In their characterization of world-class research universities, Jamil Salmi (2009) and Philip G. Altbach and Jorge Balán (2007) direct attention to universities’ international standings as research institutions and their responsibility in creating new knowledge with science and technological innovation at its core. Globally, higher education is increasingly valued for its links to economic development and its major contributions to a country’s gross domestic product (GDP) (Hatakenaka 2004), with recognition of its catalytic role in growing the knowledge economy and society.

The impact of universities’ teaching, learning, and research activities related to the accelerated expansion of knowledge is tracked closely—leading to interinstitutional competition for human and financial resources within a worldwide framework. Policy makers and institution managers refer to globally acknowledged benchmarks that have been proven to strengthen universities—making them more competitive among their peers and more attractive to students, academic staff members, researchers,
employers, funding bodies, and industry. Universities in industrial economies appear to have the edge (for example, Harvard University, Stanford University, and University of Cambridge) as seen in their research outputs and outcomes and reflected in world university rankings, but newer universities in Asia (such as the University of Hong Kong and the National University of Singapore) are holding their own.

Governments of emerging economies also look to their higher education institutions to provide the fundamentals for their participation in the growth of their knowledge economies, particularly in competitive innovation and research products. This chapter reviews the paths taken by two universities—the National University of Singapore (Singapore) and the University of Malaya (Malaysia)—that branched out from the same roots. King Edward VII College of Medicine, established in Singapore in 1905, merged with Raffles College in 1949 to become the University of Malaya, in Singapore. Expansion of the university, coupled with independence from the United Kingdom (Malaya in 1957 and Singapore in 1959) as two separate countries, led to the creation of two branches in 1959, one in Singapore and one in Kuala Lumpur. In 1962, following the decision of the Singapore and Malayan governments (Malaysia was formed in 1963 with the addition of Sabah and Sarawak states in Borneo), the two became autonomous national universities—the University of Singapore and the University of Malaya—in their respective countries. The University of Singapore merged with Nanyang University in 1980 to become the National University of Singapore.

Immediately following the separation and establishment of the two universities in 1962, both universities made efforts to strengthen their academic staffing base and consolidate their teaching programs. Both had acquired reasonable reputations in the Southeast Asian region. The populations served in both countries are multiracial with the same racial mix in different proportions (see table 5.1). The plurality of races is particularly significant in Malaysia where education policy is influenced by different opportunities for students and academic staff members, who constitute the heart of higher education institutions.

Several questions guide this analysis. What were the attributes favorable to institutional development in the national and institutional policy contexts of the two institutions? What significant decisions have been made regarding the selection of students and academic staff members, and how are the best staff members attracted and retained? Do the universities’ research activities have the assurance of stable and adequate financial support? To what extent have strategies to internationalize the
Postseparation Policy Environment

At an early stage, the Singapore government realized the universities’ role in sustaining economic growth, and in the early 1970s, as the “labor-intensive strategy gradually gave way to a higher value technology-intensive strategy . . . a new tertiary education philosophy crystalized in Singapore” (Seah 1983, 14). As a result, being on the cutting edge of teaching and research has continued as a priority for NUS since 1962, with research excellence becoming an increasingly important mission since the late 1980s. In contrast, after 1970, UM’s institutional goals reflected the New Economic Policy, an affirmative action plan for ethnic Malays and indigenous groups, put in place in the wake of disastrous 1969 ethnic riots that took the lives of hundreds of people on both sides of the racial divide. The civil disturbances, partly the result of dissatisfaction among the Malays with their progress in the education and economic sectors, brought about sweeping changes—leading to the New Economic Policy, with education perceived as a vital instrument for achieving its objectives.

The New Economic Policy was designed to achieve national integration and unity through a two-pronged strategy: (a) eradicating poverty by

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**Table 5.1 Population Distribution by Ethnic Groups in Singapore and Malaysia**

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Singapore (4.8 million inhabitants)</th>
<th>Malaysia (28.7 million inhabitants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumiputrasa</td>
<td>14%</td>
<td>65%</td>
</tr>
<tr>
<td>Chinese</td>
<td>77%</td>
<td>26%</td>
</tr>
<tr>
<td>Indians</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Others</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

raising income levels and increasing employment opportunities for all Malaysians and (b) restructuring Malaysian society to correct economic imbalances so as to reduce and eventually eliminate the identification of race with economic function. It was expected to be in place for only 20 years but has continued under different labels—such as the National Development Policy and, most recently, the New Economic Model. A major outcome of the New Economic Policy was the imposition of ethnic quotas for student admission at a ratio of 55 to 45 for Bumiputras to non-Bumiputras, in line with their distribution in the Malaysian population. These quotas were in place until the meritocracy system was introduced in 2002, but the proportions have not varied much since then.

Apart from the student quota system, the New Economic Policy translated into more scholarships to Bumiputra students, a special foundation and matriculation programs to facilitate their entry into higher education institutions, the use of the Malay language in place of English in the entire education system by 1983, special preuniversity schools and colleges set up for rural Bumiputra children, and greater opportunities provided to Bumiputra students to study science. In UM and in government, the policy impact spiraled upward so that Bumiputra staff members, over time, secured almost all senior management, administrative, and academic positions.

As NUS kept pace with the demands of a growing economy that sought to become competitive internationally, with English continuing as the language of instruction and research, UM began to focus inward as proficiency in English declined in favor of the national language—Bahasa Malaysia—and the New Economic Policy’s social goals took precedence. The erstwhile premier university was unable to compete successfully in strategic innovations and production with regional universities. Economic competition—from economies such as China; the Republic of Korea; and Taiwan, China—revealed that unless it could bring high, value-added technology to industry, Malaysia would be unable to hold its own. The time for resting on the advantage of low-cost labor had ended, particularly when China’s cheap labor force entered the marketplace.

NUS developed in a political and economic environment where the political leadership had consistently and unequivocally emphasized that human capital development was the foremost goal for the country that was scarce in other natural resources. From NUS’s inception, the national educational development policies (Low, Toh, and Soon 1991) were based squarely on meritocracy and the need for graduates who could enhance Singapore’s growth as a hub for international financial services and trade.
As the Singapore economy increasingly shifted over the years from labor- and capital-intensive manufacturing activities toward knowledge-based activities, the role of NUS has progressively broadened to include a significant focus on research since the late 1980s and technology commercialization since the early 2000s (Wong, Ho, and Singh 2007). Moreover, the NUS mission also broadened from being a local tertiary labor developer to becoming a globally oriented university, competing for the best faculty and student talent from around the world and seeking to make a meaningful impact on the world through knowledge creation and diffusion. To provide NUS the flexibility it needed to transform its role in the Singapore economy, the Ministry of Education corporatized NUS in the mid-2000s.

In the mid-1990s, four watershed pieces of legislation were passed in Malaysia for the higher education subsector, providing a regulatory framework for the burgeoning private sector while placing strict parameters for public university management: (a) the National Council on Higher Education Act, 1996, to establish a council that formulates policy for the Malaysian higher education sector; (b) the Universities and University Colleges Act, 1971, amended in 1996 to enable corporatization of public universities and to modernize the management of public universities; (c) the National Higher Education Fund Board Act, 1997, to establish a higher education, student loan–funding agency; and (d) the National Accreditation Board Act, 1996. The latter legislation led to the Malaysian Qualifications Agency Act, 2007, which developed the Malaysian Qualifications Framework to unify and harmonize all Malaysian qualifications. Notwithstanding such efforts to reform the higher education system, the pro-Bumiputra affirmative action policy remained in force.

Between 2004 and 2009, the Times Higher Education–QS World University Rankings (THE-QS 2008, 2009) showed NUS among the world’s top 20 (2004, 2005, and 2006) and top 30 (2008 and 2009), with UM moving progressively lower between 2004 and 2008 from 89th to 230th (180th in 2009). The much-advertised rankings by the media and perceived declining standards of UM led to public questioning in Malaysia, with calls for action. One of UM management’s first actions, was to retool its institutional goals and processes. Without putting aside the long-term goals of the New Economic Policy, management developed new institutional goals in the 2000s, recognizing that the talent pool would need to be widened beyond the existing student quota levels and inward-focused staffing policies. The change to the policy of meritocracy
for student admissions, based on results of recognized examinations in 2002, was a response to the issue of widening the net for talent. UM’s mission included the goal of becoming “an internationally renowned institution of higher learning in research, innovation, publication and research” (UM 2008, 21). New priorities have brought additional challenges.

