The Capacity Building Challenge in Developing Countries: Role and Importance of Tertiary Education and Research

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Introduction

Welcome to the university of the future… All visitors will be greeted by a robot receptionist. Incoming students will receive a free ipod, a Blackberry, a laptop and a bicycle. Students in need of financial aid will compete for scholarships auctioned online on Ebay. In the university of the future, each student will have an individualized program to suit his / her specific career plans or study interests. Courses will be systematically redesigned every two years. The validity of degrees will be only five years. Most students will enroll at the same time in at least two or three tertiary education institutions to get credits towards their degree. Most courses will be online, through dynamic interaction with web-based cognitive tutors based on artificial intelligence. In the university of the future, there will be no physical library or laboratories, only e-libraries and i-labs. Daily communications from the university administration will be transmitted through SMS sent directly to the students' cellular phones. Students who graduate on time will get a $500 cash reward, whereas graduates who don't find a suitable job within six months of graduating will be reimbursed the full cost of their studies. To stimulate institutional responsiveness and relevance, the university president will tax each department at the beginning of the academic period and award the most innovative department a one million dollar prize at the end of the period. Professors will receive a bonus based on the labor market outcomes of their students. Overall, the university will receive only 10% of its income from the government. The most sought after program will not be the MBA anymore, but the Master in Fine Arts recognized for creativity skills imparted to future industry leaders.

While this description of the university of the future may seem like an improbable science fiction dream to some, or a terrifying nightmare to others, each element mentioned above can actually be found in some form among today's universities. These futuristic features are symbolic of the rapid transformation affecting tertiary education in the industrial world. In the past few years, many countries have witnessed significant transformations and reforms in their tertiary 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 at this impressive speed everywhere. Most developing countries continue to wrestle with difficulties produced by inadequate responses to long standing challenges. Among these unresolved challenges are the sustainable expansion of tertiary education coverage, the reduction of inequalities of access and outcomes, the improvement of educational quality and relevance, and the introduction of more effective governance structures and management practices.

And yet, having strong and dynamic tertiary education institutions has never been as essential for developing countries faced with the need to accelerate economic growth and reduce poverty. In this context, the paper focuses on the capacity building role of tertiary education. It starts by recognizing the importance of knowledge for developing countries in the pursuit of better economic and social outcomes. It then outlines the changing education and training needs arising from increased reliance on knowledge. The third section describes the rapidly evolving tertiary education landscape. In the final section, the paper examines the opportunities and challenges brought about by these new developments.

Growing Importance of Knowledge for Developing Countries

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. Today, economic growth is as much a process of knowledge accumulation as of capital accumulation. It is estimated, for instance, 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.[1]

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" are added to the Chemical Abstracts data base every year, compared to less than 10,000 a year in the late 1960s.

In addition to stimulating economic growth through increased productivity resulting from innovation, knowledge contributes to poverty reduction and facilitates the achievement of most of the Millennium Development Goals.

> *"Science, technology and innovation underpin every [Millennium Development] goal. It is impossible to think of making gains in concerns to health and environment without a focused Science, Technology and Innovation (STI) policy, yet it is equally true that a well-articulated STI policy can make huge gains in education, gender equality or upgrading of living conditions."*
> *(UN Science, Technology and Innovation MDG Task Force Interim Report, December 2003)*

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[1] Banker, R. , Chang, H., and S. Majumdar (1998). *Economies of Scope in the U.S. Telecommunications Industry*, Information Economics and Policy. Volume 10 No. 2, June 1998, pp. 253-72.

Drastic progress in agricultural output, for example, comes from the application of the Green Revolution. Similarly, remarkable advances in the resolution of health issues are owed to the application of scientific knowledge and the work of highly qualified health personnel. Simple GPS handheld devices can now be used easily to find water in drought stricken areas. All countries also need the scientific capacity to understand critical issues such as global warming, the pros and cons of using genetically modified crops, or the ethical dimensions of cloning. Finally, progress in seismology, vulcanology and climatology has enhanced the ability to anticipate and prepare for natural disasters like floods, tsunamis and droughts. The existence of a tsunami warning system around the Indian Ocean, similar to the one already in place around the Pacific Rim, would undoubtedly have saved thousands of lives on December 26, 2004.

