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The Development of University Education in Singapore

GOH Chor Boon and Leo TAN Wee Hin

This chapter traces the growth and development of higher education in Singapore since 1965. Emphasis is placed on how universities in the city-state have responded to changing national agendas, especially in meeting economic and manpower needs. Beginning in the 1990s, as the “old” economy gave way to the new knowledge-based economy of the new millennium, the Singapore government attempted to equip the people with creative and critical-thinking and entrepreneurial skills. This was to create a change-adaptive workforce capable of meeting the new economic and manpower demands. This ideology continues to permeate the education system. At the higher-education level, the universities have implemented reforms that empowered them to take the lead in making the country more competitive in global and regional markets.

HIGHER EDUCATION IN COLONIAL SINGAPORE

Because Singapore was a colony of the British Empire, the development of education was very much influenced by the colonial administration’s *laissez faire* policy. The British also believed that imperial subjects must not be too educated because this would pose a threat to the colonial administration. To the ruling British, higher education—and English education in general—possessed an aura of power and rarity; only a minority and privileged few could enjoy it. It is not an exaggeration to state that, in Singapore, there were only two noteworthy developments in tertiary education during the 150-odd years of colonial rule. In spite of this, it is Singapore’s “good fortune that under the British, Singapore had been the regional centre for education” (Lee 2000, 158).

The first noteworthy development was the decision to set up a college for higher education, to be known as Raffles College of Arts and Sciences, to mark

Singapore's centenary in 1919. It was eventually established in 1928. Aside from an unsuccessful attempt in 1938 to introduce an engineering department and to upgrade the college to university status, Raffles College was largely left on its own, with little direction and support from the government.

The second bright spot was the progress made by the Straits Settlements and Federated Malay States Government Medical School. Formed in 1905 as a result of concerted pressure by the Straits Chinese and their generous donations, the school's name was changed to King Edward VII Medical School in 1912; the school was further upgraded to become King Edward Medical College with a full-time teaching faculty in 1921. Through the years, the college built up its reputation, supported by the fact that its medical degree was recognized by the British Medical Council in 1916. This is perhaps one of the more significant colonial legacies as it laid a strong foundation for medical teaching and research. Today, Singapore is recognized as a leader in medical advances in this part of the world. In 1949, the union of King Edward College of Medicine and Raffles College led to the founding of the University of Malaya.

Besides setting up Singapore Polytechnic in 1954, the Nanyang University in 1955, and the University of Singapore in 1962, there were hardly any significant developments in tertiary education until the late 1970s. Nanyang University, or Nantah, the first Chinese-language university in Southeast Asia, was started with donations from people of all walks of life, from Singapore and elsewhere in the region. However, Nanyang University became a center of turbulence during the 1950s and 1960s. Established by the Chinese community, Nanyang University became a hotbed of trouble for communist student activity. The student extremists, wanted to establish a socialist independent state and destroy capitalism and colonialism. In 1962, the University of Singapore was established. This followed the decision of the governments of Singapore and the Federation of Malaya that the Singapore Division and the Kuala Lumpur Division of the University of Malaya should become separate national universities in their respective countries.

MERGING THE UNIVERSITIES: THE DANTON REPORT 1979

By the end of the 1970s, the Singapore economy had consistently achieved high growth and was considered a "newly industrializing economy." To sustain this high-growth trajectory, the government felt it was crucial to review the development of university education at this juncture. It was imperative for the economy to be supported by highly qualified people. The government wasted no time in sourcing for international experts to study and produce an unbiased report. Then-Prime Minister Lee Kuan Yew initiated the search himself and met four British academics in London in June 1979 to discuss how university education in Singapore could best be organized. Sir Frederick Dainton, then chancellor of

Sheffield University, was invited by the Singapore government to lead the study (Dainton 1979, i).

The *Dainton Report*, as it became known, was submitted to the government in December 1979, and the conclusion was, "The arguments for maintaining two universities [University of Singapore and Nanyang University] whether on two campuses or one (an absurd proposition) are extremely weak whilst those in favour of a single, strong university at Kent Ridge are compelling and I recommend accordingly" (Dainton 1979, i). Taking into consideration Singapore's demographic changes and manpower needs, the report recommended that "a total student population in the range of 12–14,000 students by the year 2000 is likely to be adequate" and that "the mix of undergraduate study should be roughly half science based and half arts and social sciences, but no dispositions should be made which ossify this distribution for all time" (Dainton 1979, 1). The report also pointed out that more could be done to enhance the quality of research.