There has been widespread recognition that the implementation of affirmative action policies in Malaysia has hurt the higher education system, sapping Malaysia’s economic competitiveness and driving some (mainly Chinese and Indians) to more meritocratic countries, such as Singapore. Meanwhile, the government has announced the New Economic Model, which would replace the New Economic Policy (NEAC 2010). With the aim of turning Malaysia into a high-income economy by 2020 with per capita income expected to move from US$7,000 to US$15,000–US$20,000, the New Economic Model plans to institute tough economic reform policies to increase the country’s competitiveness. The authors of the New Economic Model identified “insufficient innovation and creativity” and “lack of appropriately skilled human capital” among the critical factors contributing to current sluggish economic growth (NEAC 2010, 22) and inability to participate in the knowledge economy.

**Language Policy**

Keeping native-language instruction available within the Singapore school system, the first postindependence prime minister, Lee Kuan Yew, laid special emphasis on English as a common language that both connected citizens of all ethnic backgrounds and tied Singapore to the world economy. Apart from the native language, at the secondary-school level students can opt to study French, German, or Japanese, and the Ministry of Education Language Centre provides free language education for most additional languages that schools do not cover. The range of languages at school level, with English as the language of instruction throughout the system, prepares NUS graduates well for international participation. The requirement for English proficiency is not up for debate in NUS, and this policy has served its international objectives well.

In Malaysia, the language of instruction in mainstream government schools changed from English to Bahasa Malaysia in 1971, with provision for primary schooling in Chinese (Mandarin) and Tamil. At the secondary level, only the Bahasa Malaysia track comes under government provision. Chinese school students opt to switch to this mainstream track or to proceed to private, generally well-run Chinese secondary schools (about
60 schools). There are no secondary-level Tamil schools. In all schools, English is taught as a subject, and not all teachers are adequately trained.

Political exigencies accelerated the implementation schedule of moving from English to Bahasa Malaysia, bringing implementation forward to the mid-1970s instead of 1983 (Chai 1977). Academic staff members and students were not equally proficient, and infrastructural support, such as textbooks and reference materials, was in English. Massive language-training programs were put in place accompanied by a scramble to translate English texts into Bahasa Malaysia and to write new textbooks.

The Malays benefited from the rapid change in language medium, particularly those from the rural areas. However, the short-term outcome of this policy, apart from improved grades among the Malay students, was the inability or unwillingness of many to deal with English. Opportunities were lost to function in English, which is currently the global language of research, publication, scientific discourse, and electronic communication and a tool for increasing mobility. Students regurgitated lecture notes, reluctant to refer to English-language texts, journals, and sources of reference. The focus on Bahasa Malaysia brought with it an interest in Malay language, culture, and history, and this trend would have occurred anyway, given academic expertise and patterns of financial support. Efforts to internationalize teaching and research have brought renewed focus to the tension between strengthening English and supporting Bahasa Malaysia, the national language and the language of the Malay race. Unless political measures support the widespread use of English, the engagement of young Malaysians in global knowledge creation will continue to be limited.

Meanwhile, the 60 or so independent Chinese secondary schools have received a dramatic surge of applicants taking their highly competitive entrance examination. A growing number of Malay and Indian parents register their children in Chinese schools, considering them qualitatively superior with good discipline. In addition, they are convinced that learning Mandarin might give their children a head start in employment with the strong Chinese business community. Most Malaysian private universities, NUS (since 1998), and about 100 overseas institutions accept the exit examination—the United Education Certificate—for entry. In response to appeals from Chinese education groups, the Malaysian government has agreed to review the certificate’s conferral of eligibility for admission to public universities in stages, with a key criterion being attainment of Bahasa Malaysia qualifications (The Sun 2010, 3).
Financing

World-class research universities are characterized by stable and higher levels of financial support, compared with comprehensive universities that focus mainly on teaching rather than research. A history of strong government financial support, buttressed by an institution’s own fund-raising success, tend to mark the financial experience of acclaimed research universities.

Whereas the Singapore government’s financial commitment to education has stayed at about the same proportion since 1962—around 3 percent of its GDP—the proportion of public educational expenditure going to university education has climbed from 10.8 percent to 19.8 percent between 1962 and 2007. In absolute terms, this proportion amounts to approximately US$1.31 billion for 2007, indicating that all three universities have a strong base of government financial resources. The annual operating budget for NUS for 2008–09 reached US$1.55 billion with government grants constituting 58 percent of the operating budget, up from just US$287.72 million in 1990 (NUS 1990, 2009). In 2008, UM’s total income was US$280 million, and about 68 percent of this income came from federal government grants (UM 2009). Miscellaneous fees constituted 11 percent, investment income 10 percent, amortization of the grant 5 percent, and 6 percent from other income (UM 2009, 298).

Although public expenditure for education in Malaysia has constituted around 25 percent of its budget for a period of time, the absolute amounts clearly are not comparable with those of Singapore. Although the high proportion shows strong government commitment to education, inefficiencies in institutional budget practices, as discussed later in this section, render fund use less than optimal. Furthermore, Malaysia’s economy has not been in step with the expansion of country economies in the region. Table 5.2 shows an increase in GDP per capita income in current terms for Hong Kong SAR, China; Korea; Malaysia; and Singapore between 1970 and 2005, when Korea, behind Malaysia in 1970, more than tripled Malaysia’s per capita income by 2005. Singapore’s GDP per capita income was more than double that of Malaysia in 1970 and had stormed ahead to more than five times the amount by 2005. These figures translate into lower levels of financial resources available to all sectors.

A matter of concern for planners is that public expenditure for education in Malaysia does not exhibit consistent levels of allocations to the various subsectors. Between 1970 and 2006, overall public expenditure
on education as a percentage of GDP in 1970 constituted 3.98 percent, climbing to a peak in 2002 of 7.66 percent, then falling to 4.67 percent in 2006. The impact is seen in the reduced allocations of public expenditure per tertiary student (as a percentage of per capita GDP) from 97.83 percent in 2002 to 59.72 percent in 2006 (IMF 2009). In the same year, annual student expenditure at NUS (US$6,300) was higher than at UM (US$4,053) even after taking into consideration the differential costs of living in Singapore and Malaysia. The cost of living was only 1.3 times higher than that of Malaysia in 2006 (IMD 2006). Decreasing allocations translate to less financial support for institutional development. This trend is also evident in research allocations that are not consistent over time.

UM student fees are highly subsidized; only US$0.94 million, or 3 percent of the 2008 operating budget, came from tuition fees. For NUS, in 2008 tuition income was 16.6 percent of its operating budget. A comparison of average annual fees for local and international undergraduate and graduate programs in both universities showed high subsidy levels for local students in UM, whereas NUS appeared to base its fees for local students more on the principle of cost recovery. Annual tuition subsidy per local student from the government of Malaysia for a bachelor’s degree in economics is currently just under US$4,783. For medical students, while the annual student tuition fee is US$780, the government’s annual tuition subsidy per student is US$9,856 (Fernandez-Chung 2010). In NUS, in 2009 the average annual local and international student tuition fees for an undergraduate humanities program were US$4,560 and US$6,840, respectively—according to the NUS Registrar’s Office. Within a context of uncertain economic growth worldwide and the ever-increasing costs of higher education, current high subsidy levels may not be

<table>
<thead>
<tr>
<th>Economy</th>
<th>GDP per capita, 1970 (current US$)</th>
<th>GDP per capita, 2005 (current US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>394.1</td>
<td>5,141.6</td>
</tr>
<tr>
<td>Korea, Rep.</td>
<td>278.8</td>
<td>16,308.9</td>
</tr>
<tr>
<td>Singapore</td>
<td>913.8</td>
<td>26,892.9</td>
</tr>
<tr>
<td>Hong Kong SAR, China</td>
<td>959.2</td>
<td>25,592.8</td>
</tr>
</tbody>
</table>

Source: IMF 2009.
sustainable over the long term: better cost-sharing strategies need to be encouraged.

UM’s fund-raising capacities are unable to offset the gap between government allocations and the levels required for meeting teaching expenditure requirements and international-level academic research. Strategies to increase and diversify income sources include the establishment of an endowment fund, as yet modest, which stood at almost US$124 million in 2008 (according to the UM Bursar’s Office), increasing income from consultancy contracts (0.89 percent of annual income in 2008), and mounting of new market-oriented programs. Exacerbating the scarcity of resources in UM are the rigidities of the government financing modality, which is primarily a historical and negotiated incremental-cost approach (linked with inputs) in the distribution of funds among public universities. Agreed line items such as salary levels and fees leave the institution little flexibility, and UM submits monthly balance sheets to the Ministry of Finance to demonstrate expenditure carried out as agreed. This practice is in force despite the fact that the Modified Budgeting System, which operates as an output-oriented budget allocation, was introduced in 1997. An approach with a delay built into the process has the disadvantage of impairing both efficiency and institutional agility to respond swiftly to change.

