CHAPTER 4

A World-Class Research University on the Periphery: The Pohang University of Science and Technology, the Republic of Korea

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Achieving world-class status requires a university to possess competitive advantages such as tradition, resources, and a supportive environment. This circumstance may explain why world-class universities are concentrated in developed countries, which possess a relatively long modern-university history, a nurturing environment of abundant resources, and entrenched academic freedom. Perhaps it should not be a surprise that every world-class university outside the United States, with only a few exceptions, is a public institution. The Republic of Korea is one of the few developing countries that has succeeded in developing world-renowned universities—Seoul National University, the Korea Advanced Institute of

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Science and Technology, and Pohang University of Science and Technology (POSTECH), among others. POSTECH deserves special attention.

POSTECH’s uniqueness derives from its position as a private university that was able to achieve, over just the past two decades, world-class status. Significantly, it was able to overcome the serious geographical disadvantage, expressed in the typical “all roads lead to Seoul” preference for living in the capital, that normally limits a Korean university’s capability of attracting the best scholars and students. This chapter will examine the way POSTECH achieved its current status over such a short period of time and the nature of the continuing challenges it faces. Three main questions will be addressed: First, what drove a private company, Pohang Iron and Steel Company (POSCO), to found POSTECH? Second, what characterizes POSTECH as a research university? Finally, what challenges must the university meet to maintain its position? The chapter concludes with a brief discussion of the implications for higher education stakeholders in developing countries.

POSTECH was established in 1986 by a private entity, POSCO, currently the world’s second-largest steel enterprise. POSTECH is a 267-acre (1.08–square kilometer) campus located in Pohang, a midsize coastal city of more than 500,000 inhabitants. Geographically, Pohang is situated in the southeast of the Korean peninsula, about 360 kilometers (224 miles) from Seoul, the capital. It is interesting that such a small, remote city would become the home of POSTECH. In Korea, where social, educational, and cultural infrastructures have long been centralized in the capital, the geographical proximity to Seoul has been considered critical for attracting high-quality academic staff members and students. There is an old Korean expression, “Send your kids to Seoul and your horses to Jeju Island.” No single university with any hope of becoming a prestigious research institution could be found outside Seoul. Nevertheless, POSTECH successfully settled in the local city, owing to the founder’s visionary leadership, the unprecedented large-scale financial support from his company, and creative managerial strategies to attract talented scientists and students.

As its name suggests, POSTECH’s broad fields of concentration are science and technology. POSTECH has four departments of science (Chemistry, Life Science, Mathematics, and Physics), six departments of engineering (Chemical Engineering, Computer Science and Engineering, Electronic and Electrical Engineering, Industrial and Management Engineering, Material Sciences and Engineering, and Mechanical Engineering), and, for general education, the Division of Humanities and
Social Sciences. The graduate school programs are similar to the undergraduate programs, yet also offer interdisciplinary programs in related academic fields. All instruction is given in English (beginning in 2010), except for general education, which continues to be taught in Korean.

POSTECH has kept enrollments small since its inception. The current student enrollment, in 2009 figures, is approximately 3,100, including 1,400 undergraduates and 1,700 graduates (50 percent of whom are PhD candidates). About 5,000 students have earned bachelor’s degrees, about 6,000 master’s degrees, and about 1,600 doctoral degrees from POSTECH. Because the university annually admits only about 300 qualified students, who are all Korean born and of Korean descent, undergraduate programs are highly competitive. POSTECH, however, has steadily increased the number of academic staff members and currently has 244 full-time professors, maintaining a low student-faculty ratio (6 to 1) comparable to those of highly regarded universities in developed countries.

POSTECH, moreover, is affluent in its financial resources. The university’s endowment consists mostly of POSCO stock and, though fluctuating with the market, has now reached about US$2 billion. The 2009 operating budget was approximately US$220 million; POSTECH’s chief private competitor, boasting a 10-times larger enrollment, spent only twice as much in the same year. Thanks to POSTECH’s financial health, students pay no tuition and live on campus surrounded by impressive buildings and advanced classroom and laboratory facilities.

POSTECH built its solid national and international reputation in just over two decades, by strategically focusing on science and technology, keeping the university small in size, and inviting internationally respected scientists. Since 1997, the university consistently has been among the top three on the domestic university rankings list; in 1998, it was judged Asia’s best “science and technology university” by *AsiaWeek* (1999); and in 2010, it was ranked 28th in the World University Rankings by the Times Higher Education (2010). POSTECH is making a continuous effort to become a top-20 world university within the next 10 years.

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**The Korean System of Higher Education**

The history of modern higher education in Korea is relatively brief. The oldest private university, Yonsei University, founded by a group of U.S. missionaries and medical doctors, celebrated its 125th anniversary in 2009. The national universities are even younger. The first public institution, Seoul National University, was established only 60 years ago. It was
transformed into a comprehensive university by merging the Japanese-run Gyungsung Imperial College with other two-year public professional schools spread throughout the capital region. Although Korean higher learning had been under the influence of China for several centuries until the late 19th century and under the influence of Japan during the 1910–1945 colonial period, the contemporary Korean system of higher education mostly resembles its U.S. counterpart. This resemblance began when the U.S. Army military government at the end of World War II (and, not coincidentally, at the end of Japanese rule) laid the foundation of Korean education and contributed both financially and in the form of U.S. scholars who visited Korea to provide consultation to institutions on setting up curricula and overall institutional systems. As a result of the close relationship established between the United States and Korea, today one out of four professors in Korean universities has a U.S. degree, and such credentials particularly dominate the elite universities. Although the percentage is moderating, a large portion of Korean graduates still considers U.S. graduate schools their first choice for advanced study.

