

Curricula Enhancement at the Higher Educational Institutions in Singapore

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I. Introduction

The contemporary higher education system of Singapore is dominated by six institutions, namely the National University of Singapore (NUS), the Nanyang Technological University (NTU), the Singapore Polytechnic (SP), Ngee Ann Polytechnic (NAP), Nanyang Polytechnic (NP), and the Temasek Polytechnic (TP). In addition, other institutions such as the Singapore Institute of Management, National Productivity Board, Institute of Banking and Finance and many other privately operated institutions offer various diploma and degree courses on both full and part-time basis. The range of non-public funded institutions, however, are not included in this study. Generally, students at these institutions are required to pay fees for covering the full cost of instruction. Despite the fact that there is no direct subsidy by the government for these courses, some private sector companies do use the Skills Development Fund, established by the Singapore Government, to support fees of staff as part of their staff development programmes.

In addition to the above, many Singaporean students, according to 1990 Census, are pursuing higher education overseas. Most of these students are pursuing undergraduate studies and are financed by their families. A selected number of undergraduates and postgraduates are sponsored by the government agencies for their excellent performance in their secondary school examinations. They are usually funded by higher educational institutions if they are post-graduates and by agencies like the Public Service Commission, Singapore Armed Forces and government linked corporations.

This paper is exploratory in that it examines a particular phenomenon that has been introduced into higher education in Singapore. By way of providing the background to higher education expansion in Singapore, an attempt will be made to show how at every stage of expansion, the aim has been to integrate the social and economic needs of Singapore into higher education. The second part of the paper provides a glimpse of the dynamics of higher education by highlighting some of the major innovations that have been initiated in Singapore. Thirdly, curricula enhancement is described as part of the larger innovation process that is taking place in the higher education scene in Singapore.

II. Background to Higher Education

The growth and development of higher education in Singapore could be said to have begun in 1905, with the setting up of a medical school. Since then Singapore remained a centre for higher education for the entire Malay Peninsula for the next five decades. At the time of Singapore's separation and independence from Malaysia in 1965, it had four institutions of higher learning. The Nanyang University and the University of Singapore were two separate universities until 1980, when the two were merged to form the National University of Singapore. The Singapore Polytechnic has continued to be the only institution that has continued as an institution since 1954. The Teachers Training College was later renamed the Institute of Education and in 1991, it was merged into the Nanyang Technological University. Today, Singapore with a population of 3.4 million has two universities and four polytechnics to cater to the growing demand for higher education. Table 1 shows the institutions of higher learning and year of their establishment.

Table 1 - Higher Education Institutions and Year of Establishment

Institution	Year of Establishment
National University of Singapore	1980
Nanyang Technological University	1991
Singapore Polytechnic	1954
Nanyang Polytechnic	1992
Ngee Ann Polytechnic	1982
Temasek Polytechnic	1990

The development of these institutions could be linked with the development needs of the country. While the University of Malaya in Singapore, and its successor University of Singapore was established in 1949 and 1962 respectively to cater to the needs of manpower in the Arts, Science, Medicine, Economics, Law and Education. The University of Singapore from 1965 to 1980 underwent tremendous transition to fulfill the manpower needs of the commercial and professional sectors of Singapore. The newly constituted National University of Singapore with the merger of the University of Singapore and Nanyang University began to train the graduates for a developed economy of the 1980s. As Singapore economy became dominated by engineering and services sectors, the four Polytechnics and the Nanyang Technological University were started to enlarge the supply of graduates in these fields. The image of the 'traditional' universities as represented by the former Nanyang and Singapore universities gave way to 'applied' and 'necessary' disciplines in all the current institutions of higher learning. The government has always viewed higher education to be a serious arena not to be left alone in the hands of academic administrators. For most of the 1970s and 1980s, a minister in the cabinet had served as vice-chancellor of the University of Singapore. Even in the merger of two universities to create a single and the larger National University of Singapore, a minister was appointed as the vice-chancellor. In the 1990s, the Ministry of Education has increased its role in the direction of higher education by appointing a Minister to look after the two universities, and another Minister of State to pay attention to the synchronization of polytechnic education to the needs of the economy. The emphasis on implementation of the education programmes in Singapore is to steer the education system towards achieving a united and disciplined society as well as meeting the requirements of trained manpower.

The education system is British in origin and is highly structured, stratified and integrated with the national development goals. Singapore at present has a school system that consists of six years of primary school, four years of secondary school, two or three years of post-secondary (junior colleges) and three or more years of university education. The development of human resources has been used as a central policy in the country's drive towards growth and prosperity.