On August 8, 1980, the National University of Singapore (NUS) was formed through a merger of the University of Singapore and Nanyang University. The latter made way for the establishment of Nanyang Technological Institute (NTI) in 1981, and it would eventually become a full-fledged university in 1991.¹ It was a milestone development that, in retrospect, paved the way for the rise of a world-class university education system.

While the merger of the University of Singapore and Nanyang University was generally accepted as the right decision, there was also a sense of tension and uncertainty at the ground level. As observed by Dainton, the expectation of a quick takeoff could also create a lot of strains, arising not so much from the amalgamation as from the sheer rate of expansion (*Straits Times*, May 11, 1981). The new university would need to rely on expatriate staff because it would be some time before the university could generate from within itself the people to staff the system. Because of the strong emphasis on science, medicine, and engineering—which attracted brighter entrants and prepared students for better-paying jobs upon graduation—academics in the arts and social sciences, especially the Chinese-educated ones, were uncomfortable about their prospects in the new university.

NUS faculty staff were actively recruited. By 1984, its staff doubled from 600 in 1980 to 1,200. During the same period, student enrollment increased from a pioneer cohort of 8,600 to 13,000 (as compared with about 2,000 for NTI), and S\$212 million was spent on developing its infrastructure and physical facilities at the Kent Ridge campus (*Straits Times*, July 3, 1984). These were impressive achievements, and many observers pointed to three reasons for the university's rapid growth: intellectual quality of its staff, community's support of higher education, and the government's recognition of the university's role in national progress. As for NTI, the early years of its institutional history were not totally devoid of achievement. Engineering education here leaned more toward a practical-oriented

approach (as opposed to a more research-oriented engineering curriculum in NUS). As a result, NTI's engineering graduates were seen by prospective employers as more hands-on and ready for the job. In an employment survey of new graduates conducted in late 1987, NTI graduates fared better than did their NUS counterparts—98 percent of NTI graduates were employed, compared with 82 percent of the NUS graduates (*Straits Times*, Aug. 27, 1988). NTI was also singled out as one of the best engineering institutions in the world by the Commonwealth Engineering Council in November 1986 (*Straits Times*, Nov. 30, 1986). This accolade was earned because NTI's engineering faculty possessed relevant industrial experience that provided a strong, practical training of skills necessary to support Singapore's industries.

CHANGE SINCE 1990

By the late 1980s, higher education in Singapore was well poised to meet the challenges of the 1990s. Coming out of a mid-1980s recession, the Singapore economy grew robustly. Upon recommendations by a high-level economic committee, Singapore's economic growth trajectory in the 1990s and beyond shifted toward a high-technology policy, with the following goals (Ministry of Trade and Industry 1986):

- To encourage all industries to exploit and apply new advances in technology as widely as possible;
- To develop competence in selected new technologies where Singapore has a comparative advantage; and
- To move into high-technology industries as an area for growth.

The advanced technologies that were considered to have a big impact during this time were information technology, biotechnology, robotics and artificial intelligence, microelectronics, laser technology and optics, and communication technology. A bigger pool of graduates was needed to drive the economy forward into the 1990s. It was time for higher education to take another big leap—and what better way to start than the formation of Singapore's second full-fledged university.

In 1991, the Nanyang Technological Institute, together with the National Institute of Education (which was an amalgamation of the Institute of Education and the College of Physical Education), became the Nanyang Technological University (NTU). The formation of NTU in itself is a useful case study for many developing countries where, more often than not, tertiary institutions were opened for business in double-quick time.² The Singapore planners took close to a decade to refine and nurture a strong foundation for the country's second university. Sir Frederick Dainton was once again invited to review university education, and he concluded, "By 2000, Singapore should aim to have two strong university-level

institutions, one at Kent Ridge and the other at Jurong, with many subjects being offered on both campuses. This would introduce a healthy element of friendly competition for students, for current and capital resources and for research grants and contracts and links with industry and commerce" (*Straits Times*, Feb. 14, 1990). Singapore's success in the provision of primary, secondary, and junior college (or pre-university) education had resulted in larger proportions of 18-year-old age groups performing well at national examinations and eager to seek university education. In terms of enrollments in higher education in Singapore, in 1965, 3 percent and 2 percent of the relevant age cohort gained admission to local universities and polytechnics, respectively. By 1989, 14 percent of the primary one cohort would eventually enroll in local universities, while 17 percent would receive polytechnic education (Ministry of Education 2006).

