States).

17. Understood as processes of creation, transformation and organization of information in knowledge networks.

18. See Chapter 10 of this report.

Chapter 6

1. The statistical data on OECD countries come from OECD. the data on other countries come from UIS.

2. In 2001, according to the OECD, the EU invested on average 1.9 per cent of its GDP in research and development, against 2.8 per cent for the United States. This figure moreover conceals major differences, since the rate for Sweden was 3.8 per cent, for Finland 3.3 per cent and for France 2.2 per cent, whereas the equivalent rate for Greece was 0.67 per ent and for Portugal 0.7 per cent. See http://www1.oecd.org/publications/e-book/92-2003-04-1-7294/.

3. Reverse engineering analyses how an object functions to create a new different object with identical functions.

4. In certain industrialized countries, military research had long represented up to three-quarters of public research and development expenditure (OECD data).

5. A researcher at the European Organization for Nuclear Research (CERN) in Geneva, he conceived the World Wide Web in 1989.

6. ARPANET was developed, as of 1969, by the US Department of Defense in order to build a computer network invulnerable to attacks on infrastructures. In 1973 ARPANET, became international by connecting up University College (London) and the Royal Radar Establishment (Oslo). There were then 2,000 users of ARPANET. In the 1980s, ARPANET was divided into two different networks, a military one (DDN) and an academic one (NSFnet), and it was the latter which in 1995 became a commercial network.

7. The public/private ratio in the funding of research and development (source of figures – RICYT, UNESCO, OECD, MSTI 2005/1): Latin America and the Caribbean 56.9/37.2; United States 30.2/64.4; OECD 29.9/62.3; Finland 26.1/69.6; Republic of Korea 25.4/72.2.

8. "All things being equal", since it must be stressed that the gaps between the public and private share in the funding of research can also be considerable between industrialized countries – the private sector invests much more in research in the United States or Japan than in the European Union. The European Union has launched a strategy to reduce the gap with the United States, which remains the most innovative country worldwide.

9. See Juma and Yee-Cheang, *Innovation: Applying Development in Knowledge*, 2005.

10. Recommendation 62 of the Science Agenda/Framework for Action says: "Scientific advice is an increasingly necessary factor for informed policy-making in a complex world. Therefore, scientists and scientific bodies should consider it an important responsibility to provide independent advice to the best of their knowledge". See http://www.unesco.ch/biblio-f/wwk_agenda_frame.htm.

11. It is estimated that 25 per cent to 30 per cent of students in India leave their country after obtaining their degree. See Creehan, S., India's IT Crisis, *Harvard International Review*, Vol. 23, No. 2, summer 2001 (http://hir.harvard.edu/articles/index.html?id=895&page=2)

12. See Teferra, D., Revisiting the Brain Mobility Doctrine in the Information Age, Regional Conference on Brain Drain and Capacity Building in Africa, Addis Abeba, 22 to 24. February 2000.

13. See Carrington, W. J. and Detragiache, E., "How extensive is the brain drain?" *Finance & Development: A Quarterly Magazine of the IMF*, Vol. 36, No. 2, 1999 (http://www.imf.org/external/pubs/ft/fandd/1999/06/carringt.htm).

14. Despite a decrease of 7 per cent in the number of visas issued since the events of September 2001. See Jachimovicz,

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M., *Foreign Students and Exchange Visitors, 2003*. (http://www.migrationinformation/org).

15. Abdoulaye Wade, address delivered at the G8 Summit in Sea Island, United States, on 10 June 2004.

16. The causes – necessarily complex – of this aspect of the movement of trained brainpower must be analysed with circumspection, for account must obviously be taken of the internal structures of each job market. The European Commission observes that: "The EU produces a larger number of graduates and PhDs in science and technology than the US (2.14 million in 2000, compared to 2.07 million in the US and 1.1 million in Japan). The EU, however, employs fewer researchers (5.4 researchers per 1000 labour force, against 8.7 in the US and 9.7 in Japan)." (See European Commission, *EU Research Performance: Substantial Progress but Important Challenges Need to be Addressed*, European Commission, Brussels, 2003. Such figures show that account must also be taken of a brain drain away from the scientific career, whether national or international. (http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/389|0|AGED&lg=FR&display=)

17. See Chu, J., How To Plug Europe's Brain Drain, *Time*, Vol. 163, No. 3, 19 January 2004 (http://www.time.com/time/europe/html/040119/brain/story.html).

