Contribution of Tertiary Education to Economic and Social Development

In questions of mind, there is no medium term: either we look for the best or we live with the worst.

John Gardner

Tertiary education institutions have a critical role in supporting knowledge-driven economic growth strategies and the construction of democratic, socially cohesive societies. Tertiary education assists the improvement of the institutional regime through the training of competent and responsible professionals needed for sound macroeconomic and public sector management. Its academic and research activities provide crucial support for the national innovation system. And tertiary institutions often constitute the backbone of a country’s information infrastructure, in their role as repositories and conduits of information (through libraries and the like), computer network hosts, and Internet service providers. In addition, the norms, values, attitudes, and ethics that tertiary institutions impart to students are the foundation of the social capital necessary for constructing healthy civil societies and cohesive cultures—the very bedrock of good governance and democratic political systems (Harrison and Huntington 2000).

To successfully fulfill their educational, research, and informational functions in the 21st century, tertiary education institutions need to be able to respond effectively to changing education and training needs, adapt to a rapidly shifting tertiary education landscape, and adopt more flexible modes of organization and operation. This chapter looks at the challenges and at how tertiary institutions are responding to the multifaceted demands placed on them, including the need for a lifelong-learning model of education. It examines the emergence of new types of tertiary education institutions in the context of a borderless market and outlines the ways in which institutions are transforming themselves to respond to evolving educational needs, new forms of competition, and
changing information and communication technologies. A detailed list of the questions and challenges associated with the new trends discussed in this chapter is presented in Appendix A.

**Changing Education and Training Needs**

This section examines three broad activities of tertiary education institutions that assist the construction of democratic, knowledge-driven societies:

- Supporting innovation by generating new knowledge, accessing global stores of knowledge, and adapting knowledge to local use
- Contributing to human capital formation by training a qualified and adaptable labor force, including high-level scientists, professionals, technicians, basic and secondary education teachers, and future government, civil service, and business leaders
- Providing the foundation for democracy, nation building, and social cohesion.

The discussion includes an overview of the new demands that today’s world markets and emerging technologies are making on higher education and of some of the ways in which tertiary education systems are responding.

**The Innovation System**

Knowledge by itself does not transform economies, nor is there any guarantee of positive returns to investments in research and development or in other products of tertiary education. Numerous countries, including large ones such as Brazil, India, and some of the former Soviet republics, had invested heavily in building up capacity in science and technology without reaping significant returns. This is because scientific and technological knowledge yields its greatest benefits when it is used within a complex system of institutions and practices known as a national innovation system (NIS).

An NIS is a web made up of the following elements: (a) knowledge-producing organizations in the education and training system; (b) the appropriate macroeconomic and regulatory framework, including trade policies that affect technology diffusion; (c) innovative firms and networks of enterprises; (d) adequate communication infrastructures; and (e) other factors such as access to the global knowledge base and certain market conditions that favor innovation (World Bank 1999c). Tertiary education systems figure prominently in this framework, serving not
only as the backbone for high-level skills but also as a network base for information sharing.

Unfortunately, the logic of national innovation systems favors the strong becoming stronger. Countries that want to improve their innovative capacity have to make significant efforts to acquire and maintain the critical mass of appropriate infrastructure, institutions, and human resources that function in concert to allow benefits to accrue. A few countries appear to have done this in high-technology manufacturing. By 1995, developing countries accounted for 30 percent of worldwide exports—significantly more than a few years earlier—and the value of their high-technology exports had for the first time exceeded that of their low-technology products (Lall 2000: 11).

Notwithstanding the difficulties involved in constructing an adequate NIS, there are several favorable factors that can assist countries aspiring to close the gap separating them from scientifically advanced countries. First, thanks to sound research in the social sciences, much is being learned about the process of innovation, and this growing body of evidence can be used in selecting the policies and practices that make investments in human resource development more effective (see Box 2.1). Second, much of the international science community is by nature open to cross-border collaboration, since the progress of science depends on a culture of freely shared basic knowledge. This bodes well for policies that encourage research and collaboration. Third, new information and communication technologies are providing unprecedented access to existing knowledge. Finally, what countries need to accomplish in order to use scientific and technological knowledge more effectively does not involve cutting-edge research but, rather, revolves around the mundane yet essential tasks of developing effective policies and institutions in science—and technology—related sectors and producing well-trained people. Whatever the specific path a country chooses to close the knowledge gap between itself and industrial countries, improvements in the level and quality of human resources are required.

Universities are the main locus of both basic and applied research. It is important to maintain advanced training and research programs at the postgraduate level, for several reasons. According to recent studies on the determinants of national innovative capacity, “countries that have located a higher share of their research and development activity in the educational sector have been able to achieve significantly higher patenting productivity” (Stern, Porter, and Furman 2000: 25). Graduates of postgraduate programs are needed to staff public and private R&D institutes, as well as high-technology manufacturing firms. Such institutions and firms are the main mechanisms through which the results of research are infused into the local economy, transforming the technical bases of agricultural and manufacturing production. Porter, in his seminal 1990
work on competitiveness, noted that “education and training constitute perhaps the single greatest long-term leverage point available to all levels of government in upgrading industry” (Porter 1990: 628). Postgraduate programs are essential for training university professors and thus improving the quality of tertiary education, today and for future generations.