The 1990s saw the consolidation of the government's effort in fine-tuning the tertiary education sector to support its private sector-driven economic modernization strategy. The objective was to create a diversified, flexible tertiary education system capable of producing a highly qualified human resource base. Polytechnics were geared toward providing cutting-edge mid-level technical, management, and service skills, while the universities were tasked with training in high-level skills for both the public and private sectors. Polytechnics graduates who performed well academically were also given the opportunity to progress into NUS and NTU.³

Singapore's drive toward a high-technology economy required tertiary institutions to embark on research and development (R&D) activities and to establish close university-industry links.⁴ The universities responded by accelerating their research and postgraduate training to foster a more stimulating research environment and meet the growing demand for qualified research scientists and engineers. The recruitment of talented staff was pursued both locally and internationally and supported by a stringent tenure policy, rewards for good teaching and research performance, favorable staff-student ratios, well-equipped teaching and research facilities, and staff training opportunities to upgrade skills and performance. The vision set by the government for NUS and NTU was to have both institutions among the best in the world by the beginning of the new millennium.

Taking the cue, NUS and NTU embarked on ambitious expansion programs in the 1990s and, in the process, laid the foundation for their rise as world-class universities in the 21st century (*Straits Times*, Feb. 16, 1990). The universities adopted the following strategies:

- Expand undergraduate and graduate education by attracting students from the region and beyond. Research was boosted with the establishment of new research institutes at Kent Ridge and Jurong. These research institutes provided strong links between university and industry. At NUS, an Industry and Technology Relations Office was set up in 1992 to enhance cooperation in R&D between the university and industry.

- Review the undergraduate curricula in NUS and NTU to update them and to place more emphasis on creativity and thinking skills. At NUS, for example, three new areas of study in mass communications, European studies, and materials science were developed. A key priority for both universities was revamping the engineering curriculum to meet job and industry demands.
- Upgrade physical facilities to standards comparable to renowned universities like Oxford and Cambridge. A multi-million-dollar plan was adopted.
- Encourage all students to take optional enrichment courses offered by other faculties to broaden their academic horizons.
- Upgrade social and recreational facilities, including a state-of-the-art concert hall, a museum, and a visual arts center, to give university students a rich cultural and social life on campus.

By the mid-1990s, NUS had made the strategic shift from a basically traditional British model of a public university focusing primarily on teaching, to a more comprehensive research-intensive university, emphasizing entrepreneurship, R&D, and university-industry links. Together with NTU, the university sector provided the largest pool of trained research manpower in Singapore and was best placed to contribute to the country's effort in making R&D a key factor in Singapore's economic development.

The performance of the university sector was evaluated by a panel of eminent academics from the United States, Japan, and Europe in August 1997. The panel endorsed the directions the two universities had taken in their bid to become world-class institutions (*Straits Times*, Aug. 10, 1997). The panel also suggested that the establishment of a third university would meet the demand for tertiary education among Singaporeans and attract international students to meet the manpower needs of Singapore. Within three years after the idea was mooted and meticulously assessed, the Singapore Management University (SMU) received its first class of business students in 2000. The university is partnered with one of the United States' best business schools, the Wharton School of the University of Pennsylvania. This inspired collaboration aims to build a world-class university for creative entrepreneurs and visionary business leaders. SMU signed a five-year joint agreement with Wharton in 1999 to create a unique learning and research environment. Diverse and challenging programs have equipped, enriched, and honed the skills, knowledge, and experience of the men and women now capable of leading in a rapidly changing and dynamic world.

RESOURCE ALLOCATION AND GOVERNANCE

One key issue facing many developing countries is the allocation of resources to the tertiary education sector when faced with growing resource constraints. In this respect, they could learn much from the Singapore experience.

Table 7.1 University Enrollment and Output in Singapore

Year	Enrollment	Output
2000	36,121	9,244
2001	37,983	9,586
2002	39,156	9,923
2003	40,095	10,010
2004	41,628	10,165
2005	43,663	10,031

Source: Ministry of Education 2006.

Note: The figures represent the whole (full-time) student population in the education institutions for a particular year.

Admission into universities is highly competitive to avoid high dropout rates, a waste of scarce resources, and the lowering of degree standards. The size of student enrollment and course offerings are based on labor market needs, rather than a supply-driven higher education system. Despite restricted admissions, the growth in student numbers has been dramatic. Enrollment increased from 3,502 in 1960 to 36,121 in 2000, a ten-fold increase in four decades (Ministry of Education 2006). Table 7.1 shows the university enrollment and number of graduates since 2000, when SMU opened its doors.