18. Ibid.

19. See, for example, the site http://www.scienceofcollaboratories.org/.

20. See Glasner, P., From community to "collaboratory"? The human genome mapping project and the changing culture of science, *Science and Public Policy*, 23, 1996. It may be noted that while the collaboratory can assume an institutional form, as in the case of the Human Genome Project, it can also take a much more informal and spontaneous form, as was seen in the 2003 SARS outbreak: "The Severe Acute Respiratory Syndrome (SARS) had barely become public knowledge… before scientists the world over were scrambling to identify the new ill. And it was thanks largely to the information and data exchanged via internet that they were able to isolate the agent causing SARS in record time. The SARS epidemic has highlighted the key role internet can play in a global health emergency; see Erdelen, W., Thank you, Mr Berners-Lee, *A World of Science*, Vol. 1, No. 4, July-September 2003.

21. An interesting solution is to establish, in the neighbourhood of buildings given over to single disciplines, a physical location devoted to the crossing of disciplines. The University of California, Berkeley, has thus undertaken the construction of a building to house the CITRIS (Center for Information Technology Research in the Interest of Society) project (http://www.citris.berkeley.edu/), which is a semi-private interdisciplinary structure. Similar initiatives are to be found in other major North American universities.

22. See NEPAD http://www.touchtech.biz/nepad.

23. See MSF Reports, *A Matter of Public Responsibility*, 2001 (http://www.msf.org/content/page.cfm?articleid= A8293378-5AF5-4AFE-A9CA1D673B1AF764)

24. See http://www.it-environment.org/compenv.html

25. Figures supplied by the United States Environmental Protection Agency (EPA) (http://www.epa.gov/region01/solidwaste/electronic/index.html)

26. See http://www.grid.org/

27. This point is one of the conclusions of the conference "The Role of Science in the Information Society", held in Geneva on 8 and 9 December 2003 by CERN, UNESCO, ICSU, and the Third World Academy of Science, as a prelude to the World Summit on the Information Society. Luciano Maiani, the CERN Director General, sees in grid computing one of the "visible benefits" of science for the information society (http://rsis.web.cern.ch/rsis/Links/speech.html).

28. See http://www.publiclibraryofscience.org/.

29. http://www.soros.org/openaccess/

30. http://archivesic.ccsd.cnrs.fr/

31. WIPO, *Intellectual Property: A Power Tool for Economic Growth*. Geneva, WIPO, 2003.

32. The idea of a market or economy specific to symbolic goods, such as the benefits of religious salvation, was suggested in the early twentieth century by the sociologist Max Weber. The question of economies that are not directly monetary is part of the more general issue of free goods or external effects that are hard to formalize in economic terms.

33. Such a model is studied at the Centre for Intellectual Property Policy at McGill University in Canada. (http://www.law.mcgill.ca/research/centres_cipp-en.htm).

Chapter 7

1. Annan. "Science for All Nations", *Science*, 303, 13 February 2004.

2. For instance, a study of the attitude of European citizens towards science clearly illustrates this point. European Commission surveys in 2001 suggest that, even though Europeans mistrust certain products (such as GMOs), they are far more inclined, at any level of education, to trust scientists than politicians or business leaders; the crisis in science policy is accordingly "political" rather than "scientific". Cf. European Commission, *The Europeans, Science and Technology*, Brussels, 2001 (http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_154_en.pdf).

3. As part of its capacity-building mission, UNESCO has launched a series of manuals intended to help governments, research institutes and businesses to set up specialist ethics committees.

4. Cf. http://user.it.uu.se/pugwash/Etik/uppsalacodex.html.

5. The importance of these issues was emphasized in 1999 at the World Conference on Science in Budapest; the Science Agenda – Framework for Action adopted there gave UNESCO an explicit mandate to prepare a code of science ethics specifying scientists' responsibilities to society. This work is still in progress. See the Science Agenda – Framework for Action, para. 3.2 Ethical Issues, paras. 71–7.

