

Tertiary Education in the 21st Century: Challenges and Opportunities

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"It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change." Charles Darwin

ABSTRACT

In the past few years, many countries have witnessed significant transformations and reforms in their higher education systems, including the emergence of new types of institutions, changes in patterns of financing and governance, the establishment of evaluation and accreditation mechanisms, curriculum reforms, and technological innovations. But the tertiary education landscape is not changing as fast everywhere. Some universities have proudly tried to maintain their traditions, good or bad; other universities throughout the world have been passive in the face of crisis. In this rapidly evolving world, what is likely to happen to those higher education institutions which are not willing or able to change?

To approach this problem, this paper looks first at the new challenges characterizing the environment in which higher education institutions operate and compete at the beginning of the 21st century. Second, it examines some concrete implications of these challenges in terms of changing institutional forms and new ways of delivering higher education programs, looking at promising trends and experiences in countries and institutions which have taken the lead in introducing reforms and innovations.

INTRODUCTION

Imagine a university without buildings or classrooms or even a library. Imagine a university ten thousand miles away from its students. Imagine a university without academic departments, without required courses or major or grades. Imagine a college open 24 hours a day, seven days a week, 365 days a year. Imagine a college proposing a bachelor's degree in Individualized Studies or in Interdisciplinary Studies,

with a catalogue of more than 4 000 different courses. Imagine a degree valid only for five years after graduation. Imagine a college willing to reimburse its students if they do not find a suitable job within six months after graduation. Imagine a higher education system where institutions are ranked not by the quality of their teachers, but by the intensity of electronic wiring and the degree of Internet connectivity. Imagine a country whose main export earnings come from the sale of higher education services. Imagine a socialist nation which charges market rate tuition fees to obtain full cost recovery in public higher education. Are we entering the realm of science fiction? Or are these evocations real-life stories of revolution in the world of higher education on the eve of the 21st century?

In the past few years, many countries have witnessed significant transformations and reforms in their higher education systems, including the emergence of new types of institutions, changes in patterns of financing and governance, the establishment of evaluation and accreditation mechanisms, curriculum reforms, and technological innovations. But the tertiary education landscape is not changing as fast everywhere. Some universities have proudly tried to maintain their traditions, good or bad. At Oxford University, New College is a venerable 16th century institution. At Bob Jones University in South Carolina, interracial dating is still banned. These unbending institutions are not alone; other universities throughout the world have been passive in the face of crisis. The oldest university on the American continent, the Autonomous University of Santo Domingo in the Dominican Republic (established in 1538), is about to collapse under the pressure of its 80 000 students crowding facilities originally designed to accommodate only 6 000 students. The largest classical university in Latin America, the National Autonomous University of Mexico, was paralyzed for ten months in 1999-2000 by a strike over the Rector's proposal to introduce voluntary tuition fees in an amount equivalent to USD 140 per year. In this rapidly evolving world, what is likely to happen to those higher education institutions which are not willing or able to change?

THE NEW CHALLENGES

"It was the best of times, it was the worst of times. It was the age of wisdom, it was the age of foolishness..." Charles Dickens

There are three major, intertwined new challenges which bear heavily on the role and functions of higher education: *i*) economic globalization; *ii*) the increasing importance of knowledge as a driver of growth, and *iii*) the information and communication revolution.

Globalization

Globalization is the complex integration of capital, technology, and information across national boundaries in such a way as to create an increasingly integrated world market, with the direct consequence that more and more countries and firms

have no choice but to compete in a global economy. Globalization may not be a new phenomenon. The conquest of America by the Spanish and Portuguese invaders at the end of the 15th century, the triangular cotton and slave trade in the 17th and 18th centuries, the construction of the trans-Atlantic telegraph cable in the 1860s, and the colonization of most of Asia and Africa until the middle of the 20th century were key factors of economic integration and determinants of economic growth on a global scale. But there has undoubtedly been an acceleration of the phenomenon in the past two decades as demonstrated by the increase in international trade and the growing interdependence of capital markets.

Emphasizing globalization as an important economic trend does not imply a value judgment, either positive or negative. Many people see this evolution as a major source of opportunities, while critics decry the dangers of inter-dependency and high volatility, such as the risk of transferring financial crises from one country to the other. But globalization is happening, whether one approves of it or not, whether one likes it or not, and every country in the world, every firm, every working person is affected by it and is very likely a part of it.

Growing role of knowledge

The second dimension of change is the growing role of knowledge. Economic development is increasingly linked to a nation's ability to acquire and apply technical and socio-economic knowledge, and the process of globalization is accelerating this trend. Comparative advantages come less and less from abundant natural resources or cheaper labor, and more and more from technical innovations and the competitive use of knowledge. The proportion of goods with a medium-high and high level of technology content in international trade has gone from 33% in 1976 to 54% in 1996.² Today, economic growth is as much a process of knowledge accumulation as of capital accumulation. It is estimated that firms devote one-third of their investment to knowledge-based intangibles such as training, research and development, patents, licensing, design and marketing. In this context, economies of scope, derived from the ability to design and offer different products and services with the same technology, are becoming a powerful factor of expansion. In high-technology industries like electronics and telecommunications, economies of scope can be more of a driving force than traditional economies of scale.³ New types of companies, called producer services companies, have begun to prosper as providers of specialized knowledge, information and data supporting existing manufacturing firms. Experts see them as the principal source of created comparative advantage and high value added in advanced industrialized economies.⁴

At the same time, there is a rapid acceleration in the rhythm of creation and dissemination of knowledge, which means that the life span of technologies and

products gets progressively shorter and that obsolescence comes more quickly. In chemistry, for instance, there were 360 000 known substances in 1978. This number had doubled by 1988. By 1998, there were three times as many known substances (1 700 000). Almost 150 000 new “patent equivalents” were added to the Chemical Abstracts data base in 1998, compared to less than 10 000 a year in the late 1960s. Perhaps the best illustration of the short lifetime of new information and products comes from the computer industry, where the monopoly of the Intel micro-processing chip has decreased spectacularly in duration with each new version. With its 386 microprocessor, Intel dominated the market for more than three years in the late 1980s. Ten years later its competitive edge lasted only three months with Pentium II. Even more dramatic, Pentium III was supplanted by AMD’s Athlon microprocessor after being on the market for only a few weeks.