Enrollments were stimulated by:

- The expansion of primary and secondary education with a high quality of output.
- Subsidies to higher education.
- Rising family incomes.

Since the mid-1990s, about 60 percent of secondary school graduates have enrolled in the universities and polytechnics sectors—comparable to the enrollment rates of 40–60 percent in developed countries. Recurrent expenditure on universities increased two-fold, from S\$520,289,000 to S\$1,012,860,000 between 1995 and 2005. As for polytechnics, it was also a two-fold increase, from S\$338,960,000 to S\$622,933,000, during the same period (Ministry of Education 2006).

When Singapore gained its independence in 1965, the government was quick to recognize that long-term economic development is dependent on a critical mass of an educated and skilled workforce. For the past 30-odd years, university enrollment and manpower planning have been closely intertwined. Projected manpower requirements based on forecasts of economic growth determine or guide the trends in university intakes, such as the number of places allocated to each cluster of disciplines. Applicants then compete for the available places in the courses of their choice. How are these decisions made? The universities depend on market signals from employers who hire their graduates, students and their parents who choose (and pay for) degree programs, and the demand for and supply

of academic manpower in various specializations. The market responsiveness ensures flexibility and efficiency in resource allocation. During the period of the dot.com and information and computer technology boom (especially the early 1990s), university intakes for computer science and computer engineering students increased to feed the expected expansion in the information technology industry with the skilled manpower. Similarly, in the late 1990s, the government had anticipated the rise of the biotechnology sector and planned for the training of polytechnic and university graduates in this field. The underlying assumption is that there would be no misallocation of human resources.

Hitherto, Singapore's manpower planning model and its link to university enrollments worked well because the nation was catching up to developed-country levels of industrialization by enticing multinational corporations to base their mass-manufacturing operations in Singapore. In the new millennium, changing technology and skills requirements make it difficult for planners to determine the directions of manpower needs. It is also obvious to many employers in the private sector that, while manpower planning could result in a marked increase in the number of trained computer or scientific engineers, anecdotal evidence suggests that many of these graduates will switch to nonscience careers, such as banking, finance, and business, within a few years. This is not surprising because pragmatic Singaporeans would deploy their analytical skills honed during their engineering training years and put them into effective use in occupations that are perceived to provide higher rewards and status in the long run.

As reiterated throughout this book, the provision of affordable and accessible education, from preschool to university education, is a top national priority. Consequently, the state's annual budget allocation ensures that education receives a large portion of the country's public expenditure. Up to 1995, universities received an increasing proportion of the total education budget; their share rose from 10.5 percent in 1975, to 14.3 percent in 1990, and to 15.1 percent in 1995 (see table 2.2). Higher education expenditure increases were kept in line with increases in student numbers. The government understands that high-quality education costs money, and student subsidies are essential to improve equality of opportunity as well as to attract talent into higher education, particularly into economically critical fields of study. The eventual objective was to lower the student subsidy to around 75 percent of tuition costs, to reduce the overdependence of public tertiary institutions on government funding, and to introduce an activity-based funding mechanism.

In response, tertiary institutions have adopted policies to diversify their revenue sources. Student tuition fees have increased gradually since 1986 and substantially since 1989. Since 1992, tuition fees have increased between 5 and 7 percent annually to keep pace with wage and other cost increases. In addition, institutions have established endowment funds to tap nongovernment sources. The two universities,

with government support, launched a S\$500 million Universities Endowment Fund. The objective is for higher education to move toward becoming more self-supporting and less dependent on the government. Giving the public a direct stake by soliciting contributions from individual and corporate citizens—rather than indirectly through government grants—can help build up multiple links between the universities and the community at large. The government has also committed to contribute another S\$500 million to the fund if each university is able to raise at least S\$250 million (that is, a dollar-to-dollar matching grant). The income generated from this fund is to be used for a range of activities, such as special and innovative projects, as well as to develop programs that will nurture intellectual development and research. When tuition fees were increased in 1989, a Tuition Loan Scheme was instituted to ensure that no deserving student was deprived of a tertiary education. All full-time university undergraduates, regardless of parental income, could borrow up to 65 percent of their tuition fees, while polytechnic students can borrow up to 50 percent of their tuition fees.⁵

By the late 1990s, as Singapore's higher education was gaining a reputation for its academic rigor and research quality, and because of Singapore's need to respond to global competition, the issue of autonomy and governance of the universities became more significant. During the early decades, the guiding hand of the government was extended even to the direct appointment of vice chancellors to the universities and forbidding the formation of a trade union of academics. Critics argued that this close involvement of the government marked the transformation of a university modeled along classical principles of autonomy and academic freedom into one in which government influence and control had become the norm.