6. Cf. http://www.osha.gov/as/opa/worker/whistle.html.

7. Cf. http://www.unesco.org/science/wcs/background/ethics_uncertainty.htm.

8. Sources: Porchet, M., *Les jeunes et les études scientifiques: les raisons de la "désaffection", un plan d'action.* Report to the French Ministère de l'éducation nationale, de l'enseignement supérieur et de la recherche, Paris, 2002 (http://www.education.gouv.fr/rapport/porchet.pdf); Ourisson, op. cit.

9. See http://www.loreal.com/fr/groupe/index.asp?/loreal-women-in-science:/index.asp and http://www.unesco.org/science/women/evenements_projets/presentation_prix_loreal_unesco.html.

10. To fully understand this difference it may be of interest to compare the sales of the best-sellers in scientific literature destined for the general public with the print runs of the principal science reviews. At the end of 2003 the review *Science* reported some 128,000 subscribers as against 65,000 for *Nature* and 35,000 for *The Lancet* (these figures do not include consultations of articles freely accessible on the internet). Some 82 per cent of subscribers to *Science* lived in North America, as against 10 per cent in Europe, 5.7 per cent in Asia, 1 per cent in Latin America, 0.7 per cent in the Pacific region, 0.4 per cent in the Middle East and 0.2 per cent in Africa. In comparison, over 10 million copies of Stephen Hawking's *A Brief History of Time* have been sold worldwide.

11. National Science Week in South Africa. (Box 7.1) is an event of this type.

12. The term "pseudo-science" designates statements that have the appearance of a scientific presentation but are designed, not to produce empirical knowledge for the use of, and open to criticism by, the scientific community, but to advance a political, ideological or economic agenda. See also the chapter entitled Science and other systems of knowledge in the record of proceedings of the UNESCO World Conference on Science. Cf. UNESCO, World Conference on Science. Science for the Twenty-First Century, A Commitment, World Conference on Science, 26 June-1 July 1999, Budapest, Banson, 2000 (http://unesdoc.unesco.org/images/0012/001207/120706e.pdf).

13. Cf. Gascoigne, T. and Meltcalf, J., Training scientists to understand and love the media in *Science for the Twenty-first Century, A Commitment,* the Report of the 1999 Budapest World Conference on Science, Cetto, A. M., (ed.), London, Banson, 2000.

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Chapter 8

1. See Chapter 6 of this report.

2. See John von Neumann, Can We Survive Technology?, *Fortune,* 1955. This text, whose soul-searching testifies to the conflict between growing geo-political fragmentation and the tendency of technology to affect the world as a whole, constitutes an admission by the inventor (with Oskar Morgenstern) of *games theory* that whatever the progress of the rational mind, no decision in the realm of human affairs can ever dispense with intuition.

3. This paradox, known as Perow's Paradox, is attested in complex systems: when there is tight coupling between accidents, the minutest incident can give rise to major disasters. This is the theory of so-called "normal accidents". See Charles Perrow, *Normal Accidents. Living with High-Risk Technologies*, Princeton, 1999.

4. See Philippe Baumard, *Tacit Knowledge in Organizations*, New York, 1999. This provides the basis for an analysis, for example, of the mechanism of lowered vigilance, that was to lead to the accident involving the Columbia space shuttle on its return to the atmosphere in the spring of 2003.

5. The search for a balance between the moral and scientific dimensions of the precaution has led the European Union to promote a precautionary principle that amounts to proportioning the precaution measures to the scientific plausibility of the risk assumptions.

6. As early as the eighteenth century, Jean-Jacques Rousseau, faced with the earthquake and the tsunami that devastated Lisbon, had had the intuition that we cannot blame nature for building unadapted cities, for "most of our physical pains are our own doing".

7. The case of the eradication of smallpox, one of the great successes of twentieth century medicine, is a good illustration of the point. The disappearance of the illness made it seem pointless to preserve vaccine stocks, and as a result, today the threat of an epidemic provoked by rogue states or individuals is forcing us to recognize how vulnerable we have thereby made ourselves and to rebuild our stocks as a matter of urgency.