**Human Capital Formation**

A new development framework that can support knowledge-driven growth requires expanded and inclusive education systems which reach larger segments of the population. These systems need to impart higher-level skills to a rising proportion of the workforce; foster lifelong learning for citizens, with an emphasis on creativity and flexibility, to permit constant adaptation to the changing demands of a knowledge-based economy; and promote international recognition of the credentials granted by the country’s educational institutions.

**More education for more people.** Knowledge-driven economies demand higher-level skills in the workforce. In OECD countries the proportion of employees with tertiary-level qualifications is increasing, as are rates of return on tertiary education. In these industrial countries, the proportion of adults with tertiary education qualifications almost doubled between 1975 and 2000, rising from 22 to 41 percent. But even this significant growth of the pool of workers with tertiary education has proved inadequate to meet the rising demand. Studies on the evolution of labor markets in Canada, the United Kingdom, and the United States document a continuously rising demand for young workers with a college education. In the United States jobs that require tertiary education have grown faster than those that require less education, and this trend is expected to accelerate. Before the recession that began in 2001, the U.S. Department of Labor had projected that during the 1998–2008 period, jobs that require some form of tertiary education qualification would grow systematically faster than the average growth rate for all jobs in the economy. It was estimated, for instance, that the number of positions requiring a master’s degree would increase by 19 percent, on average, and those requiring an associate degree by 31 percent, compared with only 14 percent for all jobs (USDL 2000). For the cohort of men age 26–30, the wage premium linked to completion of tertiary education increased threefold in the United States and the United Kingdom between 1980 and 1996, while in Canada the wage premium almost doubled (Card and Lemieux 2000).

Recent analyses of rates of return on tertiary education in several Latin American countries confirm that this trend also holds in successful developing economies. In Argentina, Brazil, and Mexico, for example,
rates of return on tertiary education grew significantly in the late 1980s and the 1990s, representing a clear reversal of the trends in the 1970s and the early 1980s (Pessino 1995; Barros and Ramos 1996; Lächler 1997). In Brazil the rising demand for skilled labor observed between 1982 and 1998 resulted in a 24 percent increase in the private rate of return to tertiary education, while returns to secondary and primary education declined by 8 and 30 percent, respectively (Blom, Holm-Nielsen, and Verner 2001). Similar patterns of rising returns to education with increasing years of schooling have been found in other parts of the world—for example in India, the Philippines, and South Africa.2

The rising demand for highly skilled labor affects not only wages but also employment opportunities. The experience of Russia provides an illustration. On the breakup of the Soviet Union in 1991, Russian workers at different educational levels were equally likely to be unemployed. By 1996, however, the situation had changed; workers with tertiary education were less likely to be laid off and, in the event of unemployment, were 25 percent more likely to find new positions (Foley 1997). In Korea rates of return to university education increased in relation to those for primary and secondary schooling over the period 1974–88 and surpassed the rates of investment at the lower levels (Ryoo, Nam, and Carnoy 1993). This finding of rising returns to university education has been buttressed by a 2001 study (Choi 2001).

Lifelong learning. The second dimension of change in education and training needs is the short “shelf life” of knowledge, skills, and occupations and, as a consequence, the growing importance of continuing education and of regular updating of individual capacities and qualifications (Wagner 1999). In OECD countries the traditional approach of studying for a discrete and finite period of time to acquire a first degree after secondary school or to complete graduate education before moving on to professional life is being progressively replaced by a lifelong-education model. Graduates will be increasingly expected to return periodically to tertiary education institutions to acquire, learn to use, and relearn the knowledge and skills needed throughout their professional lives. This phenomenon goes beyond the narrow notion of a “second chance” for out-of-school young adults who did not have the opportunity to complete much formal study. It has more to do with the updating and upgrading of learning that will be required in order to refresh and enhance individual qualifications and to keep pace with innovations in products and services. The concept of “lifelong learning for all” adopted in 1996 by the OECD ministers of education stems from a new vision of education and training policies as supporting knowledge-based development.

Lifelong-learning requirements may lead to a progressive blurring between initial and continuing studies, as well as between training for
Box 2.1 Leapfrogging in the New Global Economy: Brazil’s Success in Plant Pathology

The Botany Department at the University of São Paulo is a spare, gray two-story building surrounded by uneven grass. The lights are turned off in the hallways to save electricity. Power outages have been a problem. But inside its walls lies perhaps the best hope to protect California’s $2.7 billion wine industry from a devastating predator. A team of Brazilian scientists has cracked the genetic code of the bacterium *Xylella fastidiosa*, which has decimated vineyards in Southern California and is rapidly heading north.