At the apex of Singapore's public funded education is a diversified, demand-driven higher education subsection, which plays the pivotal role of imparting high and middle-level skills and generating the new knowledge and research base necessary to create and adapt technology to meet the demands of society. The top echelons of this subsection are made up of two public universities, the National University of Singapore

(NUS) and the Nanyang Technological University (NTU). A third university, in the form of an Open University was implemented in 1994. The Government, in a major policy shift, provided a one time grant to the Singapore Institute of Management (SIM), a private institution, to establish the Open University and operate it. Recently, the Government announced that the SIM by the year 2,000 would be developed into the Singapore Management University, incorporating the Open University programmes and SIM's other functions to constitute the third university. The new university is expected to function like a private university with partial government support.

The second tier is made up of four polytechnics: Singapore, Ngee Ann, Temasek and Nanyang. A third tier of high and middle-level job/career-oriented training institutes has emerged, made up of joint training centres with foreign firms and a mixture of institutes and centres established by statutory boards, professional groups and private bodies. This now includes the former Vocational and Technical institutes, which have been since 1992, upgraded to post-secondary technical-vocational training institutes and called Institutes of Technical Education (ITE).

Table 2 : The Education Pyramid, 1960-1990 [Figures in parentheses indicate percentage]

	1960	1970	1980	1990
Primary	285,537 (80.9)	363,518 (68.9)	291,722 (58.1)	257,932 (48.2)
Secondary(a)	57,987 16.4	145,740 27.6	173,693 34.6	191,459 35.8
Technical & Vocational	1,257 (0.4)	4,727 (0.9)	13,839(2.8)	29,102 (5.4)
Tertiary	8,171 (2.3)	13,683 (2.6)	22,633 (4.5)	56,572 (10.6)
Universities	3,502 (42.9)	6,990 (51.1)	9,200 (40.6)	25,307 (44.7)
Polytechnics	4,669 (57.1)	6,693 (48.9)	13,433 (59.4)	31,265 (55.3)
Total	352,952	527,668	501,887	535,065

Source : Visvanathan Selvaratnam (1994) : 24.

Notes : (a) Includes pre-university enrollment.

The tertiary institutions in the first and second tiers come under the direct supervision of the Ministry of Education. They meet Singapore's demand for high level manpower and applied research. The third, consisting of a variety of training and professional institutions are supported by both the public and private sectors and is career/workplace oriented and strongly market-driven. In the third tier, the joint training

centres are under the preview of the Economic Development Board (EDB), while the other centres, institutes, and colleges are under the various statutory boards, professional and private bodies.

The enrollments, course orientation, and output of all state run and financed higher education institutions are planned at the national level by the Council for Professional and Technical Education (CPTE) which is chaired by a Minister. In essence, the CPTE identifies Singapore's high and middle-level manpower priorities, and concentrates on achieving them. It also monitors the critical linkage between its manpower policy priorities, strategies and the economy.

The higher education institutions are required to meet the manpower targets set by the CPTE as well as have the flexibility to respond to changing manpower priorities and the development of marketable skills among the students. The aim is to maximise the utilisation of the country's human resources for productive use and avoid graduate mismatch and unemployment.

In order to support a demand-driven system of higher education and training, the former institutions and courses (modelled on the colonial system) were restructured and refined. Physical facilities such as high quality classrooms, lecture theatres, tutorial and seminar rooms, laboratories, workshops, libraries, and student/staff housing facilities were expanded to cater for increasing student enrollments and improving the quality of teaching and research. The recruitment and retention of high quality academic and administrative staff through monetary and non-monetary incentives were used to reinforce this drive.

1. The First Tier: Universities

The University of Singapore did not grow rapidly until the late 1960s. In line with national economic needs in the post-war period, the emphasis of the university was on science and technology. New courses in applied chemistry, fisheries, and biology were introduced, and business administration, sociology, political science and Malay Studies were added. In 1969, to meet the demand for high-level skills, Faculties of Engineering and Architecture and the School of Accountancy and Business Administration were added to the four existing faculties, Arts and Social Sciences, Science, Medicine, and Law.

In the seventies, the University of Singapore experienced a steady growth. Enrollments grew from 4,559 in 1969 to 7,030 in 1979, an increase of nearly 70 percent. In the vocationally oriented Faculties of Engineering and Business Administration,

enrollments grew more than anticipated, largely due to the rapid growth of the industrial and services sectors.

The Singapore Government gave full recognition to degrees of the Nanyang University in 1968. However, the academic quality and the employability of graduates compared with those of the University of Singapore were much lower. The Nanyang University, ever since its establishment faced problems of quality control (Lucien W. Pye and Arthur L. Singer, Jr., 1964). The 1959 Prescott Commission and the 1960 Nanyang University Review Committee, which reviewed Nanyang University's overall standards, found that its method of organisation and administration along with its low quality of academic staff were not consistent with those of a modern university. A subsequent Curriculum Review Committee, set up in 1965, was severely critical of the University's curriculum, standards, and medium of instruction.

The Committee made major recommendations for changes in the curriculum and a shift to bilingualism with English (the main working language of Singapore) and Mandarin as the main media of instruction. In spite of those efforts to reform Nanyang University from within, the University continued to 'end up with the weakest students, and even smaller numbers' (Lee Kuan Yew, 1980).