In addition, in many fields the distance between basic science and technological application is narrowing or, in some cases, disappearing altogether. The implication is that pure and applied research is not separate any longer. Molecular biology and computer science are two salient examples of this evolution.

The results of a recent survey of technical innovation in US manufacturing firms underscore the strategic importance of academic research in the development of new industrial products and processes. On average, 19% of new products and 15% of new processes were directly based on academic research. The proportion was even higher, 44 and 37% respectively, in high technology industries such as pharmaceuticals, instruments and information processing.⁵ There is also a significant geographical dimension to this relation between academic research and industrial applications. This is underlined by a rich body of evidence on the impact of universities on regional development and the spillover effects of academic research on industrial research and technology and local innovation.⁶

Information and communication revolution

The third dimension of change is the information and communication revolution. The advent of printing in the 15th century brought about the first radical transformation in the way knowledge is kept and shared by people. Today, technological innovations are revolutionizing again the capacity to store, transmit, access and use information. Rapid progress in electronics, telecommunications and satellite technologies, permitting high capacity data transmission at very low cost, has resulted in the quasi abolition of physical distance. Sixty years ago a phone call from New York to London cost the equivalent of USD 300 per minute, today that same call costs only five cents per minute. In 1985, the cost of sending 45 million bits of information per second over one kilometer of optical fiber was close to 100 dollars; in 1997, it was possible to send 45 000 million bits per second at a cost of just 0.05 cents.⁷ For all practical purposes, there are no more logistical

barriers to information access and communication among people, institutions and countries.

IMPLICATIONS FOR HIGHER EDUCATION

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

What are the implications of these converging challenges for higher education systems and institutions? They herald: *i*) radical changes in training needs; *ii*) new forms of competition; and *iii*) new configurations and modes of operation for higher education institutions.

Changing training needs and demand patterns

To begin with, a trend towards higher and different skills has been observed in OECD countries and in the most advanced developing economies. In knowledge-driven economies, ever-greater numbers of workers and employees need higher level skills. This is confirmed by recent analyses of rates of return in a few Latin American countries (Argentina, Brazil and Mexico) which show a rising rate of return for tertiary education, a reversal of earlier trends in the 1970s and the 1980s.⁸ Moreover, in OECD countries, highly skilled white-collar employees account for 25 to 35% of the labor force.

The second dimension of change in education and training needs is the growing importance of continuing education needed to update knowledge and skills on a regular basis because of the short "shelf life" of knowledge. The traditional approach of studying for a discrete and finite period of time to acquire a first degree or to complete graduate education before moving on to professional life is being progressively replaced by practices of lifelong education. Training is becoming an integral part of one's working life, and takes place in a myriad of contexts: on the job, in specialized higher education institutions, or even at home. As Shakespeare wrote with prescience several centuries ago: "Learning is but an adjunct to ourselves, and where we are our learning likewise is."

In the medium term, this may lead to a progressive blurring between initial and continuing degree studies, as well as between young adult and mid-career training. Finland, one of the leading promoters of continuing education in Europe, is among the most advanced nations in terms of conceptualizing and organizing tertiary education along these new lines. Today, the country has more adults engaged in continuing education programs (200 000) than young people enrolled in regular higher education degree courses (150 000).

This evolution also means that, in the medium term, the primary clientele of universities will no longer be young high school graduates. Universities must now

organize themselves to accommodate the learning and training needs of a very diverse clientele: working students, mature students, stay-at-home students, traveling students, part-time students, day students, night students, weekend students, etc. One can expect a significant change in the demographic shape of higher education institutions, whereby the traditional structure of a pyramid with a majority of first degree students, a smaller group of post-graduate students, and finally an even smaller share of participants in continuing education programs will be replaced by an inverted pyramid with a minority of first time students, more students pursuing a second or third degree, and the majority of students enrolled in short term continuing education activities. Already in the United States, almost half of the student population consists of mature and part-time students, a dramatic shift from the previous generation. In Russia, part-time students represent 37% of total enrollment.

From the student's perspective, the desire to position oneself for the new types of jobs in the knowledge economy provides a strong incentive to mix study program options and qualifications, often beyond traditional institutional boundaries. New patterns of demand are emerging, whereby learners attend several institutions or programs in parallel or sequentially, thus defining their own skill profiles on the labor market.

Another important consequence of the acceleration of scientific and technological progress is the diminished emphasis in tertiary education programs on the learning of facts and basic data *per se*. There is a growing importance of what could be called *methodological knowledge* and skills, *i.e.* the ability to learn in an autonomous manner. Today in many disciplines, 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, access and apply knowledge to problem solving. In this new paradigm, where learning to learn, learning to transform information into new knowledge, and learning to transfer new knowledge into applications are more important than memorizing specific information, primacy is given to information seeking, analysis, the ability to reason, and problem-solving. In addition, competencies such as learning to work in teams, peer teaching, creativity, resourcefulness and the ability to adjust to change are also among the new skills which employers value in the knowledge economy.