Despite its brief history, Korean higher education has substantially expanded in scope. Currently, 3.5 million undergraduate students are enrolled in about 400 colleges and universities. Roughly 80 percent of these students attend private institutions. This high share of private institutions is a distinctive characteristic of Korean higher education. Although private colleges and universities enroll more than four-fifths of undergraduate students, the government has only minimally subsidized these institutions. The lack of public funds to private institutions leads to a heavy reliance (about 70 percent, on average) on tuition and fees for revenue. Students of private universities typically pay two times more than their counterparts attending public institutions, where the central government is the main source of revenue (about 60 percent).

Over the past several decades, the types of higher education institutions have become more varied. Although Korea lacks classification schemes for institutions of higher education (such as that of the Carnegie Foundation for the Advancement of Teaching in the United States), Korean universities can be divided roughly into several categories by primary mission (that is, research and teaching) and coverage of disciplines. National universities, including Seoul National University and regional universities, are research universities that cover a comprehensive array of academic fields. The most prestigious, Seoul National University, currently has about 17,000 undergraduates and 1,500
full-time professors in 86 departments and expends approximately US$300 million every year (Seoul National University 2009). Private research universities such as Yonsei University and Korea University are comparable to Seoul National University in those respects. A few highly regarded but smaller research universities narrowly focus on science and technology, including the Korea Advanced Institute of Science and Technology and POSTECH. The former institution enrolls 4,000 undergraduates, employs about 400 full-time professors in 23 degree programs, and spends US$100 million yearly (KAIST 2009). The remaining universities are institutions that have the primary mission of teaching and that serve regional or vocational needs for higher education. This group includes colleges and universities of many kinds, such as industrial universities, universities of education, technical universities, open universities, and junior colleges.

Another distinctive characteristic of Korean higher education is the strong control the government traditionally has assumed. Although its influence has gradually eroded, the government still has a high stake in higher education even for private universities. As such, the government continues to lessen its direct intervention in or regulation on institutional management and instead exerts influence through such indirect measures as competition grants and performance funding. As a result of this new approach, high-performing universities have received more subsidies through various recent projects such as Brain Korea 21 (1999–2012) and World Class University project (2009–12). Private research universities, including POSTECH, have significantly benefited from these government-initiated funding programs (Rhee 2007).

The Background of Building a New University

At the time of POSTECH’s establishment, the education and research environments of Korean higher education institutions were, in fact, poor; that is, the idea of a research university in Korea was foreign. Until the late 1980s, academic atmospheres on university campuses were barely developed, specifically because of students’ political demonstrations for democracy as well as the simple lack of institutional resources for quality education and research (Han 1983). For instance, even the Engineering College of Seoul National University, having an exceedingly high student-faculty ratio, failed to supply a sufficient number of computers essential for science and engineering education. Moreover, in 1985 the educational expense per student was as low as US$1,500, which was only about 10 to
20 percent of that in Japan (US$17,000) and the United States (US$8,000). Substantial governmental support for academic research, including the fields of science and technology, began only in the 1980s, as a result of the establishment of the Korea Science and Engineering Foundation in 1977 and the Korea Research Foundation in 1981 (Umakoshi 1997). Meanwhile, domestic private companies began either to buy into existing universities or to create new ones. For instance, Hyundai founded Ulsan Engineering College in 1970; in 1977, Woo Joong Kim, then president of Daewoo Corporation, contributed his assets to the takeover of Ajou Engineering College, turning it into a university in 1980; and finally, the LG Group founded the Yonam Institute of Digital Technology in 1981. The early 1970s to 1980s was an era in which private enterprise branched out into higher education and cultivated human resources in the fields of science and technology.

POSCO, established in 1973 with the help of a portion of the Japanese indemnity fund and the compensation for Japanese rule, accomplished an unexpected success with Japanese technical assistance. Thus, an anxious Japan avoided further technology transfer to Korea. POSCO, feeling that its own technology development was indispensable, eventually established the Research Institute of Industrial Science and Technology in 1987. POSTECH was established in the same year for the purpose of managing the research institute, as well as for providing advanced education for budding engineers and laying the groundwork for future technology development. Then, in 1986, the POSCO’s chief executive officer, Tae Joon Park, articulated his vision of what POSTECH should pursue in his inaugural remarks:

I would reiterate that POSTECH’s opening today not only is going to nurture national leaders with a clear national outlook, a creative intelligence, and a great humanity for the future society, as any traditional university would do, but also, as a leading institution, is going to pave the way for our nation’s advancement in science and technology. For industrial advancement and global competitiveness, it is of the utmost importance to secure advanced technology. POSCO also is in urgent need of world-class talent and research capability, in order to further advanced technology development and become a leading company in the 1990s. To this end, POSCO will continue to increase investment in Research and Development; and certainly, we established this research-oriented university (POSTECH) in the belief that a close link between industry, an industrial research institute and a university will make our dream come true. (POSTECH 2007)
The idea of establishing the new research university met with much opposition at the time. Stakeholders in the government and in POSCO were skeptical about whether POSCO could continuously provide sufficient support until the university became financially independent. POSCO proved itself up to the task of providing POSTECH with sufficient and reliable financial support, thanks to its successful business operations. Still, from a financial stability aspect, it was an acute risk. As the plans for the establishment of POSTECH took shape, the local community proved resistant, as well, because it expected a comprehensive, large-enrollment university that could serve its higher education needs. At that time, Pohang, with a population of 200,000, was the only city in the country without a four-year university. However, POSTECH declared its aspiration to become a small-size research university exclusively concentrating on the science and technology fields. Despite these obstacles, and in keeping with Tae Joon Park’s persistently strong leadership, POSTECH was established.

**Early Development of POSTECH**

From the time of its inception and foundation, POSTECH—as Tae Joon Park, the founder and chief executive officer intended—aimed to become a research university nurturing human resource competencies in the fields of science and technology, using the California Institute of Technology as its model. Park visited that university on his business trip to Los Angeles in the spring of 1985 when the establishment plan of POSTECH was being formulated, meeting the university’s administrators to obtain advice. The visit to the California Institute of Technology apparently helped Park to specify and make concrete his ideas about POSTECH. He envisioned that the university should pursue the goal of becoming not a comprehensive university, but rather a small institution devoted to advanced research in science and technology. His specific requests to the university founding team reflect mostly the characteristics of a typical contemporary research university: a low student-faculty ratio, a greater proportion of graduate students to undergraduates, a low net education cost, student on-campus housing, and a high-quality campus environment. These features, as contained in the new university plan, represented a drastic departure from the Korean universities of the 1980s.