Tension mounted between the Chinese and English educated in the job market as the career prospects of the Nanyang graduates began to suffer. It was apparent that Nanyang University, and particularly its graduates, could not "survive the test of the market" (Lee Kuan Yew, 1980). As observed by the Minister of Education in 1980, "the question of what students should learn and what professors should teach cannot be divorced from the larger question of the role of the university in the society which pays its bills and from which it draws its students." (Tony Tan Keng Yan, 1980.)

Consequently, the Government initiated the reforms from outside the university. It persuaded the University Council to accept unanimously the Prime Minister's proposal to merge the Nanyang University with the University of Singapore in August 1980 to form the National University of Singapore (NUS). The merger was in accordance with the recommendations of the Sir Frederick Dainton's Report on University Education in Singapore of 1979, in which he stressed the need for Singapore to have a single strong national university.

To meet the anticipated high quality skilled manpower demand, the Government, on the recommendations of CPTA, took far reaching measures to expand engineering and technology training facilities at all levels.

Instead of expanding the Faculty of Engineering at NUS, in 1981, the Nanyang Technological Institute (NTI) was established as a separate engineering institute on the

former campus of the Nanyang University. The NTI began with three schools, namely Mechanical and Production Engineering, Civil and Structural Engineering, Electrical and Electronic Engineering. Later the Applied Science and Accounting and Business schools were added.

NTI was to produce the “highly skilled manpower needed for the sophisticated, capital-intensive, high value added industries that will figure predominantly in Singapore’s economy in the 1990s” (Molly Chan, 1983:5). The main role of NTI was to train practice-oriented engineers to complement the output of the more academically biased engineers at NUS. The latter were to be better suited for research and development and corporate management than to fulfilling the demand for skills in the rapidly growing industrial sector. In 1987, the School of Accountancy of NUS moved to NTI to complement its engineering orientation.

NTI was treated as an autonomous institution for administrative and financial purposes. In academic matters, however, it functioned as an integral part of NUS. The graduates of NTI were awarded NUS degrees, and from its inception in 1981 through 1991, NTI produced 7,200 Accountancy and Engineering graduates.

In July 1991, in accordance with the recommendation of the Dainton Report of 1989, NTI was made a full-fledged university and named the Nanyang Technological University (NTU). The Institute of Education and the College of Physical Education were merged into a single National Institute of Education (NIE) and incorporated as a component of NTU. It began awarding its own degrees from 1992.

The overall aim for NTU is to develop it into a comprehensive university with general academic excellence and niches of international eminence. As a comprehensive university, it is to offer courses from a wide variety of disciplines and break away from its former mould, which offered only technology related courses. In addition, it was encouraged to compete with NUS.

The structure of NTU is an American-British hybrid in that the American university credit-hour system has been incorporated into a prescribed core curriculum. In 1992, it added the two new vocationally oriented schools, namely Hotel Administration and Communications.

The Government’s long-term policy assumes that, as Singapore develops, it will need not only engineers, doctors and skilled administrators but also writers, artists, and musicians to enrich the cultural life. In order to maintain their vigour, the two universities are encouraged to develop into comprehensive universities and to compete and offer as many courses as required at their respective campuses. Each university is encouraged to develop its own potential and establish a niche, in regional, national, and

international academic arenas in relation to their teaching and research. It is envisaged that competition between them will stimulate creativity as well as force the two universities to meet student and national needs.

The Open University, established in January 1994, is a private sector institution under the management of SIM. The three joint first degree courses offered with the Open University (London) were English Language and Literature (BA), mathematics (BSc), and computer science (BSc). Candidates who completed these courses are awarded a British Open University degree. These courses are expected to enhance Singapore's manpower development as well as the personal development and the job prospects of the students. The government gave a one-time capital and development grant of S\$38 million including the lease of a sizeable piece of land in its establishment. To ensure that its degrees are of high standard, the Senior Minister of State for Education, chairs the Open University Degree Programme (OUDP) Steering Committee. In 1998, the government announced that OUDP together with SIM would be transformed in the year 2000 into the third University of Singapore, the Singapore Management University.

In sum, the Government's prime objective is to ensure that, "... universities will be in tune with the times keeping an ear on what society expects of graduates and adapting their degree programmes." "University lecturers will be cognizant with teaching methods." "They will fulfill the university's mission to inspire and challenge the nation's finest minds".."Tutors will develop not only the creative abilities of their students but also the entrepreneurial spirit so that students are driven to broaden their needs and extend their vision" (The Next Lap, 1991:48.)