A direct product of the application of science and technology 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. For all practical purposes, there are no more logistical barriers to information access and communication among people, institutions and countries

Changing Education and Training Needs

A trend towards higher and different skills has been observed in OECD countries and in the most advanced developing economies, as a result of increased competition in the labor market and rapid change in economic structures. 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.[2] Moreover, in OECD countries, highly skilled white collar employees account for 25 to 35 percent of the labor force.

A second, related dimension of change is the *need to train young people to be flexible and to acquire the capacity to adapt easily to a rapidly changing world*. Recent research carried out by Levy and Murnane on the skills requirements for the tasks performed in the US labor market shows the types of skills for which there is less demand or which have been taken over by computers and those for

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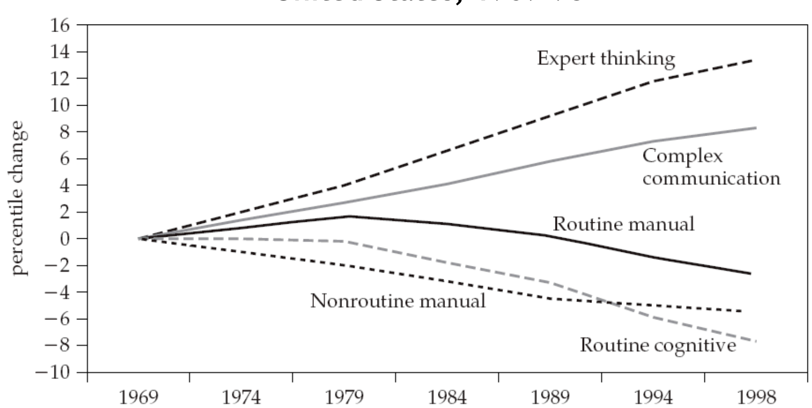
2 Lächler, U. (1997). *Education and Earnings Inequality in Mexico*, The World Bank, unpublished paper. Pessino, C. (1995). *Returns to Education in Greater Buenos Aires 1986-1993: From Hyperinflation to Stabilization*. Centro de Estudios Macroeconómicos de Argentina, working paper 104 (June). Barros, R. and L. Ramos (1996). *Temporal Evolution of the Relationship between Wages and Education of Brazilian Men*. In Birdsall, N. and R. H. Sabot, eds.. Washington, D.C.: Inter-American Development Bank / The Johns Hopkins University Press.

which there has been increased demand.[3] In their path-breaking study, the authors divided the tasks performed in firms into five broad categories:

- *Expert thinking:* solving problems for which there are no rule-based solutions, such as diagnosing the illness of a patient whose symptoms are out of the ordinary;
- *Complex communication:* interacting with others to acquire information, to explain it, or to persuade others of its implications for action; for example, a manager motivating the people whose work he/ she supervises;
- *Routine cognitive tasks:* mental tasks that are well described by logical rules, such as maintaining expense reports;
- *Routine manual tasks:* physical tasks that can be well described using rules, such as installing windshields on new vehicles in automobile assembly plants; and
- *Non-routine manual tasks:* physical tasks that cannot be well described as following a set of "if-then-do" rules and that are difficult to computerize because they require optical recognition and fine muscle control; for example, driving a truck.

The figure below shows trends for each type of task. Tasks requiring expert thinking and complex communication grew steadily and consistently during the 1970s, 1980s, and 1990s. The share of the labor force employed in occupations that emphasize routine cognitive or routine manual tasks remained stable in the 1970s and then declined over the next two decades. Finally, the share of the labor force working in occupations that emphasize non-routine manual tasks declined throughout the period.

Economy-wide Measures of Routine and Non Routine Task Inputs
United States, 1969–98



Source: Reproduced from Levy and Murnane (2004), p. 50, figure 3.5.

Note: Each trend reflects changes in the numbers of people employed in occupations emphasizing that task. To facilitate comparison, the importance of each task in the US

[3] Levy, Frank, and Richard Murnane (2004). *The New Division of Labor: How Computers Are Creating the New Job Market*. Princeton, NJ: Princeton University Press and Russell Sage Foundation.

economy is set to zero in 1969, the baseline year. The value in each subsequent year represents the percentile change in the importance of each type of task in the economy.