Challenges Facing University Management and Administration

The decades since 1962 have brought about a sea change in the level of complexity confronting the management, administration, and overall organization of NUS and UM. University leadership has had to adjust to the now universally accepted understanding of the deep links between economic growth and education. Institutional managers and administrators, largely from a bureaucratic civil service background, have had to learn to be more entrepreneurial, to work with industry, and to collaborate in joint outputs and commercialization of products against a background of increasingly sophisticated and high-tech electronic tools. Management has had to become responsible for overseeing the updating and fine-tuning of curriculum, pedagogy, and assessment techniques to match growth and change areas. Economic growth, with its need for stimulating locally grown innovations along with the creation of new knowledge, propelled the institutions to shift from pursuing the primary role of teaching to pursuing both teaching and research. The policy shift to encompass a significant role in research has been implemented with greater resource intensity and outcomes in NUS than in UM.
The changing nature of the universities’ functional goals ran parallel to equally challenging physical and logistical changes with new faculties, institutes, and centers and growing student and staff numbers. Additionally, both universities have had to develop policies for internationalizing academic and research staff members as well as students, keeping in mind the effect of such policies on programs, financial, and human resources.

The external tertiary education environment has been equally in flux. Emerging from a situation of monopoly, the two universities have had to develop competitive strategies for human and financial resources as other tertiary institutions were established. Singapore has three public universities, whereas Malaysia has 20. Both countries host a vast array of twinning programs and partnerships with international universities. Singapore has positioned itself as a regional hub by attracting leading foreign universities such as Institut Européen d’Administration des Affaires (INSEAD) and the University of Chicago to the city state. In Malaysia, a vibrant, private higher education segment has also grown with branches of five foreign universities—Curtin University of Technology, Monash University, and Swinburne University from Australia; and the University of Nottingham and Newcastle University from the United Kingdom.

What mechanisms did university management and leadership develop to deal with such extensive and deep changes, and what was the impact on institutional development? To what extent did the two universities possess or develop the nimbleness to adjust to these changes?

**University Management and Governance**

After Singapore separated from Malaysia, the Singapore campus of the University of Malaya was renamed Singapore University and was constituted as a public university under the Ministry of Education of Singapore. Like UM, Singapore University was structured as a statutory board, with the vice-chancellor appointed by the cabinet and the strategic direction of the university overseen by a university council with public- and private-sector members who were appointed by the government. In both Singapore University and UM, faculty and administrative staff members were treated as government employees and their salary structure pegged to that of the civil service system. Although this governance structure continued when Singapore University became the National University of Singapore, more autonomy was granted to the university administration over the years, culminating in the corporatization of the university in the mid-2000s. Concomitantly, there was a gradual shift in university administrative practices from those of the U.K. model to that of the U.S. model.
For example, the faculty-rank structure shifted from the British system of lecturers, senior lecturers, and other positions to the U.S. professorial ranking system, and the title of vice-chancellor was changed to president.

Between 1962 and the mid-1970s, policy setting and decision making in UM, as in NUS, were the functions of the University Council, which had representation from the private sector and government—the latter including the Ministry of Education and later the Ministry of Higher Education (established in 2004). The Minister of Higher Education appoints the vice-chancellor, and the vice-chancellor appoints the deans. The centralized system’s inertia restrained UM’s management from acting in its own best interests, foregoing the agility that autonomy brings to strong world-class universities. A central Ministry of Higher Education unit handles students’ selection and their distribution across all departments. Government approval is required for new programs and clearance of course content in which 30 percent is new content. Hiring, firing, and salary decisions are not fully independent of the Ministry of Higher Education, making it difficult for management and university leadership to replace unproductive staff and reward productive staff. There have been some changes over the past decade. Campus activities, except for those that are political in nature, have enjoyed resurgence. In a reformist move in 2009 triggered by new leadership, there were open elections for deans’ positions (taken up by only four faculty groups).

The New Economic Policy succeeded in reducing poverty and substantially addressed interethnic economic imbalances. Its implementation, however, has increased the cost of doing business, because of “rent-seeking, patronage . . . (engendering) pervasive corruption, which needs to be addressed earnestly” (NEAC 2010, 7). In a bid to gain confidence and improve transparency, accountability, and overall governance, the universities’ administrative procedures such as criteria for staff promotion, and evaluations by internal and external academic assessors are now disclosed (since 2009) on each university’s electronic network, moving from little or no informed discussion to a more open forum. Such practices have the potential for changing the management and academic culture of the university by moving away from decisions based on personal relationships to those based on agreed institutional goals and individual achievement.

**Leadership**

Between 1962 and the present, NUS leadership demonstrated the value of continuity in position, with only five vice-chancellors during the period—most of whom were respected scholars of international repute.
This experience contrasts with the 10 vice-chancellors for UM over the same period, only some of whom were recognized as top-notch scholars and two were nonacademic senior civil-service personnel. Many served for single tenures of three years, and at least two did not complete their first tenures. Few have had sufficient experience in steering a large, complex educational institution through a highly political environment. Many have, therefore, relied heavily on rigid government guidelines with scant regard for managerial, academic, and financial autonomy.

On the heels of the negative publicity brought about by poor global ranking of Malaysia’s leading universities, government authorities provided new leadership to UM in 2008 by appointing a vice-chancellor with a proven performance record from a successful government-linked university. His program of institutional change reflects an attempt to bring about internal realignment with the policies and practices of successful international research universities, focusing on developing a culture of scholarship. He has a significant challenge, having to woo both administrative and academic staff to his reformist views.

**Strategic Planning**
In the early 1980s, NUS had followed the policy of capping the number of traditional courses to allow for growth in professional courses—such as engineering, architecture, construction, and real estate management. Prevailing government policies related to high-level labor requirements continued to influence university admissions in science and technology-based areas as did constant monitoring of market forces to reduce risks of graduate unemployment. In more recent years, in response to the changing needs of the economy, NUS has launched new schools such as the Lee Kuan Yew School of Public Policy and new multidisciplinary programs such as bioengineering. UM’s strategic planning focused on the student-entry level; grounded in the New Economic Policy, distribution was based on 55 percent Bumiputra to 45 percent non-Bumiputra, and the goal was to increase the number of Bumiputra admissions in national priority areas of science, technology, and professional program admissions rather than capping enrollment in courses. The Ministry of Higher Education’s targets of a 60 to 40 distribution between science and technology programs and the humanities programs provide a guideline.

**Autonomy and Responsiveness to Change**
In Singapore, after Parliament passed the bill to corporatize NUS in 2006, the greater autonomy conferred by the act enabled NUS to accelerate the
process of organizational transformation that it had begun in the late 1990s to better meet the challenge of global competition. For example, although NUS had already begun to offer more competitive compensation packages to recruit faculty from overseas before 2006, corporatization gave the university, as a not-for-profit organization, greater flexibility in structuring offers, including providing generous start-up research grants and reduced teaching loads in initial years for top researchers. It also further increased NUS leadership and management flexibility in institutional practices such as market adjustment allowance for faculty in fields with high-market demand (for example, medical and finance) and recruiting of deans and department heads through international search committees.

The progressive increase in autonomy granted to NUS has enabled it to respond to new opportunities more proactively and more nimbly. In response to perceived needs, NUS could develop relatively quickly, for example, a wide range of new interdisciplinary educational programs such as nanotechnology and interactive digital media. To support diversity of educational approaches, NUS has launched a new medical school (in collaboration with Duke University, in the United States) based on the U.S. postgraduate and research-based medical school model, while continuing to expand the existing U.K.-style undergraduate medical school. As part of the campus expansion program, NUS is also developing a new residential college system, adapting elements of the residential college system of the United Kingdom’s University of Cambridge and University of Oxford.