The leadership role that Tae Joon Park played at this stage was important but not sufficient for the establishment of a research university. The following innovative approaches undertaken by university administrators at various stages help explain the university’s early success.
First, POSTECH filled all full-time faculty positions with PhD recipients, 60 to 70 percent of whom were renowned Korean scientists living abroad—PhD recipients in the science and engineering fields were rare in Korea at that time. These scientists voluntarily returned to Korea because they were dedicated to the cause of national development. Nevertheless, the university’s offer certainly was enticing: an excellent research environment, a teaching load of only two or three courses per year, a sabbatical year every six years, a competitive salary that was among the highest within Korea, and faculty apartments near the campus. The unique two-step process of hiring professors in the early years of POSTECH is interesting: First, as mentioned, the university hired a small number of experienced Korean scientists living overseas who had established their international reputations; second, the university asked all of them to initiate a search for promising young scholars in their disciplines. Every year since then, the backbone professoriate has successfully attracted a large number of talented young scholars.

Regarding students at POSTECH, the undergraduate freshmen of the opening year were in the top 2 percent of their high school classes. The university had instituted a highly competitive admissions requirement, and as extra enticement, all entering students were promised free tuition and provision of dormitory housing. Along with media promotions, the university reached out to the top high school students nationwide through a brochure, the hosting of a science camp on campus, and admissions conferences in major cities. Historically, such promotional activities simply were not practiced by universities, least of all by elite institutions—especially in the 1980s, when higher education was a supplier’s market. After POSTECH’s unexpected success in recruiting high-honors students in the first years, graduate students from prestigious universities considered it for their advanced research and academic careers. Graduate students were attracted not only because their tuition fees were waived and they were able to live free in well-appointed apartments on campus, but also because they had access to laboratories with the finest facilities and high-end computer systems, which no other universities had at that time.

At its inception, POSTECH did not adopt administrative procedures from other benchmarked universities, instead importing POSCO’s own management techniques and systems, albeit selectively. Those advanced techniques and systems enabled efficient management of the university. POSTECH’s overall administrative system and staff proved very supportive, unlike those of other national and private institutions that saddled faculty with bureaucratic red tape and decision-making procrastination.
The study of failure models also contributed to POSTECH’s initial success. Officials from Seoul National University and Ajou University generously suggested approaches on founding a university—in fact, cautionary tales based on their experiences of failure. They emphasized that the academic plan must be formulated ahead of the facility plan. In fact, faculty recruitment strategies were formulated to avoid the less-than-positive results achieved by Ulsan University (located in Ulsan, an industrial city about 65 kilometers [40 miles] south of Pohang). Ulsan University’s College of Engineering, founded by the Hyundai Group in 1970, had difficulties attracting science and engineering professors with doctorates and had to fill positions with those holding master degrees. In addition, it failed to attract a sufficient number of qualified students, which resulted in the admission of less-qualified students from the local community. Almost inevitably, and thus unintentionally, Ulsan University grew into a four-year comprehensive university, which was far from an institute of science and technology. POSTECH therefore ensured that all faculty positions were filled with doctoral-degree recipients, and it raised the admissions standard for first-year students to a higher level than that of Yonsei University and Korea University, which were and remain the top private universities in Korea.

**Governance and Leadership**

The University Corporation, established by POSCO, holds final executive authority and is responsible for decisions on major academic, financial, and policy matters. Specifically, POSTECH’s board of trustees within the corporation is similar to that typical of U.S. private universities; they both have a number of external figures deliberating and making decisions for the university. However, POSTECH’s board is much smaller—for example, one-fifth the members of the California Institute of Technology’s board of trustees—although the two universities are comparable in size of enrollment. For this reason, the chairman of the board happens to be relatively more influential than other members in the general management of the university. However, since the beginning, autonomous management of the university has been guaranteed. Thus, the chairperson entrusts management authority—such as the power to appoint faculty—to the president. This is unusual in Korean private universities, where the chairperson, who typically is the owner of the university or a member of the owner’s family, is actively involved in institutional management. In many cases, as well, family members functioning as trustees or chief
administrators intervene in decision making on important university affairs—such as faculty hiring and institutional financial management. Actions that sometimes amount to meddling for the purposes or benefits of these family members or the family overall have often led to disputes over faculty hiring or, even worse, financial corruption (for example, embezzlement of university funds). POSTECH, notwithstanding the chairman’s powerful influence, has never reported any such incidents.

**Institutional Management**

Since its establishment, POSTECH has continually devised university development plans; most recently, a new vision and set of strategies—VISION 2020 for a World-Class University—was inaugurated. POSTECH’s plan, accordingly, is to become a top-20 world-class research university by 2020. To achieve this goal, POSTECH has selected 11 performance indicators in five areas, the progress of these indicators is monitored, and the results are publicized annually on the Web. These ambitious performance goals clearly show not only POSTECH’s aspiration, but also the performance gap that remains between it and top-class U.S. universities. POSTECH endeavors to reduce that gap using three main strategies: selectivity and focus of approach, research collaboration, and internationalization. Because POSTECH, a small university, cannot easily secure professors for every academic field, it strategically selects high-impact research areas and also encourages faculty members to work together through team-based projects with potential synergy. To strengthen research collaboration, POSTECH has implemented the split-appointment system, a joint faculty appointment by two or more departments, and actively encourages interdisciplinary research. The university also recognizes that internationalization is a must, if world-class status is to prove an attainable goal, and makes a tremendous effort to attract distinguished scholars from abroad.