However, the governance and interventionist style began to change, especially as the government realized that its model was increasingly inappropriate in the globalization context. Hence, since the late 1980s, the Singapore government has started a process of decentralization and carried out various comprehensive reviews of its higher education system (such as the *Dainton Report* in 1989 and the July 2005 report of an international advisory panel suggesting the public universities be given more autonomy). Different reform strategies to strengthen and make higher education competitive have been tried. The guiding principle is that tertiary institutions have a strategic role in the creation and application of knowledge to provide a better Singapore to live in. Curriculum is constantly reviewed and emphasis is now placed on a broad-based, cross-disciplinary university education. More innovative pedagogy and assessment have been introduced, with a focus on creative and critical thinking. Universities' role in the advancement of knowledge has been strengthened through postgraduate and research education. At the same time, a comprehensive quality assurance and management system has been put in place to enhance each institution as a center for quality education.

While the government has basically controlled the provision of higher education because tertiary institutions are primarily state funded, it has always been prepared to make changes—as happened in 2000 with the establishment of SMU. Unlike NUS and NTU, which operated like statutory boards until 2006, SMU was set up as a private limited company and governed by the Companies Act.⁶ A different governance framework could be tried at SMU, and best practices could then be applied in all three institutions. To encourage competition, avoid wasteful duplication, and enjoy greater autonomy, the three universities—NUS, NTU, and SMU—were urged to develop their own unique characteristics and niches.

Finally, to make Singapore's universities more innovative and entrepreneurial to meet the demands of the knowledge-based economy, the Ministry of Education decided to allow NUS and NTU to be corporatized in 2006.⁷ This is a distinctive milestone in Singapore's history of tertiary education. Corporatization would provide the universities with the flexibility to recruit world-class talent; manage their budgets; and build a stronger sense of loyalty and ownership among students, staff, and alumni. NUS and NTU are expected to reach high international standards in both teaching and research and even become models for other regional universities to emulate. An underlying objective is to broaden the coverage of various disciplines and to foster the emergence of cross-disciplinary teaching and research.

With the corporatization process completed, the Singapore government would remain the major source of funding. However, all three universities have their own endowment fund programs and actively seek partnerships with alumni, industry, and the local community as alternative sources of funding. The next target is for Singapore's higher education to attain and sustain world-class status and continue as one of the engines to create wealth for the city-state.

RESPONDING TO THE CHALLENGES OF THE NEW ECONOMY

Higher education in Singapore is now challenged to make the fullest use of the autonomy granted by the government. Producing academic excellence and technological innovation now rests squarely on the university itself. In most developing countries, the government provides the bulk of the funding for universities and, hence, has a strong say in the governance and goals. Universities in Singapore, in the new millennium, decide what undergraduate programs to offer; enrollment targets and criteria for admission; tuition fees; terms and conditions of faculty recruitment; and how faculty, students, and the university as an institution are evaluated and benchmarked. Central to this approach is the introduction of competition between education institutions and of rigorous institutional reviews, both of which are meant to ensure the quality, efficiency, and effectiveness of higher education.

The knowledge-based economy requires graduates to possess higher-order thinking and communication and information technology skills. Employers value professionals with the capacity to learn, unlearn, and relearn. They also seek a diverse workforce in terms of training, outlook, and subject knowledge. In industrial economies, the trend is for undergraduates to gain a basic knowledge of disciplines and breadth of coursework (rather than narrow specializations) because highly specific skills and knowledge can quickly become outdated. As stated by Gardner (2004, 250), "Trends in our increasingly globalized society have brought interdisciplinary concerns to the fore. Issues like poverty reduction, antiterrorism, privacy, prevention of disease, energy conservation, ecological balance—the list could be expanded at will—all require input and syntheses of various forms of disciplinary knowledge and methods."⁸ Responding to the changing landscape, university education in Singapore, too, is shifting gradually but surely toward a more interdisciplinary approach. Teaching pedagogy in Singapore's tertiary institutions is now galvanized toward developing in young adult Singaporeans

- The capacity to think analytically and creatively within and beyond disciplines.
- The ability to tackle problems and issues that do not respect disciplinary boundaries.
- An understanding of the global system.