8. It is moreover significant that Amartya Sen relates the idea of *human security* to the concept of human development, complemented from the standpoint of growth models by taking into account the risks of negative growth. See the contribution of Amartya Sen, Commission on Human Security, *Security Now, Report of the Commission on Human Security* (Paris, 2003), pp. 1-19. The UNDP defines human development as "a process of enlarging people's choices … the three essential ones are for people to live a long and healthy life, to acquire knowledge and to have access to resources need for a decent standard of living". (*Human Development Report 1990*, Box 1.1, p. 10).

9. The Human Security Network is a group of countries promoting a dialogue over issues related to human security. This network includes Austria, Canada, Chile, Costa Rica, Greece, Ireland, Jordan, Mali, the Netherlands, Norway, Slovenia, Switzerland, Thailand and South Africa (as an observer).

10. See *Human Security Now*, op. cit., p. 17.

11. The case related by Franciso Sagasti is particularly striking: in November 2001, twenty-eight schoolchildren in a remote village in the highlands of Peru died after preparing their powdered milk in a vat reserved for a powerful insecticide. None of them could read the label and they all died from poisoning. See Science, Technology and Globalization, in *The Future of Values*, UNESCO/Berghahn Books, 2004.

12. Cf. Beck, U., Risiko Gesell Schaft, Frankfurt, Suhrkamp.

13. In this respect, it is necessary to accord due value to the broad potential of what is called local, traditional or indigenous knowledge, in order to encourage both risk prevention and the emergence of pluralistic knowledge societies and the respect of cultural diversity (see Chapter 9 and the subsection on Warning Systems and population preparedness earlier in this chapter).

14. For example, the effort made by the first companies that adopted the new norms and set an example in this field should be not only applauded, but also encouraged by tax allowances, prizes and awards (positive sanctions). Conversely, the law must punish the companies that fail to respect the norms (negative sanctions).

15. The promotion of human security is one of the strategic goals of UNESCO. In November 2000, about 100 people met at UNESCO for the First International Meeting of Directors of Peace Research and Training Institutions, in order to establish an Action Plan. Today, UNESCO organizes conferences and leads regional investigations on this theme, in cooperation with regional organizations and institutions (African Union, European Union, ASEAN, FLACSO, etc.). In 2007, UNESCO is planning to hold an interregional conference on human security. See http://www.unesco.org/securipax.

16. See *Human Development Report 1999*: *Globalization with a Human Face*.

17. Indeed, the developing countries must make sure that they do not become experimenting fields for products

under suspicion some richer countries. The assessing procedures of GMOs-related risks raise the issue of their cost. The more complex and precise the tests, the more abundant and varied the data, and the higher the costs of the procedures in equipment, personnel and time. In order to avoid being powerless in the face of such costs, developing countries will probably have to promote regional strategies allowing them to lead the independent tests they consider as necessary and adapted to their environment as well as their agricultural practices.

18. In 2002, The Conference of the Parties to the 1992 Convention on Biological Diversity (CBD) recommended that "in the current absence of reliable data on genetic use restriction technologies, without which there is an inadequate basis on which to assess their potential risks, and in accordance with the precautionary approach, products incorporating such technologies should not be approved by Parties for field testing until appropriate scientific data can justify such testing, and for commercial use until appropriate, authorized and strictly controlled scientific assessments with regard to, *inter alia*, their ecological and socio-economic impacts and any adverse effects for biological diversity, food security and human health have been carried out in a transparent manner and the conditions for their safe and beneficial use validated".

Chapter 9

1. From the time of the World Conference on Cultural Policies (MONDIACULT, Mexico City, 1982), a major change was seen at international forums in the political demarcation of the cultural field. An initially narrow definition of culture, focused essentially on arts and letters, gave way to a broader definition, derived from work in anthropology. This new perspective was taken up in particular by the World Commission on Culture and Development (WCCD), presided over by Javier Pérez de Cuéllar (*Our Creative Diversity. Report of the World Commission on Culture and Development*. Paris, UNESCO, 1995), and the Stockholm Intergovernmental Conference on Cultural Policies for Development (1981), before being inserted at the beginning of the *Universal Declaration on Cultural Diversity* adopted by UNESCO's General Conference at its 31st session, in November 2001: "Culture should be regarded as the set of distinctive spiritual, material, intellectual and emotional features of a society or a social group, and … encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs" (preamble).