Under a unique combined project, the U.S. Department of Agriculture, the California Department of Food and Agriculture, and the American Vineyard Foundation are funding the work. The U.S. government turned to Brazil for help because “Brazil is now the leader in this area of agriculture,” said Edwin L. Civerolo of the USDA’s Agricultural Research Service. “We did not have the experience or infrastructure to do the work.”

Brazil’s accomplishment illustrates the new rules of science in the global economy. Researchers anywhere in the world who do quality research and master the Internet can leapfrog national borders and challenge the traditional citadels of science in the United States and Europe. Brazil’s achievement took money, focus and the right microbe.

The Brazilian team broke into the major leagues last year when its genetic analysis of a *Xylella* strain that attacks orange trees was published in the leading research journal *Nature*. That feat made the São Paulo scientists the first in the world to decode the genome of a plant pathogen. Since then they have carved out their niche in the global scientific community as leading experts on plant pathology.

Their funding initially came from the state of São Paulo, which sets aside 1 percent of its tax revenue every year for scientific research. The brains came from 200 researchers in 34 laboratories throughout São Paulo state led by biologists Marie-Anne Van Sluys and Mariana C. de Oliveira of the University of São Paulo and João Paulo Kitajima, a computer software specialist at the University of Campinas.

The University of São Paulo’s laboratories house the latest gene-sequencing equipment and analyzers. Each machine rapidly sequences units of DNA, essentially spelling out in order all the letters of the microbe’s genetic code. The results are then sent electronically to the bioinfomatics laboratory at the University of Campinas, where genes are identified and described by computer analysis. The results are sent back to the biologists to determine the genes’ function and significance.

Key to Brazil’s success was the decision not to follow the conventional route of most countries on a quest for scientific glory and build a special institute for genetic research. Instead, the São Paulo State Research Foun-
Box 2.1, continued

dation created a virtual genomics institute, called the Organization for Nucleotide Sequencing and Analysis, out of existing laboratories. Rather than bricks and mortar, funding went into sequencers and computers. The network has grown to 50 centers throughout Brazil. Researchers are connected by the Internet and communicate daily.

“No buildings, no walls, no turf battles,” said the president of the foundation. The operating imperative was one of cooperation, rather than competition, among scientists. Andrew Simpson, of the Ludwig Institute for Cancer Research, put it this way: “It’s human nature to be competitive. What we did was to turn it outward. We’re competing as a group against the rest of the world.”


young adults and midcareer training. Finland, one of the leading promoters of continuing education in Europe, is among the most advanced nations in conceptualizing and organizing tertiary education along these new lines. Today, Finland has more adults engaged in continuing education programs at the tertiary level (200,000) than young people enrolled in traditional degree courses (150,000).

The lifelong-learning approach stresses the primacy of the learner. Tertiary education institutions will have to organize themselves to accommodate the learning and training needs of a more diverse clientele: working students, mature students, stay-at-home students, traveling students, part-time students, day students, night students, weekend students, and so on. New patterns of demand are emerging whereby learners attend several institutions or programs in parallel or sequentially, thus taking the initiative to define their own skill profiles on the labor market.

Another important consequence of the acceleration of scientific and technological progress is the diminished emphasis on remembering countless facts and basic data and the growing importance of methodological knowledge and analytical skills—the skills needed for learning to think and to analyze information autonomously. Today, in a number of scientific disciplines, elements of factual knowledge taught in the first year of study may become obsolete before graduation. The learning process now needs to be increasingly based on the capacity to find and access knowledge and to apply it in problem solving. Learning to learn, learning to transform information into new knowledge, and learning to translate new knowledge into applications become more important than memorizing specific information. In this new paradigm, primacy is
given to analytical skills; that is, to the ability to seek and find information, crystallize issues, formulate testable hypotheses, marshal and evaluate evidence, and solve problems. The new competencies that employers value in the knowledge economy have to do with oral and written communications, teamwork, peer teaching, creativity, envisioning skills, resourcefulness, and the ability to adjust to change.

Many of these competencies involve social, human, and intercultural skills that are not normally taught in science- or technology-based disciplines. This development calls for better integration of the hard sciences and the humanities. Tertiary curricula generally tend to be specialized because well-defined, measurable skills are recognized requirements in many fields. Nevertheless, it is important to enrich curricula with general subjects whenever possible.

A coherent intellectual complement to disciplinary work or professional programs can help broaden the foundation of knowledge and further dispose students toward a love of learning. Cooperative education—in which periods of institution-based learning that lay down the foundations of knowledge alternate with the acquisition of work-related skills, competencies, and practices in the workplaces of associated enterprises—has become an important element of tertiary education in many OECD countries.

**International recognition of qualifications.** The third dimension of change in the pattern of demand for training is the growing attractiveness of degrees and credentials with international recognition. In a global economy where local firms produce for overseas markets and compete with foreign firms in their own domestic markets, there is a rising demand for internationally recognized qualifications, especially in management-related fields. Many entrepreneurial university leaders have been quick to identify and capitalize on this trend, as evidenced by the multiplication and expansion of master of business administration (MBA)–type programs throughout the world.