2. The Second Tier : Polytechnics

The main goal of the polytechnics is to meet the rapidly growing requirements for middle-level technical manpower in the various economic sectors. In 1963, the Singapore Polytechnic was restructured and upgraded to the status of an advanced college of technology. Its craft courses were transferred to the vocational and technical institutes. A second independent technical institution, called the Ngee Ann College, was set up in 1963 by the Ngee Ann Kongsi (Association) for Chinese-educated secondary school graduates to acquire a vocationally-oriented post-secondary education. The college became a public institution in 1967, and was upgraded in 1982 to be a polytechnic. A third polytechnic, the Temasek Polytechnic, was established in 1990 to complement the existing programmes as well as broaden course options. A fourth institution, the Nanyang Polytechnic, was established in July 1992, incorporating health sciences and

nurses training originally carried out by hospitals.

In April 1973, the Teacher's Training College (TTC) was upgraded to an Institute of Education (IE) with responsibility for all teacher training and research in education. It had provisions for qualified students to enroll in the University of Singapore for Diploma, Master's, and Doctorate degrees in education. A College of Physical Education (CPE) was established in 1984, to train specialist teachers in physical education. Later both the IE and CPE were incorporated into the NTU.

3. The Third Tier: Other Centres of Public and Private Training

The Vocational and Training Industrial Training Board (VITB) institutes were upgraded to post-secondary Institutes of Technical Education (ITE) to meet the needs of secondary school graduates and the economy. The new system consists of seven ITEs, and trains all school leavers not pursuing other forms of training to obtain higher-level skills before entering the world of work.

The EDB, under a co-operative and jointly run training scheme with foreign governments and firms, has established technical manpower development institutes. These include the German-Singapore Institute (GSI), French-Singapore Institute (FSI), Japan-Singapore Technical Institute (JSTI), Precision Engineering Institute (PEI), Philips-Government Training Centre (PGTC), Information Communication Institute of Singapore (ICIS), Matsushita-EDB Surface Mount Technology (SMT), and the National Productivity Board (NPB).

Professional groups have established several institutions in addition to SIM. These include the Institute of Banking and Finance (IBF), the Marketing Institute of Singapore (MIS), and the Export Market Institute (EMI). These are independent, non-profit and self-financing institutions.

III. Major Innovations In Higher Education

Singapore has been successful in the last thirty-five years in evolving a highly developed and effectively managed and financed higher education system. It has been totally committed to an educational philosophy that high quality human resource development at all levels is a prerequisite for successful economic growth. For this purpose, the Government has generally drawn up all policy directives while providing generous funding to education. While education is seen as providing the maximum potential for training all citizens to prepare for participating in the labour market, higher

education has been used to provide the high and middle-level skills needed for Singapore's increasing participation in a global economy.

The major innovations in higher education during the post-independence decades include the drive toward making it have relevance and excellence, establishing the university-industry linkages, and funding. As curricular enhancement is examined in the next section, it is not discussed here.

1. Excellence in Education

In making higher education improve its relevance and quality, the higher education institutions have continuously strived to improve the structure and content of academic programmes. The yardstick for such efforts have been the universities in the United States and Britain.

Undergraduate degree programmes, once fashioned on the British model, have slowly evolved to include a mix between the British and American models. Undergraduate degree programmes vary in length according to the fields of study. Professional courses like architecture, medicine, dentistry take about five years, while engineering and all honours courses take four years of study. In the 1990s, the NUS and NTU also incorporated the American model of examining at the end of every semester as compared to the older practice of teaching the entire year and conducting one single university wide examinations. The American system of units and credits are used now, while the former practice of the lecturer instructing all students at tutorials is still pursued. A third term has been introduced to allow students to expedite their graduation from the university.

English has become entrenched as the language of instruction at all higher institutions. The policy to use English is considered to be a pragmatic way to master technological knowledge and hence enhance Singapore's competitive edge in the global economy. However, this is counter balanced by twelve years of schooling in mother-tongues of pupils during their schooling years.

The National University of Singapore has constantly sought to introduce programmes that break down disciplinary focus and allow students to pursue courses across departments within a faculty or university-wide access to courses. In both universities students in applied or professional courses spend a semester in internship within industrial organisations. Both universities have also established year abroad programmes for students to spend a semester or an academic year with overseas universities. A similar practice can be observed at the four polytechnics.

Excellence in the tertiary institutions is also interpreted as quality teaching, research and publications in international journals. The higher institutions have instituted strict adherence to lectures and tutorials by academic staff rather than by teaching assistants. A favourable staff-student ratio has led to the rapid expansion in training local staff while hiring foreign staff who are highly talented. The universities are expected to have a staff-student ratio of 1:10 with much lower ratio in the medical faculty. The polytechnics maintain a ratio of 1:14. Staff student contact hours form about five hours a week, while teaching ranges from 10 hours per week at universities and twenty hours at polytechnics.