The Corporatization of Higher Education Act in Malaysia was passed in 1997. As in the case of NUS, the act would allow universities to manage themselves like corporate bodies, reducing bureaucratic red tape and delays in the decision-making process. Critical features included securing financial autonomy for higher education institutions; freedom to appoint university leaders, deans, and heads of institutes; and freedom to select students. However, the legislative framework that would have opened the door to university autonomy was never fully implemented. The official reason provided was that in the cash-strapped environment following the 1997 financial crisis, universities would find it impossible to function without government funding. UM lost the opportunity to manage itself and continued as an executor of government policy and decision making, drawing the comment that university autonomy has been systematically eroded in Malaysia. The University of Malaya, which enjoyed a certain autonomy during its early days, has now joined younger universities that are directly controlled or
strongly influenced by the government. Basic freedoms of university staff and students have been so effectively curbed. . . . It is not surprising, therefore, that the quality and standards of local universities have been deteriorating. (Ali 2009, 266)

The 1980s and 1990s ushered in a global technology explosion. Because of insufficient technological understanding, vision, resources, and know-how, UM—and, indeed, the government—did not act swiftly enough at systemic and institutional levels to implement measures to take advantage of new technology. The education management information system, for instance, is woefully inadequate—where it exists. At the institutional level, student and staff databases for UM, and from the Ministry of Education for the country as a whole, were available in electronic form only after 2002. This modernization was continued by the Ministry of Higher Education after its establishment in 2004 (Ministry of Higher Education 2005, 2006, 2007). There is greater recognition now that as research activities expand and become more sophisticated, high-level performance in computing and effective database management become indispensable building blocks of the research environment.

**Secondary Schooling and Preparedness for Tertiary Education**

In both Singapore and Malaysia, government-funded schools follow a centralized, common curriculum leading to common examinations. International testimony to the Singapore secondary education system is borne out by the country’s repeated successful performance in TIMSS (Trends in International Mathematics and Science Study). For example, among children age 13, Singapore was ranked top in both mathematics and science in the TIMSS cycles of 1995 and 2003 and third and first, respectively, in the most recent cycle (Salmi 2009). Malaysia participated in the TIMSS eighth-grade assessment in 1999 (28 countries), 2003 (44 countries), and 2007 (49 countries). Although Malaysia’s performance ranking improved from 1999 to 2003 (World Bank 2007, 48), average scores in mathematics and science in 2007 remained significantly behind those of Singapore (474 versus 593 and 471 versus 567, respectively) and other East Asian emerging economies.

School curriculum in Singapore is regularly reviewed and revised—the A-level curriculum in 2007 being a case in point—which broadens a student’s choice of options for examinations. A new subject, knowledge and inquiry, was designed to expose students to the construction and nature of
knowledge, creating the need to cut across disciplines. To gain acceptance into university, students must pass the knowledge and inquiry course or the general paper, which tests general knowledge. About 25 percent of the A-level cohort gains seats in one of Singapore’s three universities.

A longitudinal study on the transition from school to work analyzed the experiences of students seven years after leaving school in Malaysia. It concluded that the public education system had “in large measure been responsible for a memory-based learning designed for the average student” (Nagaraj et al. 2009) rather than a system that stimulates and fosters creative thinking and excellence. Study findings indicated that the system fosters the fear of providing the wrong answer, promoting conformity and uniformity rather than fresh and creative thinking, with rote learning and memorization appearing to be the key factor for success in examinations (Wong 2004, 159–60). Rote learning, memorization, uniformity, and conformity foster risk aversion but not the development of creative thinkers (The Economist 2000). These findings do not augur well for tertiary-education entrants expected to fulfill Malaysia’s plans for graduating future high-performing researchers.

**Undergraduate, Graduate, and International Students**

The primary significant constituents of world-class research universities are students and faculty members. Strong international research universities are known to be highly selective, admitting the best and brightest students nationally and internationally, growing their graduate numbers compared with the undergraduate enrollment, and hiring high-performing faculty members from a worldwide talent pool.

NUS has traditionally admitted students at the end of 12 years of schooling on the basis of A-level examination results. Although the requirements for qualification to various departments vary according to their popularity, the general trend is that of increased stringency over the years, particularly for courses that are high in demand—such as those in medicine, law, and business. Focusing on nurturing creativity, NUS adopted a more holistic approach in 2003 where attributes such as reasoning ability, critical thinking, and leadership potential are taken into consideration through the incorporation of scores in Scholastic Aptitude Test 1, which tests analytical and problem-solving skills, and bonus points are awarded in the admissions decision for participation in co-curricular activities. Departments are also allowed to reserve a certain percentage of places for candidates who excel in areas beyond academic grades.
The strong secondary school system yielded high school graduates who have met university admissions criteria, with enrollment in NUS growing steadily from 2,149 undergraduate and graduate students in 1962 to 29,761 in 2000 (NUS 1962, 2000). Despite increasing stringency in admissions criteria, the share of academically strong foreign students has also increased over the years, particularly from Malaysia, Indonesia, China, and India. Since 2000, the total student enrollment has been relatively stable, reaching 30,350 in 2008, and is expected to stay about the same in the near future. Although undergraduates dominated in the early years (about 95 percent of total enrollment in the period 1962–70), the proportion of graduate students has increased steadily over time, reaching more than 23 percent in 2008, with a long-term target of achieving one-third. The ratio of students to teaching faculty members climbed from 11 to 1 in 1980 to 18 to 1 in 2000, decreasing to 14 to 1 in 2008. The ratio of students to teaching and research staff members was 10 to 1 in 1990, decreasing to 8 to 1 in 2008, consistent with the university’s objective of inducting students effectively into university-level learning and research.

The distribution of students among departments has changed over the years, reflecting the changing labor demands of the Singapore economy. Between 1970 and 2008, the share of student enrollment in engineering increased the most, from around 14 percent to around 27 percent at both the undergraduate and the graduate levels. However, medicine experienced a steadily declining enrollment share, from 27.0 percent to 5.6 percent for undergraduates and 47.0 percent to 8.0 percent for graduates. In the arts and social sciences, the proportion of undergraduates remained steady at around 20 percent over the same period, but their share of graduate enrollment had declined from 25 percent in 1970 to 10 percent in 2008.

Many program innovations were introduced over time to expose the students to industrial practices, research engagement, and international socialization. In 1999, a core curriculum program, modeled after that of Harvard University, was launched to provide a broad-based education emphasizing writing, critical thinking, and an appreciation of interdisciplinary connections. In July 2001, a new University Scholars Programme was started as a fusion of these two programs to provide greater curriculum flexibility to talented students wishing to pursue a more interdisciplinary program of study. In addition to innovative educational programs, NUS has invested heavily in teaching infrastructure and pedagogy. An advanced learning management system, the Integrated Virtual Learning Environment, supports ubiquitous e-learning; the system has been widely adopted across
all departments and subsequently has been commercialized through a spin-off company.

Carefully planned international exchange programs may be seen as a combination of NUS goals of internationalization and experiential learning, leading to enhanced research outcomes in the long term. Distinctive programs give NUS an advantage. For example, a partnership program with the Massachusetts Institute of Technology was initiated in 1998 to enable top NUS graduate students in cutting-edge engineering and life science fields to take jointly conducted courses and to conduct research supervised by faculties from both universities. Besides the use of video-conferencing technology, NUS students in the program spent one semester to one year at the Massachusetts Institute of Technology. The program was so successful that it evolved from an NUS-degree-only program to a joint-degree program. In 2000, the new NUS Overseas College program was launched to allow NUS undergraduate students with entrepreneurial interests to work as interns in high-tech start-ups in Silicon Valley, California, for one year while taking entrepreneurship classes at Stanford University. The NUS Overseas College program has since been extended to partnerships in five other high-tech hubs: Philadelphia, with the University of Pennsylvania; Stockholm, with KTH (Royal Institute of Technology); Shanghai, with Fudan University; Bangalore, with the Indian Institute of Science; and Beijing, with Tsinghua University.

Malaysian students primarily have two modes of entry to public university education. The first is the Malaysian Higher School Certificate (local acronym STPM) based on a national, standardized examination taken at the end of 13 years of primary, secondary, and higher secondary education. The second is the one-year or two-year (for weaker students) matriculation program, developed and conducted by various institutions at the end of 11 years of schooling. The 2002 policy of admitting students based on merit, as measured by the results of STPM and matriculation examinations, raises important questions about the dual entry modes. All students admitted are required to have a minimum cumulative grade point average ranging from 2.5 to 3.0 out of 4.0, but the extent to which these very different schooling standards and assessments are equivalent is an issue that has not been openly debated. Although the different pathways increase access, they do not assure quality at entry.

As with NUS, expansion of enrollment at UM showed upward trends with 8,545 students in 1971, rising to 27,396 in 2009, with the attendant issues of students at weak entry–level performance, insufficient numbers of experienced staff members, and relevance of curriculum and
instructional materials dogged by the language policy. Enrollment in UM in the 1960s and 1970s was heavily concentrated in the social sciences and humanities, in part because of the lower cost of establishing and developing these disciplines, the pull of employment opportunities in the postcolonial expanding state bureaucracy, and the increased admission of Bumiputras who crowded into subjects such as Islamic and Malay studies. By 2008, however, student enrollment in science, technology, and medical sciences was almost 40 percent—with humanities and social sciences at 60 percent—moving toward the Education Development Plan for Malaysia 2001–10 target of 60 percent for science and technology and 40 percent for humanities and social sciences (Ministry of Education 2001).