2. Cf. Constitution of UNESCO.

3. There is no commonly accepted definition of "biopiracy" in the international community. However, SciDevNet suggests the following description: activities linked to the access or use of genetic resources that would conflict with the legal measures in the Convention on Biological Diversity. Biopiracy also refers to illegal patent registrations over genetic resources.

4. "Multilingualism" denotes here a single individual's knowledge of several languages; "plurilingualism" refers to the coexistence of a plurality of languages in a given geographical or political area.

5. *The Future of Values,* op. cit., p. 78.

6. One of the indicators of this predominance is the terminological vagueness surrounding the designation of these "other" types of knowledge, not only in common language, but also, and more generally, in the vocabulary of the human sciences. Within the framework of its programme on Local and Indigenous Knowledge Systems (LINKS), UNESCO has sought to formulate a definition that would help to clarify the aforementioned categories: "Local and indigenous knowledge refers to the cumulative and complex bodies of knowledge, know-how, practices and representations that are maintained and developed by peoples with extended histories of interactions with the natural environment". In 1999, the Budapest World Conference on Science shed further light on the matter by making it clear that what is involved is not only indigenous knowledge but also forms of local knowledge that do not easily fit into the "indigenous" category and whose holders may be for instance farmers

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in Africa, stock breeders in Europe, fishermen in the North Atlantic, etc.

7. New Zealand, for example, whose government has defined the "knowledge society" project as a priority for achieving national integration and whose indigenous Maori population represents nearly 10 per cent of its total population (2004 estimate: 9.7 per cent), has given special attention to the possibilities offered by cyberspace in terms of new forms of cultural expression and creativity. The increase in the number of Maori sites has led logically to a significant upsurge of interest in Maori culture, difficult though it is to measure it (except in terms of the number of visitors to such sites). Cf. R. H. Himona, *Fostering the Creation of Local Contents,* communication at the regional preparatory conference for the World Summit on the Information Society, Tokyo, UNESCO, 2003.

8. The "best practices" database of UNESCO's Management of Social Transformations Programme (MOST) offers an example of an international cross-cutting coordination initiative. It proposes a selection of examples illustrating the use of local knowledge in sustainable and economically viable strategies against poverty. Thus, cases are highlighted where indigenous knowledge has been able to contribute effectively to development, and this may facilitate the possible reproduction of such practices in different cultural and social contexts.

9. Model law on Rights of Local Communities, Farmers, Breeders, and for the regulation of Access to Biological Resources.

10. Decision 391 on the common system of access to genetic resources.

11. Framework agreement on the access to biological and genetic resources.

12. Law on the protection of the environment and the conservation of biodiversity.

13. 2.186-16/01 provisional measure on the access to genetic resources, the protection of traditional knowledge and the sharing of the benefits linked to its use.

14. According to UNESCO, intangible heritage might be defined as "the practices, representations, expressions, as well as the knowledge and skills, that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. It is sometimes called living cultural heritage, and is manifested inter alia in the following domains: oral traditions and expressions, including language as a vehicle of the intangible cultural heritage; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; traditional craftsmanship. The intangible cultural heritage is transmitted from generation to generation, and is constantly recreated by communities and groups, in response to their environment, their interaction with nature, and their historical conditions of existence. It provides people with a sense of identity and continuity, and its safeguarding promotes, sustains, and develops cultural diversity and creativity" (http://portal.unesco.org/culture/en/ev.php-URL_ID=2225&URL_DO=DO_TOPIC&URL_SECTION=201.html).

15. In particular, Terralingua, Lingualsphere Observatory, the Summer Institute for Linguistics International, the International Federation of Teachers of Living Languages, and Language Rights.

16. Linguapax has now become a non-governmental organization that endorses this name and this mission originally created on the initiative of UNESCO. See http://www.linguapax.org/en/eduang.html.