Staff recruitment is seen as another major area of achieving excellence in education. As tertiary education expanded rapidly, the available pool of talented academics in Singapore became inadequate to meet the demand. In order to overcome the shortage as well as to recruit the best from across the world, regular recruitment of foreign staff is carried out at the tertiary institutions in countries like England and the United States. Increasingly tenure is stringently granted in order encourage staff to show their teaching, research capabilities as well as the ability to publish in international journals. Academic salaries are kept competitive with international standards. In addition, staff is allowed to engage in consultancy practices and keep a large portion of their fees. As a result of all these incentives, Singapore's institutions have been able to recruit high quality staff in a competitive international market.

Almost all staff are expected to have a Ph.D. before being admitted to the universities. Most of them have received their training in the United States, Britain, New Zealand, Australia and Canada. Most departments at the universities recruit their best students and send them overseas for further education. For tenured staff, the sabbatical leave allows most of them to spend a year in developed countries.

Quality control is emphasised by reference to providing world class training. Student quality is ensured by stringent admission procedures to only students who have achieved well at the school 'ordinary' and 'advanced' level examinations. Almost all disciplines engage external examiners from leading world universities to comment on each discipline's academic standards. Feedback surveys among students are used to improve lecturer performance.

2. Promotion of University-Industry Linkages

The universities and their staff are expected to be actively involved in research. Though polytechnics staff are not expected to undertake research, they are encouraged to

undertake consultancy work.

'Publish or perish' ethics for academics at universities has meant high quality applied research. Publication in international journals is used as a benchmark for staff tenure and promotion.

In order to make the universities become centres of research excellence, the NUS, for instance has set up two types of research establishments. The specialty research institutes include the following:

- Institute of Molecular and Cell Biology (IMCB).
- Institute of System Science (ISS).
- Institute of Micro Electronics (IME).
- National University Medical Institute (NUMI).

The within faculty research centres are as follows:

- Centre for Advanced Studies;
- Surface Science Centre;
- Image and Signal Processing Centre;
- Centre for Business Research and Development;
- Centre for Management;
- Centre for Building Performance and Construction;
- Centre for Real Estate Studies;
- Centre for Optoelectronics;
- Centre for Integrated Circuit Failure Analysis;
- Reliability and Magnetic Technology Centre;
- Bioprocessing Technology Unit;
- Centre for Researching Human Socomotion;
- Preosthetic Research Centre;
- Centre for Assisted Reproduction Techniques.

The Nanyang Technological University has set up the following research centres:

- Entrepreneurship Development Centre (ENDEC);
- Grumman International/Nanyang Technological University Institute of Computer Integrated Manufacturing (GINTIC);
- Institute of Computer Integrated Manufacturing (CIM);

- Institute of Manufacturing Technology (IMT);
- Microelectronics Centre;
- Centre for Advanced Construction Study;
- Centre for Transportation Studies;
- Computer Graphics Centre;
- Innovation Centre;
- Centre for Applied Research in Education.

Both universities have signed 'memorandum of understanding' with leading research universities in United States, United Kingdom and Europe.

Post-graduate education and training was not a significant activity until the mid-1980s. The few students who enrolled for graduate study were examined by a major thesis they wrote. In the 1990s, every faculty has been encouraged to establish post-graduate schools. In 1996, NUS alone had 3,881 students engaged in post-graduate training. This is a phenomenal increase compared to 332 in 1980. The universities offer attractive research scholarships to invite local and foreign students.

Research and development is the key focus in fostering the linkages between universities and industries. From 1978, the government has introduced generous incentives through tax rebates, a Research and Development Assistance Scheme (RDAS) and Product Development Assistance Scheme (PDAS) to enhance co-operation between industries and universities. The National Technology Plan 1991 laid out the targets to be achieved. These include:

- The total national expenditure on R & D to reach 2 percent of GDP.
- The Private sector to support at least 50 percent of this total sum.
- The ratio of the number of scientists and engineers involved in R & D activities to reach 40 per 10,000 labour force.

The NUS set up the Industry and Technology Relations Office (INTRO) to encourage co-operation in R & D between NUS and industry. The NTU has established an Industrial Relations Unit to further the link with industries in professional training, career opportunities and technical consultancies.

3. Finance

As education is considered critical to the development of human resources,

Singapore government has invested heavily in education. Singapore's total expenditure on education has been between 5.1 percent of the Gross Domestic Product (GDP) in 1985 reducing to 3.9 percent of the GDP in 1989. The expressed intention is to maintain at around 6 percent of GDP, which is considered as the level of expenditure in Japan (Straits Times, 30 January 1986).

Even though student numbers in tertiary education rose from 8,171 in 1960 to 56,572 in 1990, the government has matched this growth with generous funding. This was done in order not to allow quality to suffer. From 1980 to 1990, the share of expenditure for tertiary education rose from 16 percent to 26 percent of the total expenditure for education. However, the government has sought to progressively diversify the revenue sources of all tertiary institutions. Student fees are being gradually increased over a period of time. From 1992, the fees are to be annually increased by 5 to 7 percent. The policy is to keep student fees pegged at 29 percent of each of the university's operating costs (Straits Times, 15 May 1992). In order for universities to have their own funds for research and development, the Universities Endowment Fund has been established to have S\$1 billion (Straits Times, 9 October 1991). Student loans have been established to support financially less endowed students. The loan repayment periods are between 10 to 20 years (G. Shantakumar, 1992).