The concept of an "enterprising university" was assiduously supported by NUS, NTU, and SMU. Since 2003, the Singapore economy has rebounded strongly from a recession at the start of the new century. The role of higher education in a knowledge-driven economy has never been more crucial as innovation and human capital are seen as keys to future economic growth. Several initiatives are being introduced by the universities to position Singapore's tertiary education in the new century:

- The establishment of global campuses (and external campuses in countries like India and China and in the Silicon Valley) using state-of-the-art multimedia technologies to plug into the worldwide revolution in information and communications, and facilitate cross-boundary learning.
- Quality teaching programs, with emphasis on multidisciplinary learning and cross-faculty modules, to produce highly qualified graduates who have broad intellectual horizons and are steeped in a culture of lifelong learning.
- A thriving culture of research enhanced by state-of-the-art research institutions.
- A vigorous external relations program with strong links to industry collaborators and international academic partners.

In the New Economy, the ticket to faster and broader income growth is innovation. The New Economy puts a premium on what Nobel Laureate economist Douglas North (2005) calls “adaptive efficiency,” which refers to the ability of institutions to innovate, continuously learn, and productively change. As markets fragment, technology accelerates, and competition comes from unexpected places, learning, creativity, and adaptation have become the principal sources of competitive advantage in many industries. As in the industrial economies, university administrators and government leaders alike in Singapore have wanted to make the research university more relevant to business and the economy. Advocates of a greater economic role believe that the university’s most important contributions are the transfer of research to industry, the production of commercial inventions and patents, and the creation and spinoff of start-up companies. To meet this challenge, the research university must change its mission from the static categories of research, teaching, and service to the more dynamic ones of discovery, learning, and engagement. For example, some university courses could be conducted through the “learning by doing” approach (instead of in the classroom)—working in a research laboratory, helping create a start-up company, participating in a theater or arts group, or working at a nonprofit community organization. Universities must change how they grant promotion and tenure for faculty members and grade and evaluate students in ways that encourage such engaged activity throughout the institutions.

NUS is the more “mature” university in terms of having had a head start in research, and R&D indicators affirm the rapid infusion of a research and entrepreneurial culture in that institution. The number of invention disclosures and patents filed by and granted to NUS increased from 169 in 1998 to 298 in 2004. During the same period, the number of NUS spinoffs and start-ups increased from 1 to 13.⁹ Research staff increased from 843 (59 percent of total teaching staff) in 1996 to 1,087 (62 percent of total teaching staff) in 2004 (National University of Singapore 2005). Economists, including Joseph Schumpeter and Robert Solow, have demonstrated the central role that technology plays in economic growth, and, undoubtedly, university technology—as measured by patent applications, disclosures of inventions, licensing income, and business start-ups—is closely associated with the level of technological change and innovation in the country. Singapore’s higher education sector demonstrates the fact that the successful commercialization of university R&D requires a systematic approach, starting with the championing by top leadership to make intellectual property creation and commercialization an integral part of the institutional mission. Filtering downward are policy changes and incentives, including availability of research funding, that support and motivate a mind-set change of faculty. Although new knowledge is created in universities and research institutes, actually absorbing and applying those ideas by industry is a different story altogether. The latter, including local

small and medium technological companies, must be consistently looking at the universities for new processes and products and have the absorptive capacity to use them to generate wealth.¹⁰

While Singapore's higher education sector is nurturing a pro-enterprise and research climate, university leaders and policy makers recognize that there is still room to carefully explore the economic and social effects of the university's role in contributing to the development of talent and tolerance. These are significant benchmarks of the growth and development of a creative economy—a concept that the city-state of Singapore is propagating, not just in the areas of science and technology, but also in entertainment, performing arts, architecture, building construction, and so forth. For the university to become a truly creative hub, it has a crucial role in producing and attracting talented students and renowned faculty members who, in turn, would draw companies, venture capitalists, laboratories, and research institutes to locate nearby to take advantage of the institution's talent and infrastructure. The higher education sector is also attempting to establish an open and tolerant social climate between the community of learners within the campuses and between the university and its surrounding social community. Societies throughout history have tended to flourish when they are open to new people and ideas, while stagnating during periods of insularity and orthodoxy. Talented and creative people favor diversity and a wide variety of social and cultural options.¹¹ Openness to ideas is crucial in both attracting talent and succeeding economically. Talented and creative people “vote with their feet,” and they tend to move away from communities where their ideas and identities are not accepted.