A recent example of international collaboration is the initiative taken by the National University of Singapore in establishing a joint master’s program in engineering with the Massachusetts Institute of Technology (MIT). Students from both campuses attend lectures conducted either at MIT or in Singapore, using video conferencing through the U.S. high-speed broadband network system (VBNS) in combination with SINGAREN, Singapore’s high-speed research network.3

**Nation Building, Democracy, and Social Cohesion**

Adapting to the changing environment is not only a matter of reshaping tertiary institutions and applying new technologies. It is equally vital to
ensure that students are equipped with the core values needed to live as responsible citizens in complex democratic societies. A meaningful education for the 21st century should stimulate all aspects of human intellectual potential. It should not simply emphasize access to global knowledge in science and management but should also uphold the richness of local cultures and values, supported by the time-honored and eternally valuable disciplines of the humanities and social sciences, including philosophy, literature, and the arts.

Tertiary education has many purposes beyond the acquisition of concrete skills in preparation for the world of work. It also involves developing a person’s ability to reason systematically about critical questions and issues, to place facts in a broader context, to consider the moral implications of actions and choices, to communicate knowledge and questions effectively, and to nurture habits that promote lifelong-learning behaviors outside the formal academic setting. The skills of formulation, synthesis, analysis, and argumentation can be developed in a wide variety of curricula and a mix of pedagogical approaches. Indeed, it is important to have adequate learning resources and teaching capacity to cultivate student achievement in these higher-order skills. But opportunity is as important as the means of developing these characteristics: an environment that promotes freedom of thought and speech is essential for nurturing a cadre of self-motivated, responsible thinkers.

It is important at the tertiary level that intellectual exploration and argument be tempered by civility. Although individual inquiry and truth seeking can sometimes be a solitary exercise, classroom and collaborative activities help enrich social capacity and develop an inclination toward orderliness.

Through the transmission of democratic values and cultural norms, tertiary education contributes to the promotion of civic behaviors, nation building, and social cohesion. This, in turn, supports the construction and strengthening of social capital, generally understood as the benefits of membership in a social network that can provide access to resources, guarantee accountability, and serve as a safety net in time of crisis. The institutions, relationships, and norms that emerge from tertiary education are instrumental in influencing the quality of a society’s interactions, which underpin economic, political, and social development. Universities and other tertiary institutions are the crossroads for social cooperation, which can foster strong networks, stimulate voluntary activity, and promote extracurricular learning and innovation.

A growing body of research supports the notion that the general quality of social infrastructure is a critical factor in the effectiveness of governments, institutions, and firms, helping to nurture and transfer knowledge that not only produces goods and services but also serves as
the foundation of a just society (Ritzen 2000; Solow 2000). Social frag-
mentation, distrust, and corruption have measurable costs and are often
difficult to remedy. Trust, information sharing, and sound governance
are now understood as important economic agents that support develop-
ment through effective interaction. Tightly knit networks and account-
able communities that are created and nourished in tertiary institutions
provide important venues for access to income and opportunity. Tertiary
education promotes cooperation during education and after graduation,
linking individuals across sectors of the economy and connecting them
outside formal networks. This cooperation can ultimately improve gov-
ernment performance, engender civic engagement, and lower the inci-
dence of inequality, social exclusion, and corruption—to the benefit of
society, the state, and the market. In postconflict nations especially,
enhanced social capital is essential for assisting societies in reinventing
themselves with a sound moral compass.

Tertiary education can also play a crucial role in promoting social
mobility. It is important to provide adequate and equitable tertiary edu-
cation so that the entire citizenry can maximize its participation at all
levels, creating new educational opportunities for all groups in society,
in particular poor people.

Finally, scientific advances, especially in medicine and biotechnology,
raise many complex issues that go beyond science to include matters
related to ethics, public regulation, business practice, community life,
globalization, and world governance. Countries cannot address issues
such as genetically modified food, stem cell research, or cloning effect-
ively without the leadership and civic engagement of individuals who
have been formed by a strong tertiary education grounded in philoso-
phy, ethics, and tradition.

The Changing Tertiary Education Landscape

Over the past two decades, many countries have experienced a remark-
able diversification of their tertiary education sectors. The appearance
of a variety of new institutions alongside the traditional universities—
short-duration technical institutes and community colleges, polytech-
nics, distance education centers, and open universities—has created
new opportunities to meet the growing social demand. In Latin Amer-
ica, Asia, and, more recently, Eastern Europe and Sub-Saharan Africa,
this trend has been intensified by the rapid growth in the number and
size of private tertiary education institutions. A second wave of institu-
tional diversification is now discernible with the emergence of new forms
of competition in tertiary education that transcend traditional con cep-
tual, institutional, and geographic boundaries (CVCP 2000). The main new actors and institutions emerging in the “borderless” tertiary education market are discussed in sequence below. They are (a) virtual universities, (b) franchise universities, (c) corporate universities, (d) media companies, libraries, museums, and other institutions, and (e) education brokers (Salmi 2001). On the heels of these new actors come software producers, publishers, entertainment firms, and others seeking to tap the potential of an emerging international market in tertiary education (Bennell and Pearce 1998).