The third dimension of change in training needs is the growing attractiveness of degrees and credentials with international recognition. In a global economy where 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 illustrated by the following examples:

- In the US, a rapidly growing number of online universities are reaching out to students in foreign countries. Jones International University, which already serves students in 38 countries, is the first online university in the world that has been formally accredited by the same agency that accredits traditional universities such as the University of Michigan or the University of Chicago.
- In Asia and Eastern Europe, there has been a proliferation of so-called overseas “validated courses” offered by franchise institutions operating on behalf of British 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.
- Hundreds of thousands of students in Commonwealth countries take each year exams organized by UK Examination Boards such as the Institute of Commerce and Management or the London Chamber of Commerce and Institute.⁹
- In the Middle East, the American universities of Beirut and Cairo attract significant numbers of young people eager to earn a US degree.
- In China, one of the fastest growing private education institutions is a school specializing in preparatory courses for American colleges, called the New Oriental School, which already boasts 50 000 students in Beijing alone.¹⁰
- In Germany, where higher education is predominantly public, a number of private business schools have been recently established, either as independent institutions or subsidiaries of existing public universities. Following the example of a rapidly growing number of MBAs in the Netherlands and France, programs in these schools are taught in English and international students are actively sought.

New forms of competition

The decreased importance of physical distance means that the best universities of any country can decide to open a branch anywhere in the world or to reach out across borders using the Internet or satellite communication links, effectively competing with any national university on its own territory. The President of the University of Maryland wrote an article of complaint in the Washington Post in April 1999, vehemently protesting the opening of a branch of the University of Phoenix in Maryland. The California-based University of Phoenix, one of the most dynamic distance universities in the US, uses an incentive system to reward professors on the basis of the labor market outcomes of graduates and boasts an enrollment of 68 000 students. The British Open University has inundated Canadian students with Internet messages saying more or less “we’ll give you degrees and we don’t really care if they’re recognized in Canada because they’re recognized by

Cambridge and Oxford. And we'll do it at one-tenth the cost".¹¹ It is estimated that, in the US alone, there are already more than 3 000 specialized institutions dedicated to online training. Thirty-three states in the US have a statewide virtual university; and 85% of the community colleges are expected to offer distance education courses by 2002.¹² Distance education is sometimes delivered by a specialized institution set up by an alliance of universities, as is the case with Western Governor University in the US and the Open Learning Agency in British Columbia. The proportion of US universities with distance education courses has grown from 34% in 1997-98 to about 50% in academic year 1999-2000, public universities being much more advanced than private ones in this regard.¹³ The Mexican Virtual University of Monterrey offers 15 master's programs using teleconferencing and the Internet that reach 50 000 students in 1 450 learning centers throughout Mexico and 116 spread all over Latin America. In Thailand and Turkey, the national open universities enroll respectively 41 and 38% of the total student population in each country.

Corporate universities are another form of competition which traditional universities will increasingly have to reckon with, especially in the area of continuing education. It is estimated that there are about 1 600 institutions in the world functioning today as corporate universities, up from 400 ten years ago. Two significant examples of successful corporate universities are those of Motorola and IBM. Recognized as one of the most successful corporate universities in benchmarking exercises, Motorola University, which operates with a yearly budget of 120 million dollars representing almost 4% of its annual payroll, manages 99 learning and training sites in 21 countries.¹⁴ IBM's corporate university, one of the largest in the world, is a virtual institution employing 3 400 professionals in 55 countries and offering more than 10 000 courses through Intranet and satellite links. The 1999 recipients of the Corporate University Awards sponsored by the *Financial Times*, which recognize the most innovative corporate university initiatives of the year, were TVA University, IDX Institute of Technology, Dell Learning, IBM Corporate University and ST University.¹⁵

Corporate universities operate under one of any combination of the following three modalities: *i*) with their own network of physical campuses (*e.g.* Disney, Toyota and Motorola); *ii*) as a virtual university (*e.g.* IBM, Dow Chemical); or *iii*) through an alliance with existing higher education institutions (*e.g.* Bell Atlantic, United HealthCare, United Technologies). A few corporate universities, such as the Rand Graduate School of Policy Studies and the Arthur D. Little School of Management, have been officially accredited and enjoy the authority to grant formal degrees. Experts are predicting that, by the year 2010, there will be more corporate universities than traditional campus-based universities in the world, and an increasing proportion of them will be serving smaller companies rather than corporate giants.

The third form of unconventional competition comes from the new “academic brokers”, virtual entrepreneurs who specialize in bringing together suppliers and consumers of educational services. A few examples can be mentioned to illustrate this new trend:

- Companies like 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.¹⁶
- Rennselaer Polytechnic Institute coordinates and delivers degree programs from Boston University, Carnegie Mellon, Stanford University and MIT for the employees of United HealthCare and United Technologies.¹⁷
- Nexus, a UK based company advertising itself as the “world’s largest international student recruitment media company”, organizes fairs in many East Asian and Latin American countries, bringing together higher education institutions and students interested in overseas studies.
- Web sites like HungryMinds.com and CollegeLearning.com act as clearing-houses between schools and prospective students.
- ECollegebid, a consortium of colleges and universities, matches student objectives and ability to pay for an education with the willingness of a tertiary institution to offer tuition discounts.