IV. Curricula Enhancement : An Example of the National University of Singapore

Singapore achieved political independence in 1965. Since then, the universities have been reshaped to provide the needed professional and technical manpower for an economy that is constantly evolving to remain competitive in a global economy.

The Singapore society as part of the global economy has seen a number of fundamental changes that have had a profound impact on higher education in general and on universities in particular. At the rate of innovation is accelerating. Scientific and technological developments lead more rapidly to new products, to new modes of communication, and to new economic conditions. Global interdependence is growing, and even on a local scale many problems and issues are becoming more complex. These developments have both affected the nature and importance of knowledge and have thereby significantly changed the role and functions of the university.

In teaching, as in research, the university needs to forge a closer relationship with the world beyond the campus. Moreover, it should become involved as much in the aggregation, interpretation, dissemination and application of existing knowledge as in

the quest for new knowledge. Internally, the university's mode of instruction and the content of curricula require adjustment to bridge theory and practice and to help students learn as much from the latter as from the former.

The above purpose is expressed today in the discourse among policy planners at the National University of Singapore. However, the ideal of providing a broad, humanistic preparation for a career was lost in the growing emphasis on professionalism and the fragmentation of faculties into distinct disciplines. Meeting the educational needs of a knowledge-based society is explored at both the universities in Singapore.

At the National University of Singapore, while various quality maintenance procedures have strengthened each discipline and faculty, the provision of a broad-based education that will equip students for their career in a rapidly changing world has remained the concern of policy planners.

In the 1980s, the NUS introduced Human Resource Management (HRM) as a compulsory course for all Arts and Social Science students to better prepare them for a career upon graduation. Science and Engineering students were made to take cross-faculty modules in the humanities to offset their professional biases. In the early 1990s, the NUS experimented with Faculty Enrichment Modules (FEM) to better enable students to benefit from university training. While both programmes are still in use, the NUS is currently looking to the twenty-first century, to initiate curricula enhancement processes in order to overcome the division of knowledge into departments, programmes and faculties.

At the NUS, this curricula enhancement exercise is considered as part of creating a 'world-class university' comparable with those universities in developed countries. The development of a core curriculum that will complement the disciplinary focus of student learning is viewed seriously. The NUS has initiated the debate as to what should be the best model to be followed. As part of this search process, the NUS invited Professor Henry Rosovsky of Harvard University in November 1997 to give a public lecture on Harvard's core curriculum.

As Harvard University is generally viewed as a leader of educational innovations in the United States, NUS has concentrated on its core curriculum as a model for adaptation to the Singapore environment. Academics familiar with other U.S. universities have been co-opted to improve on the Harvard model.

Harvard's undergraduate curriculum is divided into three parts: the 'in-depth' study of a major field; the 'breadth requirement' which is the core programme; and elective courses that students may choose without constraints. At Harvard, the major field requires the equivalent of two years of study, while the core programme and electives each take up the equivalent of one year.

The Core Programme has been a contemporary adaptation of a general education. It represents a general notion that undergraduates need to be educated for something beyond vocations and occupations. In accordance with varying periods in history, that 'something' has been defined in the past as citizenship, or leadership, or intellectual cultivation. The contemporary core programme at Harvard is aimed toward producing graduates who meet the following description of an educated person:

- An educated person must be able to think and write clearly and effectively.
- An educated person should have achieved depth in some field of knowledge to sharpen power of reasoning and analysis.
- An educated person should have a critical appreciation of the ways in which we gain and apply knowledge and understanding of the universe, of society, and of us. Specifically, he or she should have an informed acquaintance with the mathematical and experimental methods of physical and biological sciences; with the main forms of analysis and the historical and quantitative techniques needed for investigating the workings and development of modern society. With some of the important scholarly, literary, and artistic achievements of the past; and with the major religious and philosophic conceptions of man.
- An educated person is expected to have some understanding of, and experience in thinking systematically about, moral and ethical problems. It may well be that the most significant quality in educated persons is the informed judgement which enables them to make discriminating moral choices.
- An educated person should have good manners and high aesthetic and moral standards - that is, the capacity to reject shoddiness in all of its many forms, and to explain and defend his or her views effectively and rationally.
- Finally, an educated American, in the last years of this century, cannot be provincial in the sense of being ignorant of other cultures and other times. It is no longer possible to live our lives without reference to the wider world in which we live. A crucial difference between the educated and the uneducated is the extent to which one's life experience is viewed in wider contexts.