**Virtual Universities**

The elimination of the physical distance barrier as a result of the ICT revolution means that it is possible for outside institutions and providers to compete with local universities and reach students anywhere, in any country, using the Internet or satellite communication links. An estimate made in early 2000 suggested that there were already more than 3,000 specialized institutions dedicated to online training in the United States alone. Thirty-three U.S. states have a statewide virtual university; and 85 percent of all community colleges are expected to offer online distance education courses by 2002 (Olsen 2000).

The growth of virtual universities is not exclusively a U.S. phenomenon. The Virtual University of Monterrey, Mexico, offers 15 master’s degree programs using teleconferencing and the Internet to reach 50,000 students in 1,450 learning centers throughout Mexico and 116 other centers all over Latin America. Tun Abdul Razak University, the first online institution in Malaysia, has started to extend its reach to neighboring Asian countries. The African Virtual University and the Francophone Virtual University are pioneering virtual education in Sub-Saharan Africa. As of 2002, there are 15 virtual universities in Korea, offering 66 B.A. degree programs that reach 14,550 students.

**Franchise Universities**

In many parts of the world, but predominantly in South and Southeast Asia and the formerly socialist countries of Eastern Europe, there has been a proliferation of overseas “validated courses” offered by franchise institutions operating on behalf of British, U.S., and Australian universities. One-fifth of the 80,000 foreign students enrolled in Australian universities are studying at offshore campuses, mainly in Malaysia and Singapore (Bennell and Pearce 1998). The cost of attending these franchise institutions is usually one-fourth to one-third what it would cost to enroll in the mother institution.
Corporate Universities

Corporate universities are another form of competition with which traditional universities dedicated solely to postsecondary degree programs and research will increasingly have to reckon, especially in the area of continuing education. Worldwide, there are now about 1,600 corporate universities, up from 400 only 10 years ago. Motorola University has been recognized in benchmarking exercises as one of the most successful of these. It operates with a yearly budget of US$120 million, representing almost 4 percent of the firm’s annual payroll, and manages 99 learning and training sites in 21 countries (Densford 1999). Corporate universities may operate through their own network of physical campuses (examples are Disney, Toyota, and Motorola); as virtual universities (e.g., IBM and Dow Chemical); or through an alliance with existing tertiary education institutions (as do Bell Atlantic, United HealthCare, and United Technologies). A few corporate universities have been officially accredited and enjoy the authority to grant formal degrees. Experts are predicting that by 2010 there will be more corporate universities than traditional campus-based universities in the world and that an increasing proportion of them will be serving smaller companies rather than corporate giants.

Other Institutions

A diverse group of institutions—media and publishing companies, libraries and museums, and secondary schools—have also extended their reach into the world of tertiary education, taking full advantage of the new information and communication technologies. Although this new form of competition is more difficult to track, it is becoming significant at least in the United States and the United Kingdom. Examples include publishing companies that provide services linked to curriculum design and the preparation of educational materials for online delivery, and museums and libraries that offer continuing education courses.

Academic Brokers

Academic brokers are virtual, often Web-based, entrepreneurs who specialize in bringing together suppliers and consumers of educational services in many different areas. Companies such as Connect Education, Inc., and Electronic University Network build, lease, and manage campuses, produce multimedia educational software, and provide guidance to serve the training needs of corporate clients worldwide (Abeles 1998). Dozens of Web-based companies act as clearinghouses between schools and prospective students, offering information about academic and financial resources.
Need for New Quality-Assurance Mechanisms in a Global Marketplace

The emergence of borderless tertiary education heralds important changes in quality assurance needs and practices. First, it is doubtful that the philosophy, principles, and standards customarily applied in evaluating and accrediting campus-based programs can be used without major adjustments for assessing the quality and effectiveness of online courses and other modalities of distance education. Appropriate and reliable accreditation and evaluation processes are needed to assure the public that the courses, programs, and degrees offered by the new types of distance education institutions meet acceptable academic and professional standards. Less emphasis is likely to be given to traditional input dimensions such as qualifications of individual faculty and student selection criteria and more to the competencies and capabilities of graduates.

Second, very few developing nations have established accreditation and evaluation systems, nor do they have access to the necessary information on the quality of foreign programs or the institutional monitoring capacity to be able to detect fraud and protect their students from low-quality offerings. A recent survey in India showed that of 144 foreign providers advertising tertiary education programs in the newspapers, 46 were neither recognized nor accredited in their countries of origin (Powar and Bhalla 2001). The risk that students in low-income countries will fall prey to unscrupulous borderless operators is real.