Another distinctive characteristic of POSTECH’s management is the president’s authority to empower department chairs. In most Korean universities, department chairs are appointed by the pertinent individual departments and have only nominal authority to carry out routine departmental affairs for two years in rotation. However, at POSTECH, department chairs do not have a fixed term and also face the primary responsibility of hiring new faculty and assessing faculty performance in their own units. This is a very interesting development in institutional management because it goes against the Korean trend, which is
centralization. By empowering the engaged middle level of management, POSTECH has been quite successful in recruiting and retaining qualified scientists.

Research and the University-Industry Link

Since its inception, POSTECH has endowed itself with highly competent scientists and has provided them with possibly the best research environment for generating high-impact research. Undoubtedly, even with its small faculty, POSTECH has been producing excellent research results. In 2008, POSTECH faculty members published 1,464 papers, both nationally and internationally, or an average of about six papers per faculty member—the highest level among Korean universities and a level comparable to that of major U.S. universities. In addition to the respectable number of published papers—and in view of its small enrollment and quality of papers—POSTECH appears in the world’s top-20 universities per faculty citation index.

Among POSTECH’s excellent research departments, the integrated Department of Chemistry and Life Science and the Department of Materials and Devices are particularly outstanding. In the former department, there are a number of best scientist award and science award recipients among the faculty members, in addition to those topping the field in Brain Korea 21 projects. Also, recently the Department of Life Science was selected for financial support from a government-funded program offering assistance to universities in their progress toward world-class university status. In the Department of Materials and Devices, which would require first-rate facilities in any university, POSTECH maintains a premier research environment that includes the establishment of a particle accelerator and the National Center for Nanomaterials Technology.

To continuously produce high-impact research outcomes, POSTECH has been reinforcing strategic resource allocation, collaborative research, and international research partnerships, as mentioned earlier. POSTECH has chosen to emphasize research fields in which faculty members can enjoy collaborative research synergy and also has invited international scholars to participate. The future appears bright regarding active international collaborative research. Notably, beginning in 2009 and continuing until 2014, POSTECH has conducted and will conduct additional high-end research in collaboration with 23 internationally distinguished scholars invited under the auspices of the World Class University project. Additionally, the university plans to strengthen international collaboration
through cooperation with the Max Planck Institute in Germany and RIKEN, a natural sciences research institute running SPring-8 (a synchrotron radiation facility), in Japan.

As mentioned earlier, POSTECH’s founding company, POSCO, considered industrial collaboration to be one of the university’s main functions and, hence, established the Research Institute of Industrial Science and Technology (RIST) next to the main buildings on campus. Some risks are created by industry affiliation—the most significant of which is the compromising of research integrity because of a conflict of interest between faculty and a sponsoring company. Likewise, research potential could be curtailed by a perceived gap between requested research and research that faculty members would rather undertake. Indeed, some POSTECH faculty members working at RIST as adjunct researchers have been frustrated by this special conflict, which typically involves applied versus basic research. This situation is understandable, considering that POSCO in the 1980s needed applied science research to serve company-specific agendas and issues, while most faculty members had been trained—typically at U.S. research universities and research centers—for basic research.

This tension was notably acute during the university’s first 10 years, when all newly hired faculty members were required to have a joint RIST and academic appointment. However, the conflict has eased steadily for two reasons. First, POSCO dropped the dual appointment policy and began to provide research funds directly to individual faculty members. Second, as POSCO’s need for advanced technology and frontier knowledge to sustain its competitive advantage over global competitors grew, it began to perceive the greater benefits accruing from the POSTECH faculty’s basic, not applied, research. However, this tension might still exist, but in a new form. Although the growth of public funding of research has provided POSTECH faculty members with more freedom to select research topics consonant with their interests, the sponsoring government agencies have put more emphasis on national strategic areas as well as research outputs that can be readily commercialized. Statistics show that, universitywide, applied research accounts for about 75 percent of the total public funding of university research and development (MEST 2009). This is almost precisely the proportion of POSTECH’s public funding to its overall research funding. The university recently took in approximately US$98 million from public funding and about US$33 million from private sources (POSTECH 2009). As such, applied research is still a dominant form.
Whereas impartiality and communality have long characterized the international scientific community, a recent study shows that the majority of scientists in Korean universities appear to have a favorable attitude toward commercialization of research (Bak 2006). A nationalist perspective that considers such commercialization a legitimate means of promoting national interests might account for that view. The Korean government’s continuous support of the commercial application of scientific research has encouraged Korean universities’ active participation in the process. POSTECH, with the support of POSCO and government agencies, has long sought to boost the commercial value of its research, particularly by creating an administrative support system and running a business incubation center along with a venture capital operation.

The advanced system POSTECH developed in 2006, the Technology Utilization System, manages the interplay of research, patents, and knowledge transfer. Currently, 11 enterprises are under development in the POSTECH Venture Business Incubation Center. POSTECH has invested US$6.3 million in its venture companies. Moreover, during the past 20 years, 26 faculty members have started new businesses relating to the commercialization of their research. The estimated value of knowledge transfer for 2009 is about US$2 million, which is equivalent to about 3 percent per faculty member, the highest level in Korea.

Curriculum, Teaching and Learning, and Student Life

Extremely talented students constituting the top 1 percent of the Korean high school student body choose POSTECH. POSTECH students enjoy the challenges in their academic life, devoting exceptionally long hours to study during semesters. Reciprocally, they demand the university’s support in achieving a ranking of the top 0.1 percent of Korean university graduates. POSTECH makes every effort to nurture the high science and technology competencies of its students. In the regular curriculum, the chief characteristics of POSTECH’s undergraduate education are the high prevalence of small classes, the cross-curriculum expansion of English lectures, and the intensification of its math courses. As for the undergraduate program, small-size classes (those with enrollments of 20 students or fewer) constitute more than 60 percent of the total, and the low student-professor ratio provides students with abundant opportunities to interact with their professors and enhance their higher-order intellectual skills.
POSTECH also plans to intensify English education and to conduct all courses in English to mentor its students as global leaders. To those ends, POSTECH requires its students in their first two years to take intensive English courses conducted by native English-speaking instructors. Upon entering the university, freshmen must take a placement test for English. According to the results, they are required to register for a maximum of nine levels of English courses (the majority of students take six to seven courses). For acceptance into the final course, they must be able to write a paper in English. Students who successfully complete all the courses receive the POSTECH Certificate of English. Significantly, the university announced that beginning in 2010, all courses except for general education will be taught exclusively in English.