17. Among the main international legal instruments dealing with linguistic rights, mention may be made of the International Covenant on Civil and Political Rights (adopted by the United Nations in 1966, and which came into force in 1976); the Convention against Discrimination in Education, adopted by UNESCO in 1960; and the Declaration on the Rights of Persons belonging to National or Ethnic, Religious or Linguistic Minorities, adopted by the United Nations in 1992. In addition, a Universal Declaration of Linguistic Rights was adopted in Barcelona in 1996 by numerous institutions and non-governmental organizations. Article 27 of the International Covenant on Civil and Political Rights stipulates that "In those States in which ethnic, religious or linguistic minorities exist, persons belonging to such minorities shall not be denied the right, in community with the other members of their group, to enjoy their own culture, to profess and practise their own religion, or to use their own language". The Convention against Discrimination in Education makes specific mention of linguistic rights in education.

18. This was recalled at the Tenth Congress of Linguapax (Barcelona, 2004).

19. In 2001, it was estimated that 70 per cent of scientific publications in circulation were written in English. The proportion of those in French was 17 per cent, in second position, while for publications in German it was hardly more than 3 per cent and in Spanish 1.37 per cent. See Hamel, R. E., El español como lengua de las ciencias frente a la globalización del inglés, Congreso internacional sobre lenguas neolatinas en la comunicación especializada (El Colegio de México, Mexico City, 28–29 November 2002).

20. Compare the positions of John Paolilo with those of Daniel Pimienta, which are to be presented in a study

UNESCO is preparing for the second phase of the World Summit on the Information Society to be held in Tunis in November 2005.

21. Unicode, which was created in 1991 out of an initiative gathering several companies in the information technologies sector, relies on a simple principle: the encoding of each given character under one specific figure. Today, Unicode is able to treat 65,000 specific characters – which means potentially all the writing systems of the world. It is progressively replacing the American Standard Code for Information Interchange (ASCII) and now makes it possible to encode correctly in the same text languages whose writing systems are very different, such as Chinese, Arabic, Sängö, Fulfude, Spanish and French.

22. Cf. *Declaration of Principles on Tolerance*, adopted and signed by the UNESCO General Conference at its 28th session on 16 November 1995.

23. Cf. Paul Ricœur, Universal Project, Multiple Heritages, in *The Future of Values,* op. cit.

Chapter 10

1. We are talking here about knowledge as an assimilable or exchangeable commodity, (i.e. knowledge in the form of information: hence knowledge and information here, and in this case alone, are interchangeable).

2. Cf. Chapter 9 of this report.

3. Cf. Chapter 6 of this report.

4. In the countries of the South, certain proactive *knowledge-based development* policies have led to altogether remarkable performances as compared with those of other economies. Why is per capita GDP (with parity of purchasing power) in the Republic of Korea, in 2003, 8 times higher than that of Ghana in 2002, and 26 times higher than that of the Democratic Republic of Congo, according to UNDP data (*World Human Development Report* 2004), while per capita GDP in those countries was practically identical 45 years ago?

5. See *Third Outline Perspective Plan 2001-2010*, Malaysia, 2001, Chapter 5 (http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN003661.pdf)

6. See *Understanding Knowledge Societies in Twenty Questions and Answers with the Index of Knowledge Societies,* report of the Department of Economic and Social Affairs of the United Nations Secretariat, May 2005. Cf. http://www.unpan.org/cdrom-dpadm/DPADM/Understanding%20Knowledge%20Societies%20(2005).pdf

7. Francisco Sagasti, "The Knowledge Explosion and the Knowledge Divide", UNDP Background Paper, Cf. http://www.hdr.undp.org/docs/publications/ background_papers/sagasti.doc.

8. See *Third Outline Perspective Plan 2001-2010,* op. cit.

9. It should be noted that the last three diagrams in Box 10.3 seem to give excessive importance to the technological components of knowledge over the other components (scientific research, school enrolment, etc.), even though illiteracy is included in the perimeter of the dimensions studied. Hence it is likely that they are a better index of the digital divide than of the knowledge divide.

10. Even more, as we have seen before, a difference of knowledge – such as that existing between the respective fields of specialization of a physicist and a sociologist, may even prove fruitful when it is turned to account in multidisciplinary strategies to create new knowledge (without however changing the difference of knowledge that existed between them).