OECD's Program for International Student Assessment (PISA), which measures how well 15-year-olds in school are prepared to meet the challenges of today's knowledge societies, is the only available international survey that comes close to assessing the effectiveness of education systems in preparing young people for the expert thinking and complex communication skills studied by Levy and Murnane. PISA looks at students' ability to use their knowledge and skills to meet real-life challenges, rather than to master facts or a specific school curriculum. The first round of PISA was in 2000. It covered several content areas, but focused more on reading literacy, covering more than 300,000 secondary-school students in over thirty countries (including a few non-OECD members). The second round, in 2003, focused more on mathematics, and included measures of problem-solving ability. The 2003 PISA results clearly show that a large proportion of the target population does not meet the expected standards. In OECD countries, an average of 25% of the tested population have low levels of achievement (inferior to level 2 on a scale from 1 to 5). The results are much worse in developing countries. In Mexico, for example, 67% of the students attain less than the minimal level; in Tunisia 75% are in the same situation.[4]

The third 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 ourself,*
> *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). But not all countries have achieved a balanced educational development as reflected in the qualifications of their labor force. While in Finland the proportion of the population older than 15 with secondary or tertiary education levels has increased from 12 to 70% from 1960 to 2000, in a developing country such as Senegal it has grown only from 4.5 to 10% over the same period.

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

[4] OECD (2004). Learning for Tomorrow's World: First Results from PISA 2003. Paris.

are emerging, whereby learners attend several institutions or programs in parallel or sequentially, thus defining their own skill profiles in 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 is 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 Changing Tertiary Education Landscape

New Forms of Competition. The decreased importance of physical distance means that the best universities in 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. With 90,000 and 500,000 students respectively, the [public] University of Maryland University College and [private] University of Phoenix have been the fastest growing distance education institutions in the USA in the past five years. 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.*" [5] 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 percent of the community colleges are expected to offer distance education courses by 2002.[6] 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 percent in 1997-98 to about 50 percent in academic year 1999-2000, with public universities being much more advanced than private ones in this regard.[7] 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

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[5] *The Maclean's Guide to Canadian Universities*, 1999, p. 8.

[6] Olsen, J. (2000). *Is Virtual Education for Real?*, TechKnowLogia, January-February 2000, pp. 16-18.

[7] Mendels, P. (2000). *Government Study Shows a Boom in Distance Education*, The New York Times. 12 January 2000.

Thailand and Turkey, the national open universities enroll respectively 41 and 38 percent 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 four percent of its annual payroll, manages 99 learning and training sites in 21 countries.[8] 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.

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 and Dow Chemical), or (iii) through an alliance with existing higher education institutions (e.g., Bell Atlantic, United HealthCare and 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.

Franchise universities constitute a third category of new competitors. 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 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.

The fourth 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 world-wide.[9]

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[8] Densford, L. (1999). *Motorola University: the Next 20 Years*. http://www.traininguniversity.com/magazine/jan_feb99/feature1.html.
[9] Abeles, T. (1998). *The Academy in a Wired World*, Futures. Vol. 30, No. 7, pp. 603-613.

- 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.[10]
- 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 clearinghouses 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.[11] 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.[12]

Changes in Structures and Modes of Operation. Faced with new training needs and new competitive challenges, many universities have undertaken important transformations in governance, organizational structure and modes of operation.

A key aspect has to do with 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 nanotechnology, 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

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[10] Motti, J. (1999). *Corporate Universities Grow*, Internetweek. Special Issue No. 756, 15 March 1999.
[11] Klein, B. (1999). *SPJC aims for cutting edge of education*, The Tampa Tribune, 5 June 1999.
[12] Clark, S. (1999). *Corporate-Higher Education Partnerships: University of California customizes education for Silicon Valley titans*. University of California Extension, Santa Cruz. http://www.traininguniversity.com/magazine/mar_apr99/corp2.html

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.

The new patterns of knowledge creation do not imply only a reconfiguration of departments into a different institutional map but more importantly, imply 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 what experts call "transdisciplinarity", with distinct theoretical structures and research methods.[13] 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.

Even Ph. D. programs may be affected by this trend towards increased multi-disciplinarity. 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 organization 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.[14] 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,

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[13] Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., and M, Trow (1994). *The New Production of Knowledge: Science and Research in Contemporary Societies*. London: Sage.