UM has made efforts to reinvigorate and globalize the curriculum using international benchmarks. Inputs from external assessors, industry liaison panels, employers, and students themselves are being included in curriculum design and review panels with support for improved student-learning habits. To attract students to research activities, the administration has introduced mechanisms (such as the compulsory Students Project) at the undergraduate level with research electives available. To improve teaching and learning quality, UM made efforts to improve student-to-staff ratios. Student-to-faculty ratio targets as set up by the Malaysian Qualifications Agency are 25 to 1 for arts, 15 to 1 for sciences, and 4 to 1 for clinical programs. Figures reported in 2010 indicate an overall ratio of 12 to 1, with 6 to 1 for arts and social sciences, 7 to 1 for science, 8 to 1 for engineering, and 2 to 1 for medicine. The numbers for academic staff members include tutors and part-time staff.

**Graduate Enrollment**

In 2002, two reform policies were put in place: graduate enrollment was to be increased to 50 percent, and foreign students were to be actively recruited. In 2008–09, graduate enrollment was 35 percent of total enrollment, and foreign student enrollment increased to 12.3 percent. The total number of UM master’s and PhD students in 2008 was 33 percent of the total student population of 26,963, far from the 461 students, or less than 15 percent, in 1971. In 1971, arts doctoral students constituted about 34 percent of all PhD students, with engineering at 4 percent and science at 25 percent. By 2008, of the 2,246 doctoral students, arts students made up less than 10 percent of doctoral candidates, with engineering at above 9 percent, and science at almost 14 percent. Although absolute numbers have moved upward in science and engineering, in proportion to the total
number enrolled in doctoral programs, UM’s development of skills in strategic research areas has some way to go. Because undergraduate admissions policies do not focus on selecting the country’s best students (although there are some efforts to be more selective), those students are also not represented among graduate research students, most of whom are UM first-degree graduates. Adopting the policy of internationalizing the student population is one way of expanding the talent pool, a policy taken up by both NUS and UM.

**Internationalization of Students**

In line with the national strategy to promote immigration of highly skilled foreign talents to supplement the limited supply of local labor, by the late 1990s NUS took on the broader objective of attracting foreign research talent to Singapore, while providing local students with international exposure. In addition, in the steps of Western countries such as the United States (Fiske 1997), the Singapore government recognized that education itself can be a major export industry. By the late 1990s, it had established a strategic program to turn the island economy into a leading educational hub in Asia—seeing itself as the “Boston of the East.” Today, local schools and universities regularly advertise information on admissions, offering generous financial aid. Chinese and Indian students see the Singapore education system as an avenue out of the Malaysian system, where they perceive they are disadvantaged both in university selection and employment opportunities. The government has also set a goal of attracting 10 leading universities from around the world to establish campuses in Singapore (Olds 2007).

Foreign students continue to be attracted to Singapore’s international reputation for research and scholarship, instructional and research facilities, English-language instruction, excellent living conditions in a cosmopolitan society, and access to strong financial support. In 2008, the proportion of international students in NUS was 34.6 percent of the total student population, constituting 22.3 percent of undergraduate students and 57.8 percent of graduate students. The four largest sources of foreign students in NUS have traditionally been China, India, Malaysia, and Indonesia, but student numbers from newer sources like Vietnam are rising rapidly as well.

In 2008, international students made up 12.3 percent of the total UM student body, composing 5 percent of undergraduate and 26 percent of graduate students. Malaysia’s efforts to become a regional education hub have been strengthened with the Ministry of Higher Education’s plan to
increase the number of foreign undergraduate students annually at the rate of 5 percent and postgraduate students at 25 percent. The 10 countries with the largest number of students enrolled in 2008, in descending order, are the Islamic Republic of Iran, Indonesia, China, Iraq, the Republic of Yemen, Sudan, Saudi Arabia, Somalia, and Thailand. However, the value that foreign graduate students have added to research and innovation output has yet to be evaluated.

The number of international exchange students in NUS has also been increasing, with an annual average of 1,000 between 2005 and 2008. NUS aims to provide an overseas educational experience for more than half of its undergraduates. In 2009, UM hosted 991 international exchange students, while 1,008 students traveled abroad, with plans for 25 percent of each undergraduate cohort participating in programs abroad.

**Development of Academic Faculty**

With the strategic goal of making NUS a globally competitive university, the NUS senior administration had been steadily raising the bar over the years for academic faculty recruitment and retention, with the process greatly accelerated since the late 1990s. The key policy instruments include (a) progressively increasing salaries and compensation packages and making them more flexible and performance based to be more competitive internationally, especially for top talent; (b) increasing the level of research funding support and providing research facilities and infrastructure; (c) relentlessly raising the threshold for promotion and tenure; and (d) increasing the flexibility of faculty time allocation, including reducing the teaching workloads for faculty with excellent research performance records to devote more time to research. In extending the faculty tenure term from age 55 to age 65 for new hires, NUS has also been progressively raising the bar for tenure in the drive for excellence. In addition, NUS implemented a one-off exercise to selectively offer the tenure extension only to existing faculty that the university intends to retain, thus facilitating the transition to a higher level of excellence.

**Improved Qualifications**

The steadily improving quality of NUS faculty can be measured using a number of proxy indicators. First, the proportion of faculty with a PhD has increased substantially over the years; by 2005, 99 percent of the
engineering faculty had a PhD versus only 50 percent in 1970, while for science, arts and social sciences, and business, the proportion with a PhD by 2003 was 88.7 percent, 80.2 percent, and 79.8 percent, respectively. For professional schools like medicine, design and architecture, and law, the increase was more gradual because of the nature of professional practice. Second, and more tellingly, the average research productivity and quality of NUS faculty have both increased considerably over the past two decades.

The question of sound leadership in research and teaching in UM has never been more relevant where research productivity, innovation, and commercialization are concerned. UM staff shows progressive improvement of doctoral-level qualifications, particularly in science and technology areas. In 1999, only 37 percent of staff had a PhD, rising to 61 percent in 2009, or 75 percent (which is the UM institutional target for proportion of PhD recipients) when equivalents are included. Additionally, UM has made a PhD degree a requirement from the lecturer level upward, while talented local or foreign postgraduate students, particularly in science- and technology-based programs, are seen as a potential source of faculty appointments.

**Attracting and Retaining of Talent**

World-class universities usually possess the characteristic of wooing and retaining strong faculty, irrespective of nationality or ethnicity. Although data for earlier years are not available, a comparison of NUS faculty composition between 1997 and 2005 shows a pattern of rapid increase of international staff for the categories of “faculty” and “research” staff. In 1997, 61 percent of NUS’s 1,414 faculty members were Singaporeans, compared with 48 percent in 2005 (Wong, Ho, and Singh forthcoming). Other faculty members were from, in descending order, Malaysia, India, China, other Asian countries, the United States, Canada, and other countries. The high presence of faculty from Malaysia in NUS (10.8 percent in 2005, down from 12.8 percent in 1997) reflects a larger phenomenon of net talent loss from Malaysia to Singapore since their political separation. Indeed, because many Malaysians subsequently took citizenship in Singapore, the actual contribution of Malaysians to the NUS faculty was probably higher than these statistics suggest.

The situation has not gone unnoticed in Malaysia. In 2008, approximately 500,000 Malaysians were working abroad, half of whom had tertiary education. Identifying the weak education system as part of the overall depletion of skilled human resources, one must painfully conclude
that “We are not developing talent and what we have is leaving. The human capital situation in Malaysia is reaching a critical stage. The rate of outward migration of skilled Malaysians is rising rapidly . . . .” (NEAC 2010, 6). The typical reasons ascribed to outward migration include better employment and business prospects, higher salaries, better working environments, and greater chances of promotion.

By 2008, NUS had been diversifying its international sources of faculty recruitment for at least a decade, as the global competition for talent intensified. In particular, between 1997 and 2005, the proportion of foreign faculty had risen to more than 50 percent. Whereas Malaysia continued to be the largest source country for NUS faculty, other sources—particularly India, China, and North America—contributed significantly increased numbers of both faculty and research staff in recent years. Faculty and research staff from China made up 4.5 percent and 32.2 percent, respectively, in 1997. In 2005, Chinese faculty members composed 6.9 percent of 1,765 members, while Chinese research staff members had a share of 42.4 percent of 1,087 research staff members (NUS 1998, 2005). The policy of broadening the base of well-qualified faculty members and researchers has stood NUS in good stead, both in the quantity and quality of research outputs and in the density of international collaboration networks.