Countries that cannot afford to or do not have the capacity to develop their own information systems should have the opportunity to participate in international accreditation and evaluation networks. Another option, following recent initiatives in Singapore, Hong Kong (China), and India, is to insist that foreign tertiary education institutions meet the same quality assurance requirements and guarantee the same type of degree recognition as prevail in the parent institution in the country of origin (see Appendix B).

New Modes of Organization and Operation

Tertiary education institutions in many countries are initiating sweeping transformations to align themselves better with new educational demands and competitive challenges. The main goal is to increase institutional flexibility and build up the adaptive capacity of tertiary education institutions and programs. These reforms are all-encompassing, touching on program offerings, academic structure and organization, pedagogical processes and modes of delivery, physical infrastructure, and the teaching profession.
Many changes are brought about or facilitated by the application of new technologies. These technologies can be used as pedagogical tools for transforming the learning process; as communication tools supporting new modes of information sharing; as resource tools (electronic libraries, for example); and as administrative tools to improve the efficiency and cost-effectiveness of academic management processes. ICT innovations create new challenges concerning pedagogy, academic management, governance and financing, quality assurance requirements, and intellectual property rights.

**New Educational Programs and New Clients**

In a lifelong-education perspective, changes at the level of program offerings have two aspects. First, the content and learning objectives of traditional programs need to be adjusted in such a way as to provide the foundation knowledge and skills necessary to equip all students with the capacity to undertake further learning and re-learning over their lifetimes (Wagner 1999). Second, tertiary education institutions must expand their program options to address the learning needs of non-traditional students with a variety of motivations and aims—for example, individuals wishing to change professions, returning graduates who want to update their skills, and retired people pursuing personal growth interests. One can therefore expect a significant change in the demographic shape of tertiary institutions, with more students pursuing a second or third degree or a professional degree and a larger share of students, both young and mature, enrolled in short-term continuing education activities.

**Organization and Management**

As tertiary education systems move from elite to mass systems and from an emphasis on teaching to a focus on learning, students become more important actors—as primary clients, consumers, and learners. This shift requires the establishment of appropriate organizational and management mechanisms to handle these new roles and the new challenges that they represent. Tertiary education institutions need to develop, in particular, capacities to conduct beneficiary assessments, to inform and guide students concerning career choices, to accommodate the needs of students with special difficulties, and to maintain linkages with graduates as resources for student placement and fund raising.

Effective labor market feedback mechanisms, such as tracer surveys and regular consultations with employers and alumni, are indispensable for adjusting curricula to meet the changing needs of industry. There is no better linkage than when a new tertiary education institution is fully
integrated into a regional development strategy. This was what happened in Finland, where the young University of Oulu has become one of the best universities in the Nordic countries despite being located in a remote area close to the Arctic Circle. The small rural community of Oulu has been transformed into a high-technology zone where winning companies (led by Nokia), science parks dedicated to applied research in electronics, medicine, and biotechnology, and the 13,000-student university function in symbiosis.

As regards organizational structure, there is a need to articulate traditional disciplines differently to respond to the emergence of new scientific and technological fields, the shift toward a problem-based mode of production of knowledge and away from the classic discipline-led approach, and the blurring of the distinction between basic and applied research. Among the most significant new areas are molecular biology and biotechnology, advanced materials science, microelectronics, information systems, robotics, intelligent systems and neuroscience, and environmental science and technology. Training and research in these fields require the integration of a number of disciplines that were previously regarded as separate and distinct. The result is the multiplication of interdisciplinary and multidisciplinary programs that cut across traditional disciplinary barriers. The new patterns of knowledge creation imply not only a reconfiguration of departments into a different institutional map but also, and more important, the reorganization of research and training around the search for solutions to complex problems rather than the analytical practices of traditional academic disciplines. This evolution is leading to the emergence of “transdisciplinarity,” characterized by distinct theoretical structures and research methods (Gibbons and others 1994). Even Ph.D. programs are increasingly affected by this change, as students become less involved in the production of new knowledge and more involved in contributing to the circulation of knowledge across traditional disciplinary boundaries. The trend goes beyond hard science and touches social sciences as well. For example, in 1990 Japan’s private Keio University established a separate entity, the Shonan Fujisawa Campus, to provide interdisciplinary programs in policy management, environmental information, and nursing and medical care. This program is regarded as revolutionary in the Japanese context because its graduates are well received by high-performing Japanese multinational enterprises, which traditionally preferred graduates of pure social science disciplines.4

Flexibility is vital if institutions are to adapt to the changing environment. Tertiary education institutions need to be able to react swiftly by establishing new programs, reconfiguring existing ones, and eliminating outdated programs without being hampered by bureaucratic regulations and processes.
To increase flexibility in the design and organization of academic programs, many tertiary education institutions throughout the world have adopted the U.S. standard of credit-based courses. This evolution has affected entire national university systems, as in Thailand, as well as networks of institutions, such as the Indian Institutes of Technology, and single institutions like the University of Niger (Regel 1992). At a historic meeting in Bologna in June 1999 ministers of higher education from 29 European countries committed themselves to the introduction of the credit approach in their university systems and the establishment of the European Credit Accumulation and Transfer System (EUROCATS). Some industrial countries, such as Denmark, are in the process of reshaping the entire tertiary education and S&T landscape. Danish officials are considering how best to encourage the formation of broad consortia by existing tertiary education institutions, national research institutes, and a wide spectrum of lifelong-learning programs. Such learning and knowledge consortia would facilitate the shared use of physical and human resources and enable students to move freely across traditional academic and institutional boundaries throughout their lives (Denmark 2001).