At the same time, mathematics education has been given greater emphasis. All freshmen are required to register for advanced mathematics courses. The intensification of math education reportedly is more closely related to POSTECH’s philosophy of education rather than to the trend of lesser preparedness among high school graduates. In fact, according to the administrator in charge of academic affairs, the stress on math is intended to reinforce the basic education required for undergraduate engineering students and to contribute to an overall deeper level of graduate education. Such intensive math education in any case reflects the fierce competition among elite institutions, as POSTECH attempts to gain a head start in maintaining its hard-won reputation for excellence in education. Like the majority of research universities, however, POSTECH must confront the issue of faculty members’ diminishing interest in undergraduate education. Although no easy solution to this particular problem exists (Bok 2006; Lewis 2006), POSTECH is attempting a typical “carrot and stick” approach. For example, financial incentives are extended to faculty members willing to develop a program to enhance students’ active learning or creativity. The university also has introduced student course evaluations and made the results accessible to students. POSTECH faculty members’ generally less-than-ardent interest in teaching does not necessarily mean poor education. Quite to the contrary, despite professors’ lack of enthusiasm for teaching, a recent survey of both current undergraduate students and graduates showed that they were quite satisfied with the instructional quality in general at the university. However, they complained most about the lack of interaction with their professors outside the classroom. This situation is regrettable, because interaction with faculty members is known to be an important ingredient in students’ university development (Pascarella and Terenzini 2005).
The Academic Profession

Although POSTECH has not had a Nobel Prize winner among its full-time faculty, 16 national scientist award recipients, 115 international academic award or medal recipients, and hundreds of domestic award recipients are testament to its excellence. Such a success in faculty hiring should be attributed to the pivotal role that individual departments play in hiring faculty. Now common at research universities in Korea, this practice was rarely attempted at the time POSTECH first adopted it. Although the department makes the hiring plan and initiates the process, several steps were set in place to prevent anyone from exerting undue or illegitimate influence on the hiring decision. A typical hiring process works as follows: (a) a search committee consisting of three to five tenured professors in a department, plus one external reviewer, reviews applicants’ documents and recommends a sufficient number of candidates, typically five or more, for open talks and an interview; (b) the selected competing candidates are interviewed, followed by a departmental personnel committee’s recommendation of the most-qualified candidate to a university personnel committee composed of eight tenured, cross-departmental professors plus the director of academic affairs; and (c) the university personnel committee members, all appointed by the president, conduct a final review.

Once hired as an assistant or associate professor, the successful candidate must meet the minimum requirements for promotion, which vary by department. In general, the minimum requirements for promotion to associate professor include teaching three or more courses with satisfactory student course evaluations, publishing at least four research articles (eight articles for promotion to full professor) in high-impact international journals, and conducting adequate professional activities within and outside of the university. Despite the high standards, most candidates have been able to pass the promotion review. Between 1997 and 2007, five assistant professors and one associate professor left the university because they could not meet the requirements. Moreover, as the requirements for promotion have been further tightened, professors have had to publish additional articles at higher-impact journals to stay at POSTECH and, indeed, to be internationally recognized. Lately, the university has made requirements even tougher, such as requiring all assistant professors to apply for and pass their tenure review within seven years of their initial appointment. Those who fail their tenure review will have only a one-year grace period. It remains to be seen whether such stringent
standards succeed in attracting young high-potential scholars or, in fact, discourage them from choosing POSTECH.

POSTECH, a fast-changing institution, has attempted a variety of its own self-imposed transformations over the past 20 years. One remarkable change relating to the academic profession is the introduction of a performance-based compensation system in 2000. With the new system, faculty salary is determined not by seniority but by a faculty member’s accomplishments over the preceding three years in teaching, research, and public service. The university further refined the salary system so that the president could allocate incentives, according to six graded levels, to only two-thirds of eligible professors in consideration of their annual contributions to the university, the industry, and the national economy. POSTECH was one of the first champions of a performance-based salary system that is now widely instituted among private Korean universities, mainly to intensify competition among faculty members.

Internationalization

Internationalization has been the backbone of POSTECH’s aspiration to become a world-class research university since its foundation. POSTECH envisaged itself as a university offering excellence in education and research to Korean students who, thus, would have no need to study abroad. To reach its goal, POSTECH developed a research network with top-class universities worldwide. In the early days, this approach was made possible by taking advantage of its faculty’s personal connections with such universities as the University of California, Berkeley, and Carnegie Mellon University in the United States, Imperial College London and the University of Birmingham in the United Kingdom, Aachen University in Germany, and Université de Technologie de Compiègne in France. Since then, POSTECH has continued to strengthen international collaborative research with foreign partners in France, Germany, Japan, and the United States. In 1996, POSTECH established the Association of East Asian Research Universities with leading universities such as the University of Tokyo and Hong Kong University of Science and Technology, along with 14 other universities in East Asian countries. More recently, the headquarters of the Asia Pacific Center for Theoretical Physics, an international research center in the field of basic science, moved to the POSTECH campus in 2001, and POSTECH is promoting the establishment of a Korean research branch of the Max
Planck Institute. Moreover, POSTECH has established a strategic partnership with RIKEN—as mentioned earlier—a natural sciences research institute in Japan running SPring-8 (a synchrotron radiation facility), thereby further solidifying its basis for high-impact research.