Until recently, foreign staff numbers in Malaysian public universities were capped at 5 percent, but current Ministry of Higher Education policy encourages higher education institutions to increase foreign staff proportion to 15 percent by 2015. At UM, the effects of foreign staff recruitment are becoming more significant as numbers increase, intertwined with the effect of the New Economic Policy affirmative action practices. The emerging pattern of academic staff members hired by UM between 2001 and 2009 shows that (a) the majority continues to be Bumiputra; (b) the proportion of non-Bumiputra Malaysians constitutes one-third of total staff, with numbers dipping in 2009; (c) in general, the reduction in the proportion of local staff, particularly non-Bumiputra, across different categories, appears to be compensated by an increase in foreign staff at professorial and senior lecturer levels; and (d) the constant high proportion of Bumiputra lecturers between 2001 and 2009 suggests that as the first two levels of senior non-Bumiputra academic staff members retire and as foreign hires increase and existing senior lecturers and lecturers move upward through the system (on tenured civil service terms), the proportion of senior-level non-Bumiputra Malaysians will continue to decrease.
Efforts to increase the proportion of international faculty will continue for two major reasons: (a) the lack of local expertise in key research and teaching programs, particularly at the postgraduate level; and (b) the increased focus on research and hence the wider casting of recruiting nets in search of highly qualified researchers. Most foreign staff members (almost all of whom possess a PhD and work mainly in the sciences and engineering) are from South Asia, Southeast Asia, and the Middle East. UM has found it difficult to attract the best qualified and experienced international candidates, given its relatively low profile in research and publication and noncompetitive salary packages.

**Salary Packages**
Comparative data on staff salaries in NUS and UM from registrars’ offices at both universities showed that NUS salary packages were far superior to those offered by UM, even after accounting for differences in the relative cost of living. The annual performance bonuses for faculty in NUS vary, ranging from nothing to more than two months of pay with possible cuts in base pay for poorly performing faculty. In UM, allowances are not subject to income tax, and foreign nationals receive similar salary and allowance levels as nationals, except for a housing allowance of US$469 for all levels. At the professional level, special incentive allowances are given to staff from the engineering, accounting, architecture, and surveying fields. NUS has similar incentive allowances that are annually adjusted to market rates. The high NUS salaries for local and foreign staff show awareness of the global competition for talent and the need to retain the most skilled individuals to keep abreast, if not ahead, of regional and global economic growth. NUS’s human resource policy also includes an aggressive program to woo the diaspora. Malaysia’s human resource policies, as demonstrated at UM’s institutional level, may do well to emulate those Singapore models that might work. This process could happen sooner than expected because the prime minister has recently established and now chairs the Talent Corporation. This agency’s major task is to woo and retain international talent, including from the Malaysian diaspora, by offering, among other things, “Remuneration packages (that will be) . . . internationally competitive” (*New Straits Times* 2010).

**Evaluation of Staff Performance**
In tandem with making its compensation more competitive internationally, NUS has progressively raised the bar for staff performance evaluations. In particular, criteria for tenure and promotion have been significantly
raised in recent years, approaching those of leading universities in the world. In particular, it has increased the emphasis on assessment of the research impact of faculty as measured by citations in Science Citation Index (SCI) and Social Sciences Citation Index (SSCI) and publications in top-tier journals.

For UM, newly established targets have been set for staff performance evaluation that relates to publications ranked by the Institute for Scientific Information (ISI) publications, teaching hours and courses, supervision of doctoral and master’s students, supervision of research students, success in obtaining research funds, minimum teaching performance scores (based on student evaluations), completion of consultancies, and satisfactory contribution to administrative work as required by faculty and departmental responsibilities. The strong focus on ISI articles is reportedly linked to the world-class research universities ranking criteria. Although the links among research, ISI articles, and promotion opportunities provide a strong motivational force for improvement in publications, the risk lies in overlooking a more measured approach toward building an analytical and innovative institutional culture of scholarship and research.

**Development and Management of Research**

NUS has steadily increased its budget for research and development (R&D), particularly in recent years. Concomitant with this increase in direct R&D expenditure has been an increased investment in R&D infrastructure. For example, NUS established links to international academic networks through a computer network (BITNET), becoming one of the first Asian countries to join this network. Subsequently, NUS was also among the first Asian universities to implement campuswide access to the Internet. In 1989, NUS linked up with one of only two supercomputers in Singapore, enhancing the university’s role in the globalization of computing technology and skills. In 1991, NUS implemented NUSNET, a campuswide optical fiber network, and in May 1995, the library became the first in the region to launch a full-text electronic document management and retrieval system.

NUS was also among the first universities in Asia to implement a technology licensing and industry liaison office in the 1990s to manage the university’s emerging intellectual property portfolio and industry R&D collaborations. This office had progressively established a system for managing invention disclosure and technology commercialization that is modeled after the best practices of leading universities in North America,
including implementing standardized research collaborative agreements with external collaboration parties; assigning intellectual property ownership to the university; distributing licensing royalty income fairly among the individual faculty members, departments, and central administration to align interest in technology commercialization; and taking equity in lieu of royalty when an NUS technology is licensed to a spin-off founded by an NUS faculty member or student.

Driven by the rapid growth in research outputs and facilitated by the streamlined IP (Internet protocol) management support system, the number of research collaboration agreements, invention disclosures, and patents granted to NUS increased rapidly since the early 2000s, with a corresponding increase in technology licensing income. The number of external research collaboration agreements increased from 109 during 1995–97 to 394 during 2005–07. The number of patents granted by the U.S. patent office to NUS rose from 40 during 1990–99 to 204 during 2000–08, while the number of licensing agreements increased from 60 to 198 in the corresponding periods. Total licensing royalties also increased from S$335,000 (US$203,091.80 [currency converted January 1, 1999]) in 1996–99 to S$3.3 million (US$2.29 million [currency converted January 1, 2008]) during 2003–08 (see Wong, Ho, and Singh forthcoming for more details).

In the early 2000s, as part of the new vision articulated by the then-new vice-chancellor for NUS to become a “global knowledge enterprise,” the university further expanded its technology commercialization support role by explicitly establishing NUS Enterprise, a new organizational division to promote technology commercialization and entrepreneurship on a holistic basis. Reporting directly to the vice-chancellor and president, NUS Enterprise not only absorbed the functions of the technology licensing and industry liaison office into an expanded Industry Liaison Office, but also incorporated a university-level Entrepreneurship Centre that integrated the functions of entrepreneurship education, entrepreneurship promotion and outreach, and incubation support for NUS spin-offs (see Wong, Ho, and Singh 2007). Since its inception in 2002, the NUS Enterprise Incubator has supported more than 70 university spin-offs by professors, students, and recent alumni. More than 10 such companies have received follow-on investment by external investors, and one company, tenCube, has recently been acquired by McAfee Inc. (see Wong, Ho, and Singh forthcoming).

In 1982, 0.05 percent of Malaysia’s labor force or about 13 percent of its scientific workforce was engaged in R&D, comparing unfavorably to...
an average of 0.5 percent in newly industrialized countries, including Singapore (Singh 1989). The contrast continues with a total of only 500 per million personnel currently involved in R&D in Malaysia, compared with Singapore’s 5,500 per million—second globally only to Sweden at 6,000 per million (NEAC 2010, 53, figure 13).

Over the past decade, UM has invested in and upgraded its research infrastructure toward the objective of supporting R&D projects to promote multidisciplinary approaches and increased productivity. Eight interdisciplinary research clusters, such as the biotechnology and bioproducts and the sustainability sciences groups, have been established. The Institute of Research Management and Monitoring organizes the promotion, management, coordination, and monitoring of activities of all research entities. Collaboration with industry is at a fledgling stage, with public universities looking forward to the recently unveiled Ministry of Higher Education–backed Strategic Enhancement Plan for University-Industry and Community Collaboration, which is expected to include small and medium enterprises.

Staffing at many levels continues to be a challenge: senior, international, and experienced research leaders are needed to provide direction and increase the productivity of outcomes, supported by teams of well-qualified junior staff members and graduate students and by well-trained technicians for the efficient management of laboratories and equipment. Equally critical is strong technical infrastructural support such as information and communications technologies facilities. Currently, the fastest bandwidth and cost of broadband connections in Malaysia (4Mbps [megabits per second] at US$76), compares most unfavorably with Singapore’s 100Mbps at US$84.68. Within the region, the fastest bandwidth in Malaysia is five times slower and more than three times more expensive than the lowest bandwidth in Korea (NEAC 2010, 186).