At the shadier extreme of the academic brokering industry, one finds Internet-based essay mills offering to help students with their college assignments. Defended by their promoters as useful and harmless research tools, they are under attack from the academic community who decries their capacity to increase plagiarism and cheating.

Some “traditional” higher education institutions have been quick to catch onto the potential of education and training brokering arrangements. St-Petersburg Junior College recently entered into a partnership with Florida State University, the University of Central Florida and the UK Open University to offer four-year degree programs at some of its sites.¹⁸ The University of California at Santa Cruz, having set up its own corporate training department ten years ago right in the middle of Silicon Valley, has established successful partnerships with a number of corporate universities, notably those operated by GE and Sun Microsystems, even managing to attract additional state funding on a matching grant basis.¹⁹

The emergence of these new forms of competition is likely to change the nature of quality assurance bodies, mechanisms and criteria. It is doubtful that the philosophy, principles and standards routinely applied to evaluate or accredit campus-based programs can be used without significant adjustments to assess the quality and effectiveness of online courses and other modalities of distance education.

Appropriate and reliable accreditation and evaluation processes are needed to reassure 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 on the capabilities of graduates. Such a shift would reflect the results of effective teamwork among designers of pedagogical support materials, facilitators of resource-based course delivery, mentors of students, and evaluators of learning outcomes. Western Governors University's initiative to move to competency-based evaluations performed by an independent agency has created an interesting precedent, which may ultimately induce change in evaluation methods used by traditional universities.

At the national level, higher education authorities are increasingly challenged by the availability of foreign programs through distance education, franchise institutions and online courses. Very few developing nations have an established accreditation and evaluation system, let alone do they have access to the necessary information on these foreign programs or enjoy the institutional monitoring capacity to be able to detect fraud and protect their students from low quality offerings. Many Latin American countries, for example, find themselves in the awkward situation of having more distance education doctoral programs proposed by Spanish universities than conventional doctoral programs offered in their national universities. The presence of foreign universities is perceived as a threat even in some industrialized countries. In Australia, for example, the registration of the Hawaii-based Greenwich University on Norfolk Island in early 2000 has provoked a national controversy and prompted the Federal Government to establish the nation's first quality assessment agency (the Australian Universities Quality Agency):

“Distance learning is a world of extremes, when you look at the best university education around the world, some of it is now distance learning, when you look for the worst, all of it is distance learning. Bad distance learning may now be given a new lease on life by the brave new world of online teaching.”²⁰

For those countries which cannot afford to develop their own information system, there is always the possibility of participating in international accreditation and evaluation networks. Another option, following the recent initiative of Singapore and Hong Kong, is to demand from foreign tertiary education institutions that they meet the same quality assurance requirements and offer the same degree equivalence as those prevailing in the parent institution in the country of origin.

Changes in structures and modes of operation

Faced with new training needs and new competitive challenges, many universities need to undertake drastic transformations in governance, organisational structure and modes of operation.

A key aspect will be the ability of universities to organize traditional disciplines differently, taking into consideration the emergence of new scientific and technological fields. Among the most significant ones, it is worth mentioning molecular biology and biotechnology, advanced materials science, microelectronics, information systems, robotics, intelligent systems and neuroscience, and environmental science and technology. Training and research for these fields require the integration of a number of disciplines which have not necessarily been in close contact previously, resulting in the multiplication of inter- and multidisciplinary programs cutting across traditional institutional barriers. For example, the study of molecular devices and sensors, within the wider framework of molecular biology and biotechnology, brings together specialists in electronics, materials science, chemistry and biology to achieve greater synergy. Imaging technology and medical science have become closely articulated. Universities all over the world are restructuring their programs to adapt to these changes:

- At the University of Glasgow, physicians and mechanical engineers conduct research together in the field of control engineering, trying to develop technologies to help paraplegic patients.
- In Denmark, environmental science programs are taught by a group of specialists who include not only scientists and engineers but also theologians and political scientists responsible for teaching the relevant ethical and political economy dimensions. At Roskilde University near Copenhagen, traditional departmental borders were removed in the late 1980s. Chemistry and life sciences are part of a single multidisciplinary department, as are mathematics and physics or technology and social sciences. In each department, the educational experience of undergraduate students follows a project-based learning approach.
- George Mason University in Virginia started what is called the New Century College with a bachelor's degree in Interdisciplinary Studies as its main academic program.
- The University of Illinois at Urbana-Champaign and the University of Southern California have developed the "Team Engineering Analysis and Modeling" methodology based on the collaboration of researchers from a broad spectrum of the engineering and social sciences.
- The University of Warsaw's newly established Collegium for Interdepartmental Studies, which offers individually tailored undergraduate programs, is Poland's first attempt at interdisciplinary education.²¹

The new patterns of knowledge creation do not imply only a reconfiguration of departments into a different institutional map but more importantly the reorganisation 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 what experts call “transdisciplinarity”, with distinct theoretical structures and research methods.²² McMaster University in Ontario, Canada, and the University of Maastricht in Holland were among the first universities to introduce problem-based learning in their medical and engineering programs in the 1970s. The University of British Columbia is promoting “research-based learning”, an approach linking undergraduate students to research teams with extensive reliance on information technology for basic course information. Waterloo University in Western Ontario earned a high reputation for its engineering degrees – considered among the best in the country – through the successful development of cooperative programs that integrate in-school and on-the-job training. Such innovations have helped that institution achieve what the Cambridge mathematician Alfred North Whitehead described, many decades ago, as the noble mission of the university:

“The tragedy of the world is that those who are imaginative have but slight experience, and those who are experienced have feeble imaginations. Fools act on imagination without experience. Pedants act on knowledge without imagination. The task of the university is to weld together imagination and experience.”