POSTECH has also steadily expanded international student-exchange programs. Currently, the university has 71 sisterhood universities in 19 countries, about 387 POSTECH students have studied abroad short term (a semester or two), and 295 foreign students have come to POSTECH for short-term study. Since 2004, POSTECH has sent abroad an average of 90 students per year through the summer session program, which allows students to take summer school courses at top-class foreign universities. In addition, through the Association of East Asian Research Universities Student Camp and Cross Straits Symposium, an academic exchange program (involving POSTECH and Pusan National University in Korea and Kyushu University in Japan) is being offered to PhD candidates studying environment, energy, and materials. A total of 1,500 students, in 10 exchanges from 1999 to 2008, have participated in this program. Despite its active collaboration with foreign institutions, however, POSTECH has a disappointingly negligible number of full-time international students and scholars. As of 2009, the university had about 10 percent foreign professors, about 4 percent international students at the graduate level, and no students at the undergraduate level. These surprisingly low proportions of international scholars and students may be attributable to the university’s location in a local city that lacks an international dimension.

Nonetheless, a series of recent public announcements clearly indicates that POSTECH takes internationalization seriously. In February 2010, the university told the media that it would invite 10 Nobel laureates or Fields medalists as full-time professors that year. Each invited scholar would be given US$1 million for salary and an additional US$4 million for research and living costs during a three-year stay at POSTECH. The total amount to be paid would be five times more than that paid to participating international scholars through the government-funded World Class University project. POSTECH is also collaborating with Pohang city to open a new international K–12 (kindergarten–12th grade) school near the campus. Additionally, POSTECH will soon declare itself a bilingual campus where both English and Korean are used as formal languages. In this plan, all undergraduate (except general education) and graduate courses will be taught exclusively in English. All academic seminars and meetings at which an international person is present will use English as
the primary language. Moreover, every official document to be circulated throughout the university will be written in both Korean and English.

**Finance**

POSTECH’s budget was increased from US$15 million, the level at the time of its foundation in 1987, to US$170 million in 2009. During the first five years, POSTECH’s financial dependence on the University Corporation was 80 percent on average, but this amount was gradually reduced to about 30 percent in recent years. The reduced contribution from the corporation to POSTECH’s revenue was made up in large part through increased research income, which rose to 40 percent during the same period. Despite these changes in the revenue composition, the university has kept the proportion of tuition and fees to total revenue below 10 percent. It is interesting to note, however, that for reasons such as the lack of a culture of philanthropy in Korean society and the relatively very small number of POSTECH alumni, donations account for less than 5 percent of the total revenue.

POSTECH has expanded research collaboration with companies other than POSCO and, at the same time, has actively participated in government-funded projects. Nevertheless, POSCO’s research fund still accounts for the largest portion of research revenue, about 50 percent. The university’s close tie with and financial intakes from POSCO, paradoxically, restrict the university’s collaborations with other companies and, thereby, its ability to secure donations from other sources. For this reason, fund-raising campaigns thus far have not been successful. The university has barely raised US$4.3 million since 1995. Nevertheless, in terms of endowment, POSTECH might be the richest private institution in Korea, with US$2 billion worth of stocks as of 2009. The university has no domestic competitors in expenditure on instruction per student, about US$70,000, a level about five times higher than that of typical universities in Korea (MEST and KEDI 2009, 116).

Notwithstanding the government’s significant controls, private universities in Korea have been only minimally subsidized. POSTECH is no exception. Until the mid-1990s, public funding channeled into the university hardly reached 3 percent of total revenue. Over the past decade (2000–10), however, POSTECH witnessed a significant expansion of public funding of research, student scholarships, and even operating budgets. In 2008, about 30 percent of research funds came from public sources, mainly through the Ministry of Education, Science and Technology.
The government also provided full scholarships to all enrolled students until graduation, on the condition that they maintain their grade point average above 3.3 (out of 4.3). This sudden largesse can be attributed mainly to a shift in the government’s funding policies. Competitive funding programs—such as Brain Korea 21 (1999–2012) and World-Class University (2008–2012)—have played an important role in expanding public funding of private universities with excellent research capabilities. Performance-based funding, introduced in 2008 and still in effect, has allocated public funds to selected public and private higher education institutions based on a small number of government-selected performance indicators. In 2010, POSTECH received US$2 million of this money. Whereas the increased public funding has helped POSTECH keep pace with international competitors, it is not wholeheartedly welcomed by many faculty members, who fear that such subsidies are likely to lead to significant public sector intrusiveness (see the following section).

**Government Support and Control**

Whereas POSCO’s role in the development of POSTECH is unparalleled, the Korean government also has played a significant role, both as a supporter and as a regulator. This situation is not unique to POSTECH. Government funds always come with strings attached to further a higher education policy agenda. Also, it has been common for the government to control private universities through policy, regulation, and various administrative tools. During the past 20 years, POSTECH has increased its reliance on the government’s financial support, which ominously has resulted in numerous changes in POSTECH’s academic programs, research environment, and institutional management.

First, POSTECH’s participation in Brain Korea 21 and the World Class University projects changed academic programs at the graduate level. The government required universities to consolidate graduate programs into larger interdisciplinary divisions (hakbu) to join the new projects. In compliance, POSTECH reorganized its six graduate school departments into three divisions, the Division of Molecular and Life Science, the Division of Electrical and Computer Engineering, and the Division of Mechanical and Industrial Engineering, as well as one school—the School of Systems Biosciences and Bioengineering. More recently, to participate in the World Class University project, POSTECH established new graduate-level interdisciplinary programs, including Integrative Biosciences and Biotechnology, the Division of Advanced Materials Science, and the
Division of IT Convergence Engineering. The government will subsidize the university for a total of US$83 million until 2012, if the participating programs perform as expected.