The creation of a “university hub” is also a mechanism to reduce brain-drain and to achieve brain-gain of talented university graduates and faculty members. Its development will have all sorts of positive outcomes, such as employment, population, and income growth; a vital high-tech industry; and regional innovation.¹² Indeed, the target would be a seamless connection between communities and universities so that it is hard to tell where one begins and the other ends.

LEARNING FROM THE SINGAPORE EXPERIENCE

For many developing countries, such as the African nations, Singapore's case illustrates the paramount role of the state at all levels of society. The adoption of a developmental state model in which the state was a key economic player succeeded brilliantly. As examined in the chapter on the evolution and management of education in Singapore since 1965, the Singapore government has skillfully used a state-control model in regulating education changes to match manpower planning and, in the process, to make education a valued social institution. The establishment of tertiary institutions was carefully planned.

Singapore's success story has several best-practice implications for higher education policy makers in developing nations as well as for higher education experts working in donor agencies:

- Maintain a sustained and consistent policy over the long term.
- Ensure strong links among education, the labor market, and economic development.
- Develop mechanisms to matriculate high-quality students, including a merit-based admissions policy, and to recruit quality staff, accompanied by stringent tenure and reward systems.
- Develop a prioritized, development-oriented research strategy backed by an excellent infrastructure, support facilities, and incentive schemes with an aim to achieve excellence; to develop management strategies to maintain cost effectiveness in program offerings and research.
- Implement a concerted policy effort to diversify resources to complement the high government subsidies without jeopardizing quality. This policy is justifiable and feasible in areas with relatively high household incomes.

The primary function of Singapore's higher education sector is to educate and train skilled professionals to meet the manpower needs of the economy. High standards at the universities and competition for places allow only the top 25 percent of the cohort to gain admission. However, the impact of globalization has motivated many universities in industrial countries to provide lifelong learning experiences to the entire population. In Singapore, the establishment of the Singapore Institute of Management University (UniSIM) in 2005 aimed at adult students is a major step in addressing this issue. No one can predict all the likely developments associated with a major reconfiguration of the learning process, fueled by rapid technological change. Polytechnics and universities in Singapore, however, are expected to respond to some of the possible scenarios:

- Multiple learning opportunities offered by diverse sources will replace the past monopoly of formal academic institutions.
- Learners will demand and find greater flexibility and fluidity in the learning process and the accrediting of learning.
- Technology not only will open up access to more learning, but will conquer barriers of time, distance, and convenience that previously have been prohibitive.
- Greater collaboration will be necessary among institutions to share resources and between institutions and client groups, such as employers and government agencies, to achieve mutually sought learning goals.

The Singapore government is now looking at ways to expand the university sector. However, whether to increase the number of universities will be guided by

economic considerations, that is, alignment with the needs and development of the Singapore economy. This approach will “avoid falling into the error which some countries have done of simply producing more university graduates to satisfy a social demand, many of them in disciplines which do not enable them to find jobs and be productive members of the workforce”.¹³ Three steps would be taken to expand the university sector:

- Working out a plan to make available an additional 800 to 1,000 places by 2008.
- Developing a conceptual plan to expand the university sector in the long term, including deciding on the number and type of universities Singapore needs.
- Implementing and executing the conceptual plan once it is approved by the government.

The current forecast is that as the Singapore economy grows and the population increases from the present 4.6 million to more than 6 million in 2015, three medium- to large-size universities (NUS, NTU, and SMU) and three smaller specialist institutions would be appropriate for Singapore, based on a rough ratio of one university per million population.

CONCLUSION

As a source for the country's future as a knowledge-based economy, Singapore's higher education system has received great attention. The universities have undergone dramatic changes in recent years, especially in the area of governance and involvement in advanced research.

In spite of its success, Singapore's education system faces a number of emerging problems. The ability of a highly controlled system to respond independently and quickly to the growing education, training, and research needs of a rapidly expanding, highly competitive, and technology-driven private sector is limited. The future affordability of higher education for lower-income students will be difficult to maintain with sharp increases in tuition fees and costs of living. Although not a systemic or policy outcome, female students are underrepresented in professional fields such as medicine, engineering, and law. The government's policy of maintaining quotas for undergraduate admission into some critical fields of study (such as law and medicine) may encourage many talented students to pursue their choice of university study overseas. These issues are recognized by the authorities and are being addressed.