Even Ph. D. programs may be affected by this trend towards increased multidisciplinary. Proponents of a reform of doctoral education in the US predict that Ph. D. students will be less involved in the production of new knowledge and more on contributing to the circulation of knowledge across traditional disciplinary boundaries.

Realigning universities on the basis of inter- and multi-disciplinary learning and research themes does not imply only changes in program and curriculum design, but also significant modifications in the planning and organisation of the laboratory and workshop infrastructure. From the Georgia Institute of Technology comes a successful experience in developing an interdisciplinary mechatronics laboratory serving the needs of students in electrical, mechanical, industrial, computer and other engineering departments in a cost-effective manner.²³ A unique partnership bringing together Penn State University, the University of Puerto Rico-Mayaguez, the University of Washington and Sandia National Laboratories has permitted the establishment of “Learning Factory” facilities across the partner schools which allow teams of students from industrial, mechanical, electrical, chemical engineering and business administration to work on interdisciplinary projects.²⁴

The use of modern technology has just begun to revolutionize the way teaching and learning occur. The concurrent use of multimedia and computers permits the development of new pedagogical approaches involving active and interactive learning. Frontal teaching can be replaced by or associated with asynchronous

teaching in the form of online classes that can be either scheduled or self-paced. With a proper integration of technology in the curriculum, teachers can move away from their traditional role as one-way instructors towards becoming facilitators of learning. Examples of pedagogical innovations relying on information technology come from all parts of the world:

- In Brazil, a few schools of medicine and engineering in federal universities have been experimenting with the use of computer-based programs to teach mathematics in first and second year, rather than having students attend regular classes. This change in pedagogical approach has resulted in a remarkable decrease in dropout rates from 70 to 30%.
- In Australia, the University of Newcastle led the way in the use of a problem-learning approach in medical education.
- The University of Southern Denmark has cut dropout rates in its business administration program in half by replacing traditional teaching with project-based learning.²⁵
- The Colorado Community College system is pioneering a two-year degree which is taught entirely online.
- In 1999, for the first time, a course of comparative education was taught simultaneously and interactively to groups of students in two separate New York State universities, SUNY Buffalo and SUNY Albany, combining video-conferences through satellite links and Internet sessions. This is also common practice at the University of Highlands and Islands in Scotland.
- St-Petersburg Junior College, Florida's oldest community college, has pioneered the use of two-way interactive video systems to regain the distance learning market invaded by institutions like the University of Phoenix.

In a pioneer study conducted at the beginning of the 1990s, two professors at the University of Michigan, Kozma and Johnson, analyzed several ways in which information technology could play a catalytic role in enriching the teaching and learning experience. They suggested a new pedagogical model involving: *i*) active engagement of the students rather than passive reception of information; *ii*) opportunities to apply new knowledge to real-life situations; *iii*) the ability to represent concepts and knowledge in multiple ways rather than just with text; *iv*) the use of computers to achieve mastery of skills rather than superficial acquaintance; *v*) learning as a collaborative activity rather than an individual act; and *vi*) an emphasis on learning processes rather than memorization of information.²⁶ Obviously, the new model calls for new ways of evaluating learning processes and outcomes.

However, 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 in

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 offers a few cautionary warnings.²⁷ Quality online education is best achieved with relatively small class sizes, not to exceed 30 students. Moreover, it does not seem desirable to teach an entire undergraduate degree program only with 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 requirements apply also to the design and delivery of distance education programs which need to match learning objectives and appropriate technology support. In scientific fields like engineering, for example, the need for practical training is often overlooked. Computer simulations alone cannot replace all forms of applied training. In many science and technology-oriented programs, hands-on activities in laboratories and workshops remain an indispensable constituent of effective learning.

Technological change does affect only pedagogy. The information and communication revolution also has far-reaching implications for how universities are organized and deliver services. Already in the United States new universities are designed and constructed without a library building because all students are expected to use computers to access online digital libraries and data bases. Tertiary institutions with virtual libraries can join the recently established Online College Library Center which offers inter-library loans of digitized documents on the Internet. Even in traditional libraries, CD-ROMs can replace journal collections. Cornell University, for example, has created the “Essential Electronic Agricultural Library”, which consists of a collection of 173 CD-ROMs storing text from 140 journals for the past four years that can be shared with libraries at universities in developing country.

Wiring and Internet connectivity are thus becoming an important determinant of the attractiveness of a higher education institution. This is reflected by the recent publication, for the second consecutive year, of the results of a ranking survey which assesses US universities on the basis of their computer and communication infrastructure and their level of Internet use for pedagogical and administrative purposes. Case Western Reserve University, MIT and Wake Forest University were judged as the 1999 leaders in applying online services on campus²⁸. Case Western has established, in partnership with the Xerox corporation, an electronic network of 9 000 miles of cable and 15 000 information ports to dispense learning resources to students and faculty irrespective of their physical location. In 2000, Carnegie Mellon University came on top of the list, in recognition for its wireless campus network and its 11 000 networked computers. An increasing number of tertiary

institutions, like Mount St. Mary College in New York State and Drexel University in Pennsylvania, have become entirely “wireless”, taking the lead in installing high-speed wireless networks covering the whole campus.