POSTECH’s partnership with the government has also greatly enhanced its research environment. For instance, the third Pohang Light Source, completed in 1994, is an exemplary US$150 million research facility built near the POSTECH campus. The government contributed about US$60 million for its construction, and it has been run and managed by the Pohang Accelerator Laboratory (POSTECH’s annex research center) as a national user facility (the operating budget of US$20.5 million is being met by the government). Recently, POSTECH made a request to the Ministry of Education, Science and Technology for a feasibility study regarding the establishment of a fourth Pohang Light Source. Approximately US$400 million has been earmarked, and a full operational plan is forthcoming in the near future. There is also the National Center for Nanomaterials Technology, a research facility founded under POSTECH’s own supervision, which has been under construction on campus since 2004. The Ministry of Knowledge Economy has been providing financial support up to US$90 million for five years. In addition, the Pohang Institute of Intelligent Robotics (established in early 2000), the National Core Research Center, the Information Technology Research Center, the National Research Laboratory, and the National Defense Micro Electro Mechanical Systems (MEMS) Research Center are all being run with assistance from the government’s budget.

More penetrating governmental effects on POSTECH can be found in institutional management, the area in which the university traditionally has been least likely to experience external intrusion. Over the past 10 years, the government has been increasing the university operating budget subsidy, as well as the research funding for private universities, to achieve its higher education policy goals. For instance, it is funding public and private universities subject to institutional performance indicators relating to postgraduate student employment, quality of education, financial aid, and educational expenditure per student. Through this funding scheme, POSTECH received about US$350,000 in 2008. The government also is funding universities that have instituted the admissions officer system, a new admissions process promoted by the current administration in which applicants are judged not only on academic achievements in college entrance exams and high school, but also, and more important, on their socioeconomic and cultural backgrounds and academic potentials. After receiving the pertinent financial support—in
this case, about US$300,000—POSTECH duly selected all students for 2010 using this new admissions process and is expected to continue to do so while the inflow of financial support continues. Clearly, new funding programs such as these, which force POSTECH to accept government impositions regarding its goals and methods of student selection, might not be suitable or helpful for a private university to embrace.

In some respects, the government’s financial support can be validated as a contributor to the growth of POSTECH into a research university. However, it is impossible to disregard the negative aspects of the government’s contribution, which have restricted the university’s autonomy by inducing participation in the government’s chosen strategic fields of study or by interfering in university management. Whether these lasting changes, as corollaries of governmental interventions, will benefit POSTECH remains unclear. If the government relies overly on a regulatory role, the changes could well hold back the university’s potential growth.

Changing Environment and Emerging Challenges

POSTECH’s current strengths are the result of quality faculty members, talented and hardworking students, and an exceptional research environment. To achieve world-class status, the university, like other world-class universities, must invite even more talented scholars and students, regardless of their nation of origin, to provide top-rated support for research and teaching. POSTECH, however, may experience difficulties in many aspects because of intensifying competition among universities, a location that lacks an international dimension, a weak collaborative culture, insecure finances, and shortsighted internal management.

POSTECH is experiencing deepened competition not only because of the force of globalization, but also because of new research universities, competition among research universities, and the increased bargaining power of students in Korea (Peterson and Dill 1997). New public universities of science and technology recently were established in nearby cities, and domestically competing universities are rapidly growing and moving aggressively to hire faculty members, increasing the trend of faculty relocation to Seoul or other major cities. This battle for talent among the research universities is attributable, in part, to the increase in the government’s competitive research grants such as Brain Korea 21 and the World Class University projects in Korea. Furthermore, if several U.S. universities with strong engineering programs enter Incheon City near Seoul as planned, the competition could be even greater. Although
government support for higher education has not yet decreased in Korea, the increasing quantity of outstanding science and technology universities might cause dispersion of that support. This situation could create a new threat to POSTECH, which is located in a vulnerable city where social and cultural infrastructures and educational conditions are weak. Such circumstances will especially bring more challenging problems to POSTECH as it attempts to fortify and improve its position as a world-class university by attracting and hiring more foreign professors, students, and researchers.

To compete globally, POSTECH must produce high-impact research. As mentioned earlier, such research will be made feasible with the finding of new research fields of competitive advantage and the conducting of collaborative, synergy-rich research. POSTECH’s advancement in research may be hampered by both its vulnerability to the influence of the government’s power to set research agendas and its weak culture of collaboration among professors. Although the government has attempted to help POSTECH carry out international collaborative research, the scale of support is not sufficiently large, and the support tends in any case to center on the government’s strategic fields of science and technology that characterize the relatively short-term perspective of applied research. As such, this support can possibly interfere with or even retard development of the field of basic science research at POSTECH. For many reasons, however, research collaboration among faculty members across disciplines is not taking place as desired. POSTECH hopes to establish a separate research space, similar to the Massachusetts Institute of Technology’s media lab, where such collaborative research can occur.

Over the past few years at POSTECH, where only a few full-time international students and professors have been present at any one time, English has gained sufficient popularity to be adopted formally as the language of instruction. Although this is not uncommon in contemporary Korean universities, it shows a clear increasing trend in science and engineering education. For example, at Yonsei University, a private research university, one out of every two undergraduate courses, on average, is taught in English, whereas more than seven out of 10 courses offered in engineering programs are so conducted. In leading this trend, in 2010 POSTECH began teaching all courses, except general education courses, exclusively in English. An underlying rationale for increasing the number of courses taught in English is the idea that such a measure will attract more international students and scholars. This is doubtful. Students learn outside of class as well as in class. Students also learn from both their
teachers and their peers. In this sense, then, the current emphasis on the use of a certain language for instruction is insufficient justification for international students to choose POSTECH and may also negatively affect Korean students’ learning, in that few of them have the language skills necessary for participation in courses taught in English.