In the new millennium, the higher education sector in Singapore will continue to see exciting and transformational changes in response to the country's economic planning. The universities are now creating the measures—and infrastructure—to become effective contributors to regional creativity and economic growth. In the

process, they hope to become the “Harvard and MIT of Asia” and the “Boston of the East.” The pathway is toward an integrated universities–communities ecosystem that allows for the free flow of ideas, technology, creativity, and social activities. The old model of a university pumping out research results and educating students, or even commercializing innovations and creating start-up companies, is no longer sufficient for the era of creative-knowledge-based capitalism. Universities and their communities have taken the technology agenda seriously; now they must do the same with talent and openness. By drawing upon the collective creative energy of thousands of people, new ideas are generated, and new talent is created on campuses and potentially in their communities as well. Higher education in Singapore will realize considerable advantage in generating innovations, attracting and retaining talent, and creating sustained prosperity.

NOTES

1. The decision to close down Nanyang University and set up Nanyang Technological Institute, as argued by critics, was both an economic and a political one. In terms of efficient resource allocation, Singapore was deemed too small to require more than one university, and with the declining enrollment of Chinese stream students, the demise of Nanyang University would be a matter of time. Those who argued against the move felt that the pace of closure was forced, with Nanyang University graduates finding themselves being discriminated against in the job market because of their low level of proficiency in English.

2. One common strategy adopted by governments to meet public demand for access to university education is to convert polytechnics into universities. In Singapore, educational planners recognized the importance of striking the right balance in postsecondary education between subdegree and degree-level work to avoid wastage of valuable resources. Universities and polytechnics in Singapore preserve their distinctive roles, and each understands and respects the difference. The overall driving factor is to meet the manpower needs of the economy.

3. The government paid close attention to polytechnic education to build a wide base of skilled technical workers. Because of the government’s consistent marketing of the high value of polytechnic education, more and more students, many of whom had academic results that could allow them to enter universities, opted for polytechnic education instead of going down the old path to a general academic education. Good performance in their polytechnic studies would enable them to gain entry into the second or third year of university education. Hence, by 2004, 19,147 students (9,104 of whom were females) enrolled in the five polytechnics, while 12,194 opted for university education.

4. R&D is critical to Singapore’s economy, and the government formulates its R&D policies according to the country’s long-term economic development needs. R&D strategies concentrate on incremental technology and focus on the attainment of realistic goals. The National Technology Plan 1991 aimed to achieve a total national expenditure on R&D of 2 percent of gross domestic product by 1995, with the private sector contributing a minimum of 50 percent. The ratio of scientists and engineers engaged in R&D will be raised to 40 per 1,000 labor force participants.

5. The maximum amount that can be borrowed has since been increased to 90 percent.
6. SMU, which follows the Wharton business school model and was meant to be a research university, has made excellence in research a crucial agenda for its academic faculty.
7. In Singapore's context, "corporatization" refers to the transition of a statutory board to a "privately run" corporation.
8. Gardner added, "While standards are in place for judging the quality of work in the traditional disciplines, there has not been time—perhaps there has not been the motivation—to set up analogous kinds of indices for quality work in various interdisciplinary amalgams."
9. Spinoffs refer to new companies formed by NUS faculty members/researchers to commercialize NUS intellectual property (IP), while start-ups refer to companies formed by NUS faculty/researchers that do not involve IP owned by NUS. Between 1980 and 2004, a total of 82 spinoffs and start-ups were formed.
10. Although many observers have suggested that the role of higher education in a knowledge-driven economy has never been more crucial because it stimulates innovation and develops human capital, in reality, it is not easy to measure the exact contributions of universities (and other tertiary institutions, such as the polytechnics) to economic growth in the region or country. A joint project by the Massachusetts Institute of Technology and the University of Cambridge found that universities are most successful in influencing economic growth when they are attuned to the economic structure of their local economies. The nature of the industrial transformation in the local economy in large part defines what the best role is for the university to contribute to change. See Richard H. Mattoon (2006).
11. That is why regions with large numbers of high-tech engineers and entrepreneurs also tend to be havens for artists, musicians, and culturally creative people. Austin, Boston, and Seattle are cases in point.
12. It reflects a virtuous cycle whereby high levels of talent lead to more technology generation, innovation, and entrepreneurship, which then lead over time to higher rates of economic growth and more job generation, which in turn lead to higher rates of talent production, retention, and attraction.
13. From a speech by Dr. Tony Tan on ways to expand the university sector, published in the *Sunday Times*, September 2, 2007.

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