The mushrooming of virtual institutions, online education programs and web-based courses raises challenging issues of intellectual property rights and academic freedom with respect to ownership and control of education materials developed exclusively for online or other multimedia dissemination channels. The lack of clarity on the definition of ownership rights and rules for usage of new education materials is likely to pit academics against their home institutions or against the institution contracting them to prepare course materials for online dissemination or broadcasting. Recent controversies illustrate the range of potential difficulties involved in regulating these new activities. In November 1999, a Harvard School of Law professor was reprimanded by Harvard administrators for selling videotaped lectures to Concord University School of Law, an online degree granting institution. An Arizona professor who developed a televised writing course for Pima Community College a few years ago has become a celebrity on local television, but has not had any success in getting the College to acknowledge copyrights for broadcasting, year after year, the videotapes he prepared. The ownership of online courses has become one of the most problematic issues debated in the negotiations for the renewal of the collective bargaining agreement with faculty members. The University of Texas system recognizes ownership of web courses by their creators, unless both parties accept beforehand that someone is hired for the sole purpose of writing an online course. In contrast, Burlington County College in New Jersey claims sole ownership of all online courses created on campus.²⁹

Several economic factors weigh heavily in favor of the widespread adoption of electronic modes of organisation and delivery of tertiary education services. The fiscal crisis faced by most countries, rich and poor alike, the rapid growth in the cost of higher education institutions in industrialized countries, especially in the US, as well as the growing demand for tertiary education in developing nations and in the former socialist countries of Eastern Europe and Central Asia all make it a necessity to find more cost-effective alternatives to traditional models of higher education. The cost of producing a graduate from the UK Open University is about one-third that at a regular university. The cost of the Cornell electronic agricultural library mentioned earlier is about 10 000 dollars, as compared to the 375 000 dollars it would cost any university to buy all the scientific journals included in the electronic database.³⁰ Yet, this differential can be somewhat misleading. University administrators must also keep in mind the high cost of information technology and infrastructure which includes not only the initial capital outlays required to follow the advanced information and communication technology path, but also the recurrent budget outlays needed for expenditures on infrastructure maintenance, training,

and technical support. It is estimated that these recurrent costs can represent as much as 75% of the life cycle costs of technology investments. These cost dimensions have very serious implications in terms of growing digital divide among institutions within any country as well as across nations.

To be able to adapt to this changing environment, flexibility is very important. Increasingly, tertiary education institutions need the capacity to react swiftly by establishing new programs, reconfiguring existing ones, and eliminating outdated programs without being hampered by bureaucratic regulations and obstacles. But in many countries and institutions, administrative procedures are very rigid when it comes to making changes in academic structure, programs or mode of operation. In Uruguay, for instance, it is only when confronted in the mid-1990s with competition from new private universities that the venerable University of the Republic – which for 150 years had exercised a monopoly over higher education in the country – started a strategic planning process and considered establishing post-graduate programs for the first time. Another example of institutional inflexibility occurred in Venezuela, where a dynamic private business administration institute called IESA had to wait several years to receive the official approval from the Council of Rectors for a new MBA program designed and delivered jointly with the Harvard Business School. The Brazilian Institute of Applied Technology (ITA), the most prestigious private engineering school in that country had similar problems getting accredited. In Nicaragua, the recently established University of Mobile from Alabama State has been denied a license to operate by the Council of Rectors keen on protecting the Nicaraguan public universities from foreign competition. In Romania, CODECS, the first distance education institution of the country created in the early 1990s, has had a hard time getting recognition of its degrees by the national higher education authorities. The only way it was able to achieve it was in an indirect manner, by forging an alliance with the UK Open University whose degrees are recognized in Romania. Finally, at a recent meeting of the International Association of Management Education (April 2000), leaders of business schools expressed alarm at the slow and bureaucratic response of their institutions to technological advances and labor market changes. For example, at Haas School of Business (University of California, Berkeley), it took five years to approve a new master's degree in financial engineering, by which time many competitors had already started to offer similar programs.³¹

To increase flexibility in the design and organisation of academic programs, many higher education institutions throughout the world have adopted the US standard of credit-based courses. This evolution has affected entire national university systems, as in the case of Thailand, or a network of institutions in a country, such as the Indian Institutes of Technology, or a single institution, such as the University of Niger.³² The New Bulgarian University, one of Eastern Europe's most dynamic young private universities, is the first university in that country operating

with a full academic credit system. In a historic meeting in Bologna in June 1999, the Ministers of Higher Education from 29 European countries committed themselves to the introduction of the credit system in their respective university system and the establishment of a European Credit Accumulation and Transfer System (EURO CATS).

Higher education institutions are also changing their pattern of admission to respond in a more flexible way to growing student demand. In 1999, for the first time in the US, 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, similarly, a spring college entrance examination was held for the first time in January 2000, marking a sea change in the history of that country's entrance examination system. Students who fail the traditional July examination will no longer have to wait a full year anymore to get a second chance.

Effective labor market feedback mechanisms, such as tracer surveys and regular consultations with employers and alumni, are indispensable for the purpose of adjusting curricula to meet the changing needs of industry. In Denmark, industry representatives, including presidents of large companies, commonly sit on departmental boards in universities to advise them on training and research priorities. Of course, there is no better linkage than when a new higher education institution is fully integrated into a regional development strategy as 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 very close to the Arctic circle. Its growth attests to the successful transformation of a small rural community 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.³³ Palack University, in the Czech city of Olomouc, has received praise for its efforts to develop new law courses in response to the retraining needs generated by the reform of the legal system. The Michigan Virtual Automotive College is a focused learning partnership bringing together the State government of Michigan, the Detroit car industry, Michigan State University and the University of Michigan.