Securing adequate and reliable finances is another key element in POSTECH’s quest to become a world-class university. The two main sources of POSTECH’s current revenue—the founding company (POSCO) and the government—are insecure in the long term. The endowment itself consists of nothing but POSCO stock, which fluctuates with economic circumstances. For the first 10 years after POSTECH’s founding, POSCO’s tremendous support contributed to POSTECH’s growth, but that support has decreased substantially since then. Although governmental support grew somewhat substantially in scale over the past decade, it cannot be regarded as stable for the long term, as the experience of other developed countries shows. For example, the U.S. government’s support for higher education is largely influenced by economic circumstances and tends gradually to decrease (Gladieux, King, and Corrigan 2005). The recent promotion of incorporation of public universities in Korea can be seen as the government’s effort to lessen its financial share in the support of higher education (Rhee 2007). Notwithstanding these circumstances, as mentioned earlier, the fact that POSTECH has an actual patron (POSCO) makes it more difficult to reach out to other potential sponsors and donors for institutional development assistance. Furthermore, a short, 20-year history and a small class of 300 undergraduates militate against the university’s raising significant donations from alumni.

POSTECH’s current share of revenue from student tuition (10 percent or less) along with its low tuition (about 50 percent of that of private competitors) may provide it with more than enough justification for a tuition increase. Nonetheless, raising tuition fees is not a good alternative, for multiple reasons. First, government policy discourages it. Second, the university corporation, which is responsible for institutional finance, has a long-standing internal policy of keeping tuition fees below 10 percent of total revenue. Third, public competitors—Seoul National University and Korean Advanced Institute of Science and Technology—maintain their tuition at about 50 percent of the level of private institutions. Fourth, since its inception POSTECH has been well known and admired for its provision of full scholarships to its students, which is one of the compelling reasons why so many gifted high school students from low- and middle-income families select POSTECH as their first choice of university.
Finally, a tuition increase to the level of private competitors will bring in an additional US$6 million per year—only about 3 percent of total annual revenue. The costs would well exceed the financial gains of any such hike. Nevertheless, in the long run, a tuition increase must be seriously considered, for at least two reasons. First, national universities will soon be seen as incorporated. If so, tuition fees, if international experience is any indication, likely will rise significantly. Second, because POSTECH’s student body is filled with an increasing number of students from wealthy families, POSTECH could adopt a policy similar to that of U.S. Ivy League universities, which provide significant financial assistance to students from low-income families while asking other students to pay more.

For POSTECH’s first eight years, it was helmed by the visionary leader Dr. Hogil Kim, a world-renowned nuclear physicist. POSTECH’s founder, Tae Joon Park, had endorsed Dr. Kim wholeheartedly and let him take full charge of university management. Under President Kim’s leadership, a solid foundation was laid for POSTECH as a research university. Since President Kim’s passing, which was a great loss to POSTECH, the university unfortunately has experienced leadership difficulties. No new leaders selected since then have presided in office longer than four years, and vice-presidents and executive directors of administrative units have served for even shorter periods (two years, in general). Certainly, there is concern involving this short-term charge of executive and administrative affairs by internal faculty members who lack administrative experience and leadership skills, presenting potentially large obstacles in the path of the university’s transformation into a world-class institution.

Conclusion

POSTECH is one of the few non-U.S. private universities that may attain top status. The university continues to aspire to move up in world rankings. Indeed, the university hopes to fill, with a bust of one of its own faculty members, a designated space at the center of campus for honoring the first Korean Nobel laureate in science. This case study attempts to analyze how a relatively new, small, private university in a non-English-speaking country could achieve world-class status amid the challenges that emerged in the course of its evolution. From the findings of this analysis, it is hoped that higher education stakeholders in developing countries may gain insights into the creation of world-class universities in their own nation. These findings show that top status is achieved through visionary leadership, the empowering of subordinates, a superior supporting environment,
and partnership with the government. In addition, POSTECH must continue to deal with various kinds of emerging challenges for which there are no easy solutions.

To leap to a higher status, the enterprising POSTECH is about to experiment with the controversial but bold idea of using a nonnative language—English—as the primary tool for teaching science and engineering students. Whether this audacious attempt will succeed or fail, many lessons undoubtedly will be learned.

Notes

1. POSCO began as a public corporation and was privatized in 2000.
2. Jeju Island is an exotic vacation island off the southern coast of Korea.
3. For simplicity, current values and a flat exchange rate (1,000 to 1) between Korean won and U.S. dollars are used throughout this manuscript.
4. Brain Korea 21 began in 1999 and will last until 2012, providing financial support to graduate students in research projects. In the first stage, which ended in 2007, the government transferred US$1.3 billion to 564 research teams nationwide. The second stage, which began in 2008, has US$2 billion set aside to support 568 research teams from 74 universities. The World Class University project, which was initiated in 2008, is a higher education subsidy program of the Korean government that aims to create new academic programs in new growth-generating fields and to enhance international research and teaching collaboration by inviting distinguished scholars from around the world. The government will have invested US$825 million in the program between 2008 and 2012 (MEST 2008).
5. POSTECH recognized the significance to the success of any research university of attracting eminent faculty members and students. However, some individuals at the university were concerned that undergraduate applicant qualifications were set too high. President Hogil Kim, in an entertaining expression of his determination, replied: “Even if there is only one applicant, it is of no matter because then, the faculty can focus only on doing research” (POSTECH 2007, 98).
6. According to Korean law, a university is founded either by the government or by a university corporation. So, a private citizen or private entity must create a university corporation beforehand, and then a private university can be funded through the corporation.
7. The tenure system was introduced at POSTECH in 1998.
8. Although there is ongoing debate about whether Korean higher education policies reflect neoliberalism, it is fair to say that Korea is in transition from a
regulating nation to a consumer advocacy or steering nation in which the market shapes university behaviors (Reeves-Bracco et al. 1999; Rhee 2008).

9. According to the Higher Education Act as amended in early 2010, college tuition should be increased by no more than 1.5 times the recent three-year average consumer price inflation rate. The institutions that fail to abide by this guideline face administration or financial penalties, or both, imposed by the minister of education, science and technology.

10. Dr. Kim made it possible to design and construct the Pohang Light Source near the campus.

References