The adaptation of educational practices in American universities within the Singaporean context is no surprise. In the 1980s, when Confucianism was considered as a valued concept to be promoted through Singapore's education system among ethnic Chinese Singaporeans, many of the eminent scholars came from American universities.

The initial testing of the core curriculum at NUS will be confined to the Faculty of Arts and Social Sciences, and the Faculty of Sciences. Once it is implemented at the

two faculties, it will be extended to all students at NUS. The programme is to enable undergraduates to obtain balance of depth and breadth in their university education. While 'depth' in a major discipline will prepare them for the economic challenges of today, the 'breadth' obtained by a core curriculum is to prepare them for the challenges of the future. The core curriculum is seen as a way for students to be prepared to tackle problems not yet defined and take on jobs yet to be discovered.

As Singapore, together with the developed world, advances into a knowledge-based society, changes and adaptation will be a feature of life. The sustainability of new occupations and vocations will become shorter than present careers. Graduates in the next century may typically experience three or more career changes during their life-time. The workplace, moreover, will require a multidisciplinary and systems approach to address problems.

Given the above scenario as envisaged by educators, university graduates need to be involved in shaping the intellectual and cultural developments that Singapore will face. While to be equipped with an intellectual structure for understanding, students must be made to realize that knowledge is the major vehicle for development and progress. This understanding can be defined in various ways, including ideas of citizenship, intellectual sophistication, and human relations and understanding of foreign cultures.

Based on preliminary discussion among NUS officials, and consultations with educators in Singapore and abroad, a core curriculum has been conceived in a general way. It has been defined as a set of courses designed to broaden undergraduates knowledge, skills and habits of thought in areas identified to have lasting value. Such a programme assumes that students must be pushed to broaden their knowledge base. The rationale of the core curriculum is that students be exposed to ways of thinking beyond the areas of their academic concentrations; they must understand the different forms of inquiry and analysis, and their applications.

In early 1998, a multidisciplinary Core Curriculum Committee at NUS, chaired by Deputy Vice Chancellor Shih Choon Fong, has identified broad areas in which the core courses are to be developed. These areas include the followings:

- Writing Programme;
- Singapore and the Asia Pacific;
- Scientific Thinking and Methodology;
- Human behaviour in Society;
- Contemporary Societies;
- Literature and the Arts;

- Social and Economic Analysis;
- Science and Technology.

Each of the above areas have been also identified as having specific curricular goals. The core curriculum area ‘Singapore and the Asia-Pacific,’ for instance has a module named ‘Singapore : The Making of a Nation.’ Its curriculum goals are listed as follows:

- An understanding and appreciation of how Singapore becomes a nation is vital for national education objectives as well as personal commitment to the shaping of the nation. People without history have been compared to persons without memory.
- The study of history contributes to a greater awareness of the nation and region and world in which the individual person lives and socializes.
- The essential humanistic and liberal nature of history will repay the student who pursues it with the means to empathise with his fellows, to appreciate the diversity of humankind, and to respect ideas and viewpoints different from his own.

Other universities in Singapore would eventually adapt NUS’s experience and experiment in enhancing the curricula of undergraduate education.

V. Conclusion

By way of conclusion, the paper hopes to examine the future of higher education in Singapore as well as place Singapore’s success in higher education planning within some kind of socio-economic development model. These may help other societies in deciding the nature of the directions their own higher education planning should follow.

The history of higher education institutions across the world point to the need for autonomy and freedom from political interference, to the need for a detachment from short-term economic and political imperatives, and they demand support for fundamental and long-term research and scholarship (the results of which cannot be quantified or measured in the short-term, or in terms easily understood by the general community). They also stress the essential role played by the arts and humanities in sustaining cultural and philosophical traditions, and in developing new areas of critical thought and discourse. But all governments are increasingly required to scrutinize and justify every arena of public expenditure, as they seek to meet the challenges posed by an increasingly harsh

and unforgiving world.

The expansion of higher education in Singapore since 1965 shows that the government has followed an interventionist policy in not only funding higher education but also carefully planning its growth.

1. Directions for the 21st Century

The planning for the twenty-first century is to nurture and reinforce key human resource capabilities to meet the requirements of the vision set for Singapore:

“... to attain the status and characteristics of a first league developed country within next 30 to 40 years” (The Economic Planning Committee, 1991: 57.)

With this vision as the ultimate goal, higher education has been identified for increasing the supply of talented and professional people. In training this talent pool, their education is to be carefully monitored so that their training has relevance to Singapore. The future of Singapore's higher education has been identified as having three objectives:

- To keep abreast of the growing globalisation of Singapore.
- To make it respond rapidly to a fast changing industrial structure in which workers must learn new skills and even change jobs to meet new economic demands.
- To maximise the opportunities for those Singaporeans yearning for a higher education.