11. Many had enthusiastically announced the rise of a new order for social relations, in which individuals would express themselves on a computer under a virtual identity and would be deprived of any vocal inflexion or body language or other usual signs of a conversation and could not therefore be distinguished according to the gender.

12. UIS, Database on literacy, June 2005.

13. Thus, in Canada and the United States, the internet is used slightly more by women than by men. From this point of view, the split is not a split between Europe and North America on the one hand, and the rest of the world on the other, since the proportion of women internet users as opposed to men is higher in the Republic of Korea, Brazil or Singapore than in the United Kingdom, France, Germany or Italy. Cf. Minges, M. and Kelly, T., *Asia-Pacific Telecommunication Indicators 2002*, Geneva, ITU, 2002.

14. Resolution 41 adopted by the General Conference of UNESCO at its 30th session, 17 November 1999.

15. Cf. http://portal.unesco.org/ci/en/file_download.php/cec02683d1c6ff7747a8049285a8bbbfRecommendation-Fre.pdf.

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16. UNESCO, *Medium-Term Strategy 2002-2007,* para. 27 (document 31C/4 approved by the General Conference of UNESCO at its 31st session, October 2001) "In light of the ongoing and new global challenges, UNESCO's mission during the medium-term period 2002-2007 will be to contribute to peace and human development in an era of globalization through education, the sciences, culture and communication, based on three main strategic thrusts. These three distinct, yet interrelated axes are: a) developing universal principles and norms, based on shared values, in order to meet emerging challenges in education, science, culture and communication and to protect and strengthen the "common public good" (…)". Another expression, linked to that of "common public good" deserves to be noted (para. 29) that of the world's intellectual commons: "At the beginning of the twenty-first century, UNESCO's mission can then be characterized in terms of the following action items: providing a platform for dialogue and action – involving both the public and the private sectors – concerning the world's intellectual commons (…)". Cf. (http://unesdoc.unesco.org/images/0012/001254/125434e.pdf).

17. Since the work of the economists Coase and Williamson, we know that, under certain hypotheses, the market may equalize the firm's conditions of production. The lowering of transaction costs in network societies thus makes it possible for a new type of productive organization to emerge involving exchange and collaboration within a single sharing community This law is known by the name of *Coase's theorem*.

18. The discussion here on open access to scientific information and data stems from an International Symposium on Open Access and the Public Domain in Digital Data and Information for Science, 10–11 March 2003, jointly organized by UNESCO, ICSU, the Committee on Data for Science and Technology (CODATA), the US National Academies and the International Council for Scientific and Technical Information (ICSTI), and the Workshop on Science in the Information Society that followed the next day.

19. *Creative Commons* proposes model copyright licences (for music creation and academic publications alike) that, instead of submitting for the prior authorization of copyright holders any act that does not qualify for a legal waiver, "allow certain uses to be authorized for the public in advance under conditions stipulated by the author". Cf. (http://creativecommons.org/).

20. This balance highlights the tension that exists between the two paragraphs of Article 27 of the Universal Declaration of Human Rights. Cf. Chapter 3 in this report.

21. The concept of appropriation covers more than one reality. One should not overlook the distinction that exists between private appropriation and public appropriation. The concept of appropriation is often equated with forms of acquisition by individuals, private enterprises or institutions – just as the public domain is often identified with what pertains to the state or local authorities. The concept of public appropriation touches however on an important field, that of goods or knowledge belonging to public authorities or to the state, but that are not accessible to the public. The secrecy surrounding R&D in the field of national defense, intelligence or certain confidential administrative procedures reflects such appropriation. Similarly, the patents that some universities or laboratories may take out are a form of public appropriation.

22. UNESCO associated itself with this movement by publishing in May 2004 a document entitled *Policy Guidelines for the Development and Promotion of Governmental Public Domain Information*, which is accessible at http://portal.unesco.org/ci/en/ev.php-URL_ID=15862&URL_DO=DO_TOPIC&URL_SECTION=201.html

23. In the ancient world, citizenship referred among other things to the capacity to have free time to attend to public affairs. But it entailed numerous exclusions based on status: slaves, women, metics (resident non-citizens of a city of Greek origin), "barbarians" (residents of non-Greek origin), etc. Capacity then depended on the economic autonomy of voters, which was supposed to preserve them from corruption and make truly free men out of them: this was the theory of suffrage based on poll tax aimed at justifying the fact that political rights were reserved essentially for landowners. It was only with the idea of universal suffrage that it became possible to conceive of a universal political capacity linked to knowledge.