The organization of studies and the pattern of admission are evolving in many countries to accommodate in a more flexible way different moments of entry, exit, and reentry for various groups of students. In 1999, for the first time in the United States, a number of colleges decided to stagger the arrival of new students throughout the academic year instead of restricting them to the fall semester. In China a spring college entrance examination was held for the first time in January 2000. Many Korean universities also recruit students throughout the year; thus, students who fail the traditional July examination no longer have to wait a full year for a second chance.

**Pedagogical Methods**

The introduction of new pedagogical approaches supported by alternative delivery mechanisms has just begun to revolutionize teaching and learning in tertiary education. The concurrent use of multimedia, computers, and the Internet can make possible more active and interactive learning experiences through, for example, peer tutoring and self-directed learning, experiential and real-world learning, resource-based and problem-based learning, reflective practice and critical self-awareness, or any combination of these approaches. Traditional in-person teaching can be replaced by or associated with asynchronous teaching in the form of online classes that can be either scheduled or self-paced. A pioneer study (Kozma and Johnson 1991) conducted at the beginning of the 1990s analyzed several ways in which information technology could
play a catalytic role in enriching the teaching and learning experience. It suggested a new pedagogical model involving active engagement of the students rather than passive reception of information, opportunities to apply new knowledge to real-life situations, representation of concepts and knowledge in multiple ways rather than with text only, learning as a collaborative activity rather than as an individual act, and an emphasis on learning processes rather than memorization of information.

Infrastructure

The adoption of pedagogical approaches and modes of delivery that rely significantly on information technology have far-reaching implications, both positive and negative, for developing countries, with respect to the design and the cost of the physical infrastructure of tertiary education institutions. The new technologies require considerable investment in equipment and in cable or wireless networks, followed by high costs for infrastructure maintenance, training, and technical support. It is estimated that the initial capital outlays represent only 25 percent of the total costs associated with the purchase, use, and maintenance of information and communication hardware and software; the recurrent costs can thus represent as much as 75 percent of the life-cycle costs of technology investments. Such important capital investments and recurrent costs present major fiscal challenges for tertiary institutions in developing countries. Realigning the programs and curricula of universities on the basis of interdisciplinary and multidisciplinary learning and research similarly entails significant modifications in the organization of the laboratory and workshop infrastructure supporting basic science and engineering programs.5

At the same time, the judicious use of new technologies can be a source of major savings. In the United Kingdom the cost of producing an Open University graduate is about one-third that at a regular university. Traditional libraries are evolving into multifunctional information centers as digitization of information transforms their core work. Many academic libraries are now using networked information resources such as commercially available electronic databases as a means of expanding access to relevant information for all members of the academic community. Together with other departments and institutions, libraries are also engaged in the preservation of educational materials in digital form. Some of these projects can help academic libraries in developing countries cope with the pressure of the ever-increasing costs of reference documents, especially scientific journals.6 The Korean Education and Research Information Service (KERIS), a government-funded organization established in 1999, supports the purchase and sharing of quality international academic databases and online acade-
mic journals to help tertiary institutions and research institutes conserve financial resources.  

Reliance on CD-ROMs and networked databases can partially replace expensive journal and book collections and alleviate the shortage of storage space that many libraries face. In Canada 64 universities recently pooled their resources to establish nationwide site licenses for online scholarly journals. This project should give access to a larger pool of digital information to smaller universities that may not have the financial capacity to maintain a large stock of journals (Paskey 2001). Under any circumstances, however, whether to subscribe to particular networked information resources has to be determined on the basis of the pros and cons, including the cost implications, of using digitized resources or printed resources.  

Modern technology is not a panacea. To create a more active and interactive learning environment, faculty must have a clear vision as to the purpose of the new technologies and the most effective way of integrating them into program design and delivery—what experts call “instructional integration.” Then they must educate themselves in the use of the new pedagogical channels and supports.

A recent report from the University of Illinois on the use of Internet classes in undergraduate education sounds a few notes of caution (Mendels 2000). Quality online education is best achieved with relatively small class sizes, not to exceed 30 students. It does not seem desirable to teach an entire undergraduate degree program exclusively through online classes if students are expected to learn to think critically and interact socially in preparation for professional life. Combining online and regular classroom courses gives students more opportunity for human interaction and development of the social aspects of learning through direct communication, debate, discussion, and consensus building. These pedagogical desiderata also apply to the design and delivery of distance education programs, which need to match learning objectives with the appropriate technological support.  