Indicative of its growing emphasis on research in recent years, NUS had increased its research expenditures more than threefold in the past decade, from US$89.5 million in 1997 to US$321.0 million in 2007. Relative to the total operating expenses of the university, research spending has increased from about 12 percent in 2000 to more than 27 percent in 2007. Since corporatization, research funding allocation has become more performance driven and focused as NUS has positioned itself to excel in niche areas and to compete for external funding. Hence, the bulk of the research spending is in the engineering and medicine fields, with an increasing proportion going to the latter in line with the growing
emphasis on biomedical sciences in Singapore’s national R&D strategy in recent years (NUS 2000, 2002, 2008a, 2008b).

Research financing at UM has not been constant or steadily increasing over time, unlike at NUS. Government research allocations decreased from US$26.6 million in 2002 to US$8.1 million in 2004 to US$6 million in 2006 and then jumped to US$41.2 million in 2008 (UM 2010). The last figure includes additional resources provided for four universities designated as research universities in 2008. Sources of research funding were diverse. Apart from the Ministry of Education’s annual grant, funding was received from departments in the Ministry of Science, Technology and Innovation (most awarded on a competitive basis); Toray Foundation of Japan (also competitive); and various private companies, local foundations, agencies, and foreign universities. Unaudited accounts for 2008 showed a healthy trend of research funds increasing from 7 percent of the annual budget allocation in 2006 to 22 percent in 2008 (UM 2008, 25).

Data on research expenditure were not available, and hence, research output levels were not reviewed. By designating funds for four research universities—including UM—the Ministry of Higher Education expects that concentrating resources in institutions with the most potential will pay better dividends than spreading them thinly over 20 public universities. A contribution of approximately US$31.2 million equivalent annually, on a noncompetitive basis, to each of the four research universities since 2008 is a welcomed, but marginal benefit when compared with NUS. Changing trends indicate that whereas the annual grant to research universities from the Ministry of Higher Education is a direct allocation, awards from other ministries (such as the Ministry of Science, Technology and Innovation), external funding sources, and intra-university funds to UM researchers are competitively won.

**Performance Measures and Indicators of Success**

The journey taken by universities toward excellence in research and teaching is marked by measures indicating how far they have traveled and how far they might be from their destinations. These measures include external university rankings; productivity: research output, international peer-reviewed publications, citations received, and average citations per publication; and international recognition of faculty as seen in invitational leadership positions and membership in professional organizations, invitational participation in select conferences and associations, and receipt of achievement awards.
Overall International Ranking

Acknowledging that ranking methodology is much debated, this chapter uses available data from recent exercises. In key academic fields (table 5.3), NUS has the highest rank in technology, followed by biomedicine, whereas for UM, biomedicine ranks highest, followed by social sciences. The gap between the two universities appears to be widest in the fields of science and technology.

SCI- and SSCI-Indexed Papers and Citations

Perhaps one of the more useful outcomes of world university ranking exercises is an increasing awareness by government and higher education officials of publications and citations, contributing to policy changes in some higher education institutions regarding faculty research output. Such publications serve as quantitative indicators of productivity and as an important avenue of knowledge transfer. On this measure, there is a significant gap between the research output of UM and other Malaysian research universities, on the one hand, and those of the leading Asian countries, on the other. Table 5.4 shows that SCI and SSCI indexed 3,440 papers produced by UM from January 1999 to February 2009, only about one-third of the output of the next closest university outside Malaysia, the Hong Kong University of Science and Technology, which published 10,400 papers over this period. NUS’s publications output for the same

| Table 5.3 Rank of NUS and UM in the World University Rankings, 2004–09 |
|--------------------------|----------|-------|-------|-------|-------|-------|
|                         | 2004     | 2005  | 2006  | 2007  | 2008  | 2009  |
| **NUS**                 |          |       |       |       |       |       |
| Overall                 | 18       | 22    | 19    | 33    | 30    | 30    |
| Biomedicine             | 25       | 15    | 9     | 12    | 17    | 20    |
| Science                 | 35       | 34    | 22    | 25    | 31    | 27    |
| Technology              | 9        | 9     | 8     | 10    | 11    | 14    |
| Social sciences         | 10       | 13    | 11    | 20    | 18    | 20    |
| Arts and humanities     | 17       | 56    | 22    | 21    | 30    | 23    |
| **UM**                  |          |       |       |       |       |       |
| Overall                 | 89       | 169   | 192   | 246   | 230   | 180   |
| Biomedicine             | —        | 82    | 56    | 107   | 127   | 132   |
| Science                 | —        | —     | 95    | 124   | 197   | 244   |
| Technology              | —        | —     | —     | 166   | 179   | 201   |
| Social sciences         | —        | 83    | 49    | 119   | 137   | 167   |
| Arts and humanities     | —        | 45    | —     | 233   | 190   | 178   |


Note: — = not available. Rankings from 2007 are not strictly comparable to those in earlier years because of a change in methodology used by THE-QS.
period was double that of Hong Kong University of Science and Technology. The difference is all the greater when taking into account the size difference between the universities: Hong Kong University of Science and Technology has approximately 400 faculty members, compared to UM’s 1,918 faculty members in 2008.

Malaysian universities also fall somewhat behind the others in number of citations, whether measured per paper or per faculty member. For the former, all three Malaysian universities received approximately four citations per paper, whereas most of the comparison universities received more than seven citations per paper (table 5.4). The number of SCI- and SSCI-indexed engineering publications by NUS increased 25 times from an average of 37 per year during 1981–83 to 941 per year during 2001–03, whereas those for medicine increased nearly tenfold (from 62 to 602), and economics and business 4.5 times (from 20 to 90). The quality of the publications, as measured by average citations per publication in the following three years, also increased significantly—from 1.45 to 5.66 for engineering, 3.16 to 11.33 for medicine, and 0.32 to 6.36 for economics and business.

Table 5.5 compares the research publication performance of NUS and UM in four major academic fields from 1981 to 2003. As shown, UM has fallen behind NUS not only in the quantity of international-refereed pub-

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**Table 5.4  Publications and Citations of Selected Malaysian Universities versus Other Leading Asian Universities, January 1999–February 2009**

<table>
<thead>
<tr>
<th>University</th>
<th>Economy</th>
<th>Number of papers</th>
<th>Number of citations</th>
<th>Number of citations per paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universiti Sains Malaysia</td>
<td>Malaysia</td>
<td>3,250</td>
<td>13,257</td>
<td>4.08</td>
</tr>
<tr>
<td>University of Malaya</td>
<td>Malaysia</td>
<td>3,439</td>
<td>14,316</td>
<td>4.16</td>
</tr>
<tr>
<td>Universiti Kebangsaan Malaysia</td>
<td>Malaysia</td>
<td>1,528</td>
<td>5,624</td>
<td>3.68</td>
</tr>
<tr>
<td>Hong Kong University of Science and Technology</td>
<td>SAR, China</td>
<td>10,402</td>
<td>96,281</td>
<td>9.26</td>
</tr>
<tr>
<td>University of Tokyo</td>
<td>Japan</td>
<td>67,864</td>
<td>882,361</td>
<td>13.00</td>
</tr>
<tr>
<td>National Taiwan University</td>
<td>Taiwan, China</td>
<td>27,255</td>
<td>196,631</td>
<td>7.21</td>
</tr>
<tr>
<td>Tsinghua University</td>
<td>China</td>
<td>23,182</td>
<td>121,584</td>
<td>5.24</td>
</tr>
<tr>
<td>National University of Tokyo</td>
<td>Singapore</td>
<td>28,602</td>
<td>236,388</td>
<td>8.26</td>
</tr>
</tbody>
</table>

*Source*: Wong, Ho, and Singh (forthcoming) compiled from Thomson Reuters ISI Essential Science Indicators.
The National University of Singapore and the University of Malaya

Although the debate continues within UM faculty on the use of ISI articles and citations as a qualitative indicator, Malaysian universities have recently developed their own policies in encouraging and supporting publications by their academic staff. The new strategy of UM management to improve the overall academic culture has specific requirements for promotions based on ISI publications and citations. The ISI publication requirements stretch to the admission of doctoral-level students: doctoral candidates should have at least two ISI-listed publications. Among the concerns is the status of UM’s own 50 plus journals, some of which have been regularly published for three to four decades and have developed a clientele of their own. One wonders how this shift in focus will affect these journals and currently available resources.