An interesting example of willingness to change and adapt the curriculum and programs on a regular basis is provided by the University of South Florida in Tampa, one of the relatively younger public universities in the US. The engineering department offers its graduates a five-year warranty not unlike the standard warranty against manufacturing defects, which comes with any consumer good. If at any time during the five years following graduation an alumnus/a is required to apply skills in his/her work but had not received the requisite training during the time of studies at the university, he or she can re-enroll free of charge to acquire these skills. Along the same lines, a university could very well envisage to achieve the dual objective of strengthening its financial sustainability and keeping its programs

up-to-date by selling a “training for life” package. Under such a scheme new students would sign up and pay not only for their initial professional education, but also for all the retraining periods required throughout their professional career. Operating in the same geographical area as the University of South Florida, St - Petersburg Junior College boasts the ability to create a new program in just a few months to answer new educational needs in the local community.³⁴

At the same time, the need for more flexibility calls into question traditional modes and patterns of academic appointments and careers. In almost all countries, the administrative status of public university professors has usually been similar or very close to that of civil servants, with the benefit of strong employment guarantees and promotion based on seniority. In many private universities, especially in the US, tenured appointments involve equivalent arrangements. Moreover, it has commonly been assumed that the presence of full-time professors was a key determinant of quality. In many Latin American countries for instance, where private higher education represents a significant proportion of overall enrollment – or even the majority as in Brazil, Colombia, the Dominican Republic, El Salvador and Chile – one of the principal evaluation criteria applied by the accreditation authorities is the number of full-time professors. In Poland, when a new funding formula was introduced at the beginning of the 1990s to prop up quality in public universities, one of the main two parameters of the funding equation was the number of full-time professors with a doctorate.

But the need for higher education institutions to be able to respond rapidly to changing labor market signals and to adjust swiftly to technological change may require more flexible arrangements for the deployment of academic staff and evaluation of its performance, including moving away from civil service regulations and abandoning tenure-track appointments. In Tunisia, an important dimension of the reform that initiated the successful establishment of a network of non-university technology institutes (*Instituts Supérieurs des Études Technologiques*) at the beginning of the 1990s was a recruitment and remuneration scheme that would permit the full recognition of relevant professional experience and knowledge independently from the rigid rules about academic qualifications in force in the national universities. In Poland, university leaders have come to realize that over-reliance on full-time professors did not allow the flexibility of recruitment, as part-time lecturers, of practitioners required in key scientific disciplines. At the Technology University of Warsaw, for example, the impossibility of offering adequate remuneration to qualified computer science specialists from the private sector is now seen as a major obstacle.³⁵ Even in the United States, modifications to traditional tenure practices are under consideration. A recent report prepared by the American Association of University Professors looks at possible changes such as “tenure by objectives”, which involves a reconfiguration of the probationary period, post-tenure reviews that would put more emphasis on departmental than on individual

performance, and guarantees of academic freedom independent of tenure.³⁶ Some of these changes are already being piloted in a number of universities.

CONCLUSION

"We live in an era where everything is possible and nothing is certain." Vaclav Havel, former playwright, President of the Czech Republic

Higher education is facing unprecedented challenges at the start of the 21st century, under the impact of globalization, knowledge-based economic growth, as well as the information and communication revolution. These momentous changes in the environment are stretching the traditional boundaries of higher education. The time dimension is altered by the requirement for lifelong learning while new technologies are doing away with space barriers altogether.

These challenges can be seen equally as terrible threats or tremendous opportunities for the world of higher education. Some observers have gone as far as predicting the end of the traditional university as we know it, seeing open and online universities as the only cost-effective answer to the massification challenge faced by many countries:

"Universities won't survive... Higher education is in deep crisis. Already we are beginning to deliver more lectures off-campus via satellite or two-way video at a fraction of the cost. The college campus won't survive as a residential institution. Today's buildings are hopelessly unsuited and totally unneeded".³⁷

Whether we are actually about to witness the disappearance of classical universities altogether or its radical transformation as distance education progressively replaces campus-based teaching and learning, remains to be seen:

"... Many universities may die or may change beyond recognition as a result of the IT revolution. When asked what his light bulb would mean for the candle industry, Thomas Edison reportedly replied, 'We will make electricity so cheap that only the rich will burn candles.' We are entering an era in which most colleges and universities must decide whether to change a little (and thus remain in the academic candle industry) or a lot (and launch themselves into the academic electrical business)".³⁸

What is certain is that the hegemony of traditional universities has been definitively challenged and that institutional differentiation is bound to accelerate, resulting in a greater variety of organisational configurations and patterns, with the emergence of a myriad of alliances, linkages and partnerships within tertiary institutions, across institutions, and even reaching beyond the higher education sector. The recently announced alliance between MIT and Cambridge University, with financial support from the British government and private industry, is a symbolic illustration of these new trends. It is however likely, under any

scenario, that traditional universities will continue to play a major role, especially in advanced training and research, but they will undoubtedly undergo significant transformations prompted by the application of new education technologies and the pressure of market forces. A summary list of key questions and challenges associated with the new trends discussed in this document is presented as Annex.