**The Teaching Profession**

The teaching profession is itself evolving as a result of transformations in academic and pedagogical approaches. With a proper integration of technology in the curriculum, teachers can move away from their customary role as one-way instructors toward becoming facilitators of learning. The introduction of multimedia and computer-based teaching is leading toward the unbundling of professors’ traditional functions: course design, selection of textbooks and readings, course delivery, and assessment of resources. The need for tertiary education institutions to be able to respond rapidly to changing labor market signals and to adjust
swiftly to technological change may also imply more flexible arrangements for the deployment of academic staff and the evaluation of its performance. These adjustments may include moving away from civil service regulations and abandoning tenure-track appointments. Under a more radical scenario, the multiplication of online programs and courses could induce tertiary education institutions to contract independent professors not affiliated with a specific college or university to prepare tailor-made courses.

**Conclusion: Demise or Renewal of Traditional Tertiary Institutions?**

Momentous changes in the global environment are stretching the traditional time and space boundaries of tertiary education, in OECD countries and in developing and transition countries. The time dimension is altered by the requirement for lifelong learning, and space barriers are falling before the new information and communication technologies. These challenges can be seen as serious threats or as tremendous opportunities for tertiary education everywhere. The hegemony of classical tertiary institutions, especially universities, has been definitively challenged, and institutional differentiation is bound to accelerate, resulting in a greater variety of organizational configurations and patterns, including the emergence of a myriad of alliances, linkages, and partnerships within tertiary institutions, across institutions, and even extending beyond the tertiary education sector.

Under any scenario, traditional universities will continue to play a major role in both industrial and developing countries, especially in advanced training and research, but they will undoubtedly have to undergo significant transformations prompted by the application of new education technologies and the pressure of market forces. The impact of these changes is multifaceted and complex, as reflected in Table 2.1.
### Table 2.1 Evolving Tertiary Education Systems

<table>
<thead>
<tr>
<th>Desired outcomes</th>
<th>Changing education and training needs</th>
<th>Changing tertiary education landscape</th>
<th>Changing modes of operation and organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced human capital</td>
<td>Demand for higher skills</td>
<td>Appearance of new providers</td>
<td>More interactive pedagogy with emphasis on learning</td>
</tr>
<tr>
<td>New knowledge</td>
<td>Methodological and analytical skills</td>
<td>Development of borderless education</td>
<td>Continuing education programs</td>
</tr>
<tr>
<td>Adaptation of global knowledge for resolution of local problems</td>
<td>Demand for internationally recognized degrees and qualifications</td>
<td></td>
<td>Increased reliance on ICT for pedagogical, information, and management purposes Multi- and transdisciplinarity</td>
</tr>
<tr>
<td>Democratic values, attitudes, and cultural norms</td>
<td></td>
<td>Humanistic dimension of education and training Adaptability and flexibility</td>
<td></td>
</tr>
</tbody>
</table>

In the next chapter, we look at the current realities of tertiary education systems in developing and transition economies. In particular, we explore the continuing problems of access, equity, quality assurance, and governance faced by these institutions.
Notes

1. Although this remains true in a large number of areas of basic research, a growing number of scientific fields—notably, biotechnology—that produce commercially applicable knowledge are rapidly becoming more “closed,” and scientists are less willing to cooperate freely for the sake of building capacity. The World Bank is studying the magnitude and consequences of this change.

2. For India, Duraisamy (2000); for the Philippines, Schady (2002); for South Africa, Lam (1999).


5. Two examples from the United States will illustrate. The Georgia Institute of Technology has developed an interdisciplinary “mechatronics” laboratory that cost-effectively serves the needs of students in electrical, mechanical, industrial, computer, and other engineering departments. The Pennsylvania State University, the University of Puerto Rico–Mayaguez, the University of Washington, and Sandia National Laboratories have formed a unique partnership to establish “learning factory” facilities that allow teams of students from industrial, mechanical, electrical, and chemical engineering and business administration programs in the partner schools to work together on interdisciplinary projects (Lamancusa, Jorgensen, and Zayas-Castro 1997).

6. Cornell University in the United States, for example, has created the “Essential Electronic Agricultural Library,” a collection of CD-ROMs that stores texts from 140 scientific journals in the field of agriculture from 1993 on (see <http://teeal.cornell.edu/#TEEAL>). The CD-ROMs are shared with libraries in 115 developing countries at the low cost of US$22,500 for the years 1993 to 1999 and US$5,000 for updates that become available one year after the original year of publication. Many of the developing county libraries obtained the CD-ROMs with assistance from donors. The cost of buying all the journals included in the CD-ROM database is estimated at US$375,000 (reported in McCollum 1999).


8. Academic librarians have some reservations about using networked information resources: (a) publishers do not always ensure updating of digital resources as computers are upgraded, which could result in libraries not being able to use the previous version with their new equipment, and (b) subscription to networked information resources means that libraries purchase access to resources without having any control over publishers’ decisions to drop certain resources from the database or to stop archiving them.