One of the by-products of world university ranking exercises is the Ministry of Higher Education’s own ranking system for Malaysian public universities—the Rating System for Malaysian Higher Education Institutions (SETARA, in Malay)—following an Academic Reputation Survey conducted in the previous year (Malaysian Qualifications Agency 2010). The results of the first SETARA exercise, involving seven of the more established universities, were published in 2008, and UM placed

Table 5.5 Publications and Citations of UM and NUS, 1981–2003

<table>
<thead>
<tr>
<th>Year</th>
<th>Engineering fields</th>
<th>Medicine fields</th>
<th>Economics fields</th>
<th>Business and management fields</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UM</td>
<td>NUS</td>
<td>UM</td>
<td>NUS</td>
</tr>
<tr>
<td>1981–83</td>
<td>9</td>
<td>111</td>
<td>132</td>
<td>186</td>
</tr>
<tr>
<td>1991–93</td>
<td>40</td>
<td>586</td>
<td>192</td>
<td>747</td>
</tr>
<tr>
<td>2001–03</td>
<td>146</td>
<td>2,823</td>
<td>324</td>
<td>1,808</td>
</tr>
<tr>
<td><strong>Number of papers</strong></td>
<td></td>
<td><strong>Average citation rate per publication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981–83</td>
<td>1.00</td>
<td>1.45</td>
<td>2.85</td>
<td>3.16</td>
</tr>
<tr>
<td>1991–93</td>
<td>1.40</td>
<td>2.54</td>
<td>4.43</td>
<td>6.24</td>
</tr>
<tr>
<td>2001–03</td>
<td>3.83</td>
<td>5.66</td>
<td>5.08</td>
<td>11.33</td>
</tr>
</tbody>
</table>

**Source:** Author’s calculations based on Thomson Reuters, Web of Science.

**Note:** — = not available. Data are for SCI- and SSCI-indexed journals only; the citation rate is calculated as follows: The number of citations within five years of publication were collated (for example, the number of citations made in 1981–86 are collated for papers published in 1981, and so forth). The total number of publications and citations for each of the three time periods (1981–83, 1991–93 and 2001–03) are then pooled, and according to this figure, the average citation rate per publication rate is calculated.
first in the country. In SETARA for 2009, the Malaysian Qualifications Agency reviewed undergraduate teaching and learning in public and private universities, including foreign branch campuses, in six tiers with Tier 6 as outstanding. None was in Tier 6; UM was one of 18 public and private higher education institutions in Tier 5 (Malaysian Qualifications Agency 2009). Given the current leadership and management and the spirit of competition among the four research universities in the country, UM will likely invest energy and resources in maintaining the lead position nationally.

**Levels of Patenting**

Despite its flaws, patenting can be used as a proxy measure of technological inventions that have potential economic value. In particular, the number of patents granted by the U.S. patent office is often used as an international benchmark indicator to ensure comparability across countries, given that the United States is the largest market in the world (Trajtenberg 2002). Whereas NUS has significantly increased its patenting output in the post-2000 period (from an average of four U.S.-issued patents per year during 1990–99 to an average of 22.7 patents per year during 2000–08), UM has had negligible patenting output since 1990 (two U.S. patents issued since 1990) (Wong, Ho, and Singh forthcoming).

Ming Yu Cheng (forthcoming) has argued that the low level of patenting by Malaysian universities may be in part an outcome of a government policy, which clearly delineated the research roles played by universities and public research institutes. The Fifth Malaysia Plan, implemented from 1986 to 1990, stipulated that universities would give greater emphasis to basic research (40 percent) relative to public research institutes (10 percent) (Cheng forthcoming). However, her assumption that a high emphasis on basic research does not generate research of commercial value is not valid, because many of the leading universities in the world, including the Massachusetts Institute of Technology and Stanford University, that are highly focused on basic research have also been prolific in generating patents. Likewise, the rapid rise in patenting among the leading Asian universities such as NUS and Tsinghua University over the past 10 years coincided with a growing emphasis on basic research. Rather than the basic versus applied distinction, it is the quality of the research and its strategic focus on economic significance (the so-called strategic basic research, or “Pasteur’s quadrant”) that matters.
International Reputation, Recognition, Award, and Collaborations

The recognition given by peers to institutions and to individual scholars and researchers is an important marker of quality, based on peer evaluation through invitations to join selected academic and professional societies, attendance at high-level academic and professional conferences, election to world bodies, and prestigious awards. For example, in 2007, the Lee Kuan Yew School of Public Policy became the first institution outside Europe and North America to join the prestigious Global Public Policy Network. In the same year, NUS President Shih Choon Fong received the Chief Executive Leadership Award by the Council for Advancement and Support of Education. NUS also became a founding member of the 10-member International Alliance of Research Universities in 2006. At the faculty level, an increasing number of joint-degree programs have been established between NUS and other leading universities (for example, University of California, Los Angeles; Karolinska Institutet; and Peking University), testifying to the growing standing of NUS in the international academic community.

Records show that in the past, UM’s participation and performance in international academic activities have depended on individual staff proaction rather than on common university practice. Over the past five years, as Malaysian universities have become more competitive, UM has acquitted itself well as an institution in international research and innovation events such as the International Exhibition of Inventions, Techniques and Products in Geneva. UM faculty members, such as those in the field of medicine, have become aggressive in seeking and achieving accreditation at unit level: in 2008, for example, the gastrointestinal endoscopy unit was designated as one of 16 world centers of excellence by the Organisation Mondiale d’Endoscopie Digestive.

UM continues to work to obtain international accreditation, key to worldwide recognition, for teaching programs such as its bachelor of dental surgery by the general Dental Council of the United Kingdom and other professional institutions. Joint PhD programs with universities of repute—such as the Imperial College London, the University of Melbourne, and the University of Sydney—are healthy signs of growing international recognition.

Lessons Learned

The comparison between NUS and UM is instructive. The Singapore case shows how strategic thinking directed toward national development and
economic growth can become a driver for academic excellence, enabling a university from a newly industrialized economy to rapidly ascend into the league of leading global universities. For UM, this review of NUS’s achievements highlights the latter’s attention to continuity of leadership, a balanced national language policy that takes the global economic environment into account, investment in strategic planning, nurturing of students and investment in pedagogy, provision of consistent and more-than-adequate funding and qualified human resources, and establishment of a research and academic infrastructure that seamlessly spans local and international settings.

The decades that NUS has taken to progressively transform itself to move up the ladder of global excellence mirror the larger transformation of the Singapore economy from third world to first world (Lee 2000). As Singapore moves inexorably toward competing as a knowledge-based economy in the 21st century, NUS no longer aims to simply meet the educational needs of the local population, but has set its vision to become a “global knowledge enterprise” that not only excels globally in the traditional missions of research and teaching, but also takes on the “third mission” of becoming an “entrepreneurial” university that spawns successful high-tech spin-offs and generates economic wealth through technology commercialization (Etzkowitz et al. 2000; Wong, Ho, and Singh forthcoming). More important, the NUS story provides UM and other universities in emerging economies an exemplar of “development . . . as a process of integration within the world economy—rather than a process of parallel or separate development” (Lall and Urata 2003).

The challenge that faces UM is one faced by any institution or organization that needs to change its mission and priorities, affecting deep-rooted working principles, regulations, and financial management systems (Salmi 2009, 39–43). The history of UM demonstrates that national policies can severely constrain the institutional development of a public university. This situation can have significant long-term consequences that limit the university’s capacity to pursue academic excellence and compete internationally, given that such institutional capacity takes many years to build. Equally, both NUS and UM show that leadership within institutions can leverage its understanding, experience, and knowledge in fashioning strategies to bring about positive institutional change.

Affirmative action policies have worked in UM as seen in increasing enrollments and upward mobility within academic ranks for the ethnic group perceived as the most disadvantaged. Whereas Malaysia’s attention to social justice goals is important, providing information for institutions
in plural societies, it also raises the issue of balancing social goals with that of institutional competitiveness and quality. If UM is able to implement its new generation policies of merit-based student admission and staff recruitment, training, and promotion—directed to the most able, irrespective of race or nationality—then it has the potential to forge ahead.

However, a serious impediment to UM’s world-class aspirations is apparent in the low level of available financing, coupled with inefficient financial practices. The consistent, high-level financial resources of NUS allow it to offer the best instructional and research infrastructure, telecommunication, and living facilities that help to attract able graduate students and highly qualified local and international academicians and researchers. In the face of declining government funding and the need to respond to rapid change, UM must direct serious energy to accelerate its income generation and fund-raising capacity, while ensuring cost-effective management with synergy among services and functions of managerial, administrative, academic, technical, and support staff. The likelihood is that both university management and the government would want to sustain recent gains, using world and national rankings and internal incentive mechanisms as sources of motivation for laggards.

The transformation of a university to match a new vision and new targets is a courageous endeavor. It also requires the political will to stay the course over the long term, bringing together “national policies, institutional capabilities, and knowledge integration” (Mammo and Baskaran 2009, 141).

References