[14] Mechatronics is "the synergistic combination of precision mechanical engineering, electronic control, and systems thinking in the design of products and manufacturing processes." The case-study is described in Arkin, R., Lee, K-M., McGinnis, L., and C. Zhou (1997). *The Development of a Shared Interdisciplinary Intelligent Mechatronics Laboratory*, Journal of Engineering Education. April 1997, pp.113-118.

electrical, chemical engineering and business administration to work on interdisciplinary projects.[15]

The evolution towards lifelong learning means that young high school graduates will gradually cease to be the primary clientele of universities. As a result, universities must 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 US, 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 percent of total enrollment.

Tertiary 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.

Conclusion: New Opportunities and Challenges

The major trends and changes outlined in this article represent both opportunities and challenges for tertiary education institutions in developing countries, which are called upon to play a vital capacity building role in support of economic growth, poverty reduction, and achievement of the Millenium Development Goals.

On the positive side, the use of modern technology can revolutionize the way education is delivered, resulting in more and better learning opportunities. The concurrent use of multimedia and computers permits the development of blended 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.

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[15] Lamancusa, J., Jorgensen, J., and Jose Zayas-Castro (1997). *The Learning Factory—A New Approach to Integrating Design and Manufacturing into the Engineering Curriculum*, Journal of Engineering Education. April 1997, pp.103-112.

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.[16]

Web-based virtual labs, remote lab experiences and access to digital libraries are but a few examples of the new learning enhancing opportunities that increased connectivity can provide cash-strapped universities and colleges in developing countries. For instance, 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.

The open education movement, pioneered by universities such as MIT (Open CourseWare), Carnegie Mellon (Open Learning Initiative), Rice University (community-based learning "object commons"), and Harvard University (special library collections) with funding from the Hewlett Foundation, offers the promise of extensive content and software resources that tertiary education institutions in developing countries could use and adapt to fit their needs. A Chinese consortium working in partnership with MIT has already established an expanded Chinese version of the Open CourseWare website. Users all over the world are leveraging the power of the Internet to form virtual communities of learning to help each other apply and further enrich available open education resources.

But the encouraging developments discussed in this paper have also brought about significant challenges. First of all, reliance on ICT 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 2000 report from the University of Illinois on the use of Internet classes in undergraduate education offers a few cautionary warnings.[17] 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

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[16] Kozma, R. and J. Johnson (1991). *The technological revolution comes to the classroom*. Change. January/February 1991.

[17] Mendels, P. (2000). *Study on Online Education Sees Optimism, With Caution*. The New York Times. 19 January 2000.

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 with 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.

Second, poor connectivity is a serious constraint in many developing countries, which severely restricts the likelihood that tertiary education institutions could take full advantage of ICT-related opportunities. Many low-income nations have limited resources for building up their ICT infrastructure and lack the economic and political leverage to negotiate favorable access and price conditions with international telecommunications firms. A recent evaluation of connectivity in African universities found that the 87 institutions that participated in the survey have, on average, no more broadband capacity than an average household in the US, at a cost 100 times higher.[18]

Third, developing countries face a whole range of quality assurance issues as a result of the new developments analyzed in this article. It is doubtful that the principles, norms and criteria routinely applied to evaluate or accredit campus-based programs can be used without significant adjustments to assess the quality and effectiveness of virtual universities, online courses and other modalities of distance education. Appropriate evaluation processes are needed to reassure the public that the courses, programs and degrees offered by the new types of distance education institutions and the new forms of e-learning and blended programs in traditional universities 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. 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.

In the final analysis, flexibility may be the one single characteristic most likely to determine tertiary education institutions' ability to contribute effectively to the capacity building needs of developing countries. Increasingly, tertiary education institutions need the capacity to react swiftly by establishing new programs, reconfiguring existing ones, and eliminating outdated courses without being hampered by bureaucratic regulations and obstacles.

This must take place in the context of systematic efforts to develop and implement a vision through strategic planning. By identifying both favorable and harmful trends in

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[18] African Virtual University (2004). *African Institutions Connectivity Study*. Nairobi.

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 lack of strategic planning, many new distance education institutions, for example, 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.

Finally, it is important to stress that strategic planning is not a one-time exercise; the more successful organizations in both business and academia are those that are relentless in challenging themselves in the pursuit of better and more effective ways of responding to client needs. The advice that the Roman philosopher Seneca gave us two thousand years ago may be even more relevant today as it was during his time:

> *"There is no favorable wind for those who do not know where they are going."*