Countries and higher education institutions willing to take advantage of these new opportunities cannot afford to remain passive, but must be proactive in launching meaningful reforms and innovations. While there is no rigid blueprint for all countries and institutions, a common prerequisite may be the need to formulate a clear vision of how the higher education system can most effectively contribute to the development of a knowledge-based economy, how each institution elects to evolve within that system, and under what conditions the new technologies can be harnessed to improve the effectiveness and relevance of the learning experience. Preparation of the Dearing Report in the UK, the work of the National Commission for Higher Education Reform in South Africa, the Tertiary Education Green Paper in New Zealand, and the Plan for the University of the Third Millennium in France are recent examples of attempts to develop a such vision at the national level, as a tribute to the wise words of the Roman philosopher, Seneca, who cautioned us two millennia ago that “there is no favorable wind for those who do not know where they are going”. Washington State’s Master Plan for Higher Education, released in January 2000, proposes a strategy to absorb the anticipated rapid growth of the demand for tertiary education which relies heavily on the development of online education programs.³⁹

Strategic planning exercises undertaken by individual tertiary institutions serve a similar purpose. By identifying both favorable and harmful trends in their immediate environment and linking them to a rigorous assessment of their internal strengths and weaknesses, institutions can better define their mission, market niche and medium-term development objectives and formulate concrete plans to achieve these objectives. For example, the exceptional growth of the University of Phoenix in recent years has been the result of a well-thought strategy involving a business model of university governance and management, a targeted clientele of working adults, a small number of professionally oriented programs, flexible arrangements to give credit for prior knowledge and experience, extensive use of education technology, and reliance on part-time, low-paid teachers well trained in technology-based pedagogy.⁴⁰ By contrast, for lack of strategic planning, many new distance education institutions have adopted inappropriate technologies, failing to assess their adequacy against the purpose of their programs, the competency of their professors and the learning needs of their students. It is also important to stress that strategic planning and reforms are not a one-time exercise, but that the more successful organisations, in the business world as in the academic world, are

those who are relentless in challenging themselves in the pursuit of better and more effective ways of responding to the needs of their clients.

A final word of caution is warranted to signal the danger of focusing exclusively on the implacable logic of technical change and globalization. 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 necessary to live as responsible citizens in complex democratic societies. The small private University of Monterrey in Northern Mexico has been able to compete effectively with the neighboring Technology Institute of Monterrey because of its deliberate inclusion of community-related courses and activities stimulating the development of appropriate values and social skills among students. A meaningful education for the 21st century should stimulate all aspects of human intellectual potential. It should not focus only on giving access to global knowledge, but also uphold the richness of local cultures and values, in support of which time-honored disciplines like philosophy, literature, arts and social sciences will continue to remain essential. This overarching objective was artfully reemphasized by US Supreme Court Justice Antonin Scalia in a speech at the 1998 graduating ceremony of William and Mary College in Virginia:

“Brains and learning, like muscle and physical skill, are articles of commerce. They are bought and sold. You can hire them by the year or by the hour. The only thing in the world not for sale is character. And if that does not govern and direct your brains and learning, they will do you and the world more harm than good.”

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Annex I

What Can Go Wrong with the New Tertiary Education Scenario?

Problems with the education and training experience

- How to promote sufficient direct communication and human interaction on wired campuses and in web-based courses, in order to build up critical thinking and social learning? What is an appropriate mix of face-to-face and online teaching?
- Faced with many program configurations and course options to choose from, how can students construct an adequate academic path on their own?
- Is there too much emphasis on science and technology programs? What are the prospects for humanities and social sciences? How can students acquire the values needed to live as a responsible citizen?
- How can online students benefit from the international dimension of foreign studies (immersion in different culture)?

Problems of academic management

- What type of mechanisms and arrangements are desirable and effective to introduce flexibility and strengthen the capacity to change, adapt and innovate rapidly?
- How can stability be maintained in an ever-changing environment?
- How to promote inter-disciplinarity across traditional faculty and program boundaries?
- How to organize programs and courses for part-time students (integration into regular programs vs. organisation of separate programs)?

Problems with the use of technology

- How to choose technologies adapted to the curricular and pedagogical objectives of the programs?
- What is the appropriate balance between “high tech” and “high touch” (degree of human interaction as counterbalancing human response to the use of technology)?*
- How to avoid over-reliance on technological gimmicks and loss of hands-on training opportunities?
- How to preserve linguistic and cultural identity as communication in a major world language becomes more and more imperative?

*The concept of “high tech” and “high touch” was introduced by John Naisbitt in his 1982 book *Megatrends: Ten New Direction Transforming our Lives*, Warner Books, New York.

Problems of financing

- How to finance the new educational technologies and related infrastructures in a sustainable way? How to prevent a growing digital divide among institutions and across countries?

Problems of governance

- How can universities with a decentralized set-up (autonomous faculties and departments) undertake the type of comprehensive change required by the new challenges?

Problems with quality assurance

- What evaluation and accreditation mechanisms and methods are appropriate for online and distance education programs?
- What evaluation methodology should be used to assess programs that involve a heavy use of information technology?
- How can national authorities exercise quality control over foreign institutions established in their countries?
- How can students access current information on the quality of online institutions and programs?
- How to organize and regulate credit transfer arrangements between campus-based and virtual universities, as well as among virtual tertiary institutions?
- How to maintain academic standards for part-time students?
- How to conciliate the demand for rapid program and course development and the need for careful quality review?

Problems of intellectual property

- How to define and protect intellectual property rights in the case of educational materials prepared specifically for online use? Who owns online courses? How should their use be regulated?
- How to reconcile the intellectual property rights and academic freedom of professors with the rights and interests of their home institutions?

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