24. For more explanations, especially on different forms of political activism according to Pippa Norris, see http://www.pippanorris.com.

25. Cf. Chapter 8 of this report.

26. As illustrated by the proliferation of non-governmental organizations or the success of the major forums organized by civil society.

Conclusion

1. See UNDP, *Human Development Report 2003, Millennium Development Goals: A Compact Among Nations to End Human Poverty*, New York/Oxford, Oxford University Press, 2003.

2. See the *EFA Global Monitoring Report 2002, Education for All: Is the World on Track?* Paris, UNESCO, 2002.

3. BRAC (formerly the Bangladesh Rural Advancement Committee), set up in 1972, is the longest standing non-governmental organization in Bangladesh. It employs 27,000 people nationwide and its activities span three main areas: economic development, health and education. With the poor as its target population, BRAC, which defines itself as a "private development organization", advocates an integrated approach to development. The non-governmental organization works in partnership with the government on certain major national programmes. See http://www.brac.net

4. Figures presented by the foundation headed by Oscar Arias, former president of Costa Rica and 1987 Nobel Peace Prize Winner.

5. According to estimates by the Stockholm International Peace Research Institute (SIPRI), the amount is more than US$1,000 billion. See http://yearbook2005.sipri.org/highl/highlights

6. http://europa.eu.int/growthandjobs

7. See http://www.nepad.org

8. See SIPRI, op. cit.

9. Bilateral and multilateral assistance.

10. Source: OECD, International Development Statistics, August 2005. See http://www.oecd.org/dae/stats/idsonlinc

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The scientific upheavals over the course of the twentieth century gave rise to a third industrial revolution: that of new technologies, accompanied by the further advance of globalization. The resulting knowledge economy has placed cognitive resources at the centre of human activity and social dynamics. Does this mean that the twenty-first century will see the emergence of shared knowledge societies? Moreover, the digital divide is itself the consequence of a more serious split. The knowledge divide, today more than ever, separates countries endowed with powerful research and development potential, highly effective education systems, and a range of public learning and cultural facilities, from nations with deficient education systems and research institutions starved of resources, and suffering as a result of the brain drain. Another gap is opening up between the most advanced knowledge societies and those rich countries failing to invest adequately in research and knowledge. This leads to a brain drain along North-North lines. Building shared knowledge societies will be the key to a new and 'intelligent' form of sustainable human development in the new world currently taking shape before our eyes.

The UNESCO World Report offers a future-oriented overview of the upheavals through which we are living. Are the new technologies the miracle cure for inequalities and exclusion? How, in a democratic setting, should public debate be organized on the ethical questions prompted by new knowledge and technologies, such as genetic engineering, biotechnologies and nanotechnology? Shall we see the emergence of a planetary awareness of the risks human activity is posing to the planet and the species? Are we witnessing the rise of 'learning societies'? Is the construction of genuine knowledge societies dependent on addressing that major challenge of the twenty-first century – lifelong education for all? And what will higher education systems look like in the future? Knowledge also needs to be shared. The 'collaboratory' institution, favouring an approach to scientific research based on sharing (particularly between North and South), the networking of knowledge centres, and the pooling of relevant information are promising pointers. They all suggest that the path to shared knowledge societies may lie in the direction of cooperation, and not only that of competition and emulation.

Several issues form the subject of current global debate and call for hard choices on the norms that are to prevail in the societies of tomorrow. These issues include the safeguarding of cultural and linguistic diversity, the scope – or indeed extension – of the knowledge 'commons', digital solidarity between North and South, questions of copyright and intellectual property, and the relationship between knowledge and wisdom (which takes us into the realm of ethics). This first UNESCO World Report sets out to explore an uncertain future while proposing lines of enquiry and action. Its fundamental aim is the pooling, rather than the partition, of knowledge.

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