It has been forecast that by the year 2,000 and beyond, 20 percent of each primary one cohort would make it to the universities, while 40 percent would go to the polytechnics (Straits Times, 14 March 1992). Another 25 percent would undergo high-skill courses at the institutes of technical education (ITE). Thus, 60 percent of each age cohort of between 40,000 to 45,000 secondary school graduates each year will receive higher education. Thus a mass system of higher education is envisaged for the early decades of the next century. This is in preparation for the new century in which it is felt that many jobs relying on manual labour will disappear and that more and more occupations will require high school certificates. The knowledge-based global economy would demand students with higher education training.

The two universities have forged close links with the United States and the United Kingdom, which in turn would provide further linkages to Europe. When the

third conventional university, the Singapore Management University is established in 2000, it is expected to forge links with Japanese tertiary institutions. This will complement the links the NUS and NTU have developed for Singapore. In the view of a former Minister of education, this “will provide Singapore very valuable links to the three main economic powerhouses which will predominate in the world in the coming decades” (Straits Times, 14 March 1992).

2. The Development Model : An Explanation

There have been three major theoretical perspectives on the relationship between educational expansion and economic growth. These include:

- Human Capital Theory;
- Status competition or allocation theory;
- Class reproduction theory.

Though each of these is composed of several newer variations, we can identify their overall orientations easily. Human capital theory specifies processes through which education has positive effects on economic growth. The status competition and class reproduction theories suggest that education effects are more often neutral or negative.

The human capital theory posits an argument that people who have more years of schooling have better jobs and higher pay than those with less years of schooling do. So, the more people with more education, the greater the economic productivity at the aggregate level. Consequently, the national economy grows.

During the 1970s, human capital theory came under heavy attack by sociologists and economists. A summary of these arguments is as follows:

- Schools do not necessarily match what is needed on the labour market.
- More educated and less educated persons do not differ in productivity in the same job.
- Modern economy demands not a highly skilled labour force but rather a ‘skilled’ labour force because of rapid technological change and simplification of production tasks.

The status competition theory treats education as a social institution. One of its functions is to allocate personnel to positions according to educational credentials. The

desire for higher status leads people to compete for better jobs by lengthening their years of schooling. Although those with more years of schooling may gain a larger share of the economic pie than those with less schooling, the pie itself is not necessarily enlarged by the increase in the population schooling. Thus, educational expansion does not necessarily promote economic growth.

Class reproduction theories argue that the primary function of education is to reproduce the class structure and inequalities. Schooling for the elites may emphasize classical studies, humanities, or knowledge that is largely irrelevant to economic needs of society. The schooling for the masses, on the other hand, is designed to serve the interests of the dominant class. As a result, the process of class reproduction often obstructs contributions of schooling to economic output.

The debate among these perspectives has been lengthy and unresolved. There is no theoretical consensus for predicting the role of education in economic development.

More recently, the general debate over which theory is correct and whether or not education has beneficial effects has begun to be recast into a more useful question. The new question enquires the conditions under which education promotes or impedes economic growth.

The new emerging theoretical perspective views positive effects of education on economic growth as dependent on certain characteristics of the economic and educational systems. The new perspective also emphasizes that the positive effects are dependent on how closely the qualities and numbers of workers are matched to the requirements of the economy.

Where human capital processes operate to produce such a match, educational expansion contributes to economic growth. If educational expansion takes place under the condition where either class reproduction processes or status competition processes operate, education's contribution to economic growth will be weakened. These two processes reduce the economic effects of education because the organisation of the education system is determined by factors other than the needs of the economy. Such processes often result in small selective educational streams with curricula oriented to elite culture and to a mismatch in enrollments to labour force requirements, especially to overproduction of highly educated graduates for available jobs.

The search for the best equation to link educational expansion to economic growth has been extensively debated among all educational planners. As most societies spend more universities, this coupling becomes a crucial issue.

The successful coupling of education to the changing needs of the economy requires one of two things: - market forces, and/or state action. Only then will education

accurately reflect economic need vis-à-vis education. Hage, Garnier and Fuller (1991), for example, argue that strong states can insist on this coupling and thereby generate a greater payoff from investment in human capital. Weak states, on the other hand, may allow schooling to be shaped by class interests or popular demand for higher credentials.

The basic assumption is that “human capital theory works better when the state attempts to design the curricula to meet economic (and possibly political) needs and when it guarantees the quality of the output” (Hage, 1991 : 836).

Psachropoulos (1991), in contrast, emphasises the role of the market supply and demand forces. He suggests that state manpower planning is generally ineffective.

Off course, strong state activity does not guarantee successful matching of education and economic needs. Narrow interests to the detriment of general economic growth may exploit the power of strong states.

In attempting to place Singapore’s success in planning for education in general and particularly in the expansion of higher education, it is evident that strong state action has been able to couple education with economic growth. Singapore’s success with higher education has shown that commitment to broaden economic growth and the strength to effectively implement policies are both necessary.

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