

CHAPTER I

Increasing Competition Due to Economic Globalization

Due to rapid changes in technology and political relationships, traditional boundaries are of far less importance than historically. Real-time communication, instant messaging, and virtual labs allow scientists from around the world to collaborate on research and development. The barriers once associated with time, location, language, and culture have been reduced.

As the global market and workplaces expand, innovation—once the hallmark of the U.S.—can occur anywhere. Not only can it occur, but the rapid emergence of the economies of South Korea, India, China, Singapore, Malaysia, and Thailand shows that innovation is occurring and that the U.S. faces increasing competition. The Asian countries have been particularly aggressive in recruiting top American experts in critical technologies to work at elaborate new facilities in their countries. At the same time, other nations are joining the global market, but at a much slower pace; e.g. Eastern Europe, central Asia, the Middle East, Latin America, and Africa.³⁴

China—perceived by many as a likely pre-eminent 21st Century power—provides a good example of rapid economic globalization. The power of the country lies in the enormous number of its people—one out of five people in the world resides in China. Even though it has moved 300 million people out of poverty and quadrupled the average person's annual income, significant poverty still exists. Given the current rate of growth, China can pass the U.S. economy in 30 years; however, the U.S. will maintain a higher per capita income.³⁵

India is another global competitor. Norman R. Augustine, retired Chairman and Chief Executive Officer of Lockheed Martin Corporation summarized the situation as "Five qualified chemists can be hired in India for the cost of just one in America...For the cost of one engineer in the United States, a company can hire eleven in India...Given such enormous disadvantages in labor cost, we cannot be satisfied merely to match other economies in those area where we do enjoy strength; rather we must excel...markedly."³⁶

As countries around the world produce more highly skilled STEM graduates and larger pools of workers, keeping Illinois competitive will require attracting and retaining the most skilled talent. Trends in decreasing numbers of foreign-born students and increases in U.S. patents that are foreign originated indicate that a "brain drain" of highly skilled workers is a possibility as other global economies strengthen.

CONVERGENCE OF TRENDS

Increasing Levels of Graduates

One indicator of global competition is the number of college graduates produced by a country. According to one report in 2004, China graduated approximately 500,000 engineers; India graduated 200,000 engineers; and the U.S. graduated 70,000 engineers.³⁷ More recently, Duke University researchers compared only equivalent degrees and certificates and reported that in 2004, China actually graduated approximately 351,500 engineers; India graduated 112,000 engineers; and the U.S. graduated 137,400 engineers.³⁸ Regardless of the exact numbers, because their populations are so large, even a small proportion of their population will create a large number of graduates. On the other hand, South Korea graduates as many engineers as the U.S. even though it has only one-sixth of the U.S. population.³⁹

Foreign-born Students and Workers in the U.S.

In the U.S. and in Illinois, significant proportions of the workforce and science and engineering graduate programs are composed of foreign-born individuals. For example, more than half of all engineering doctorates awarded in U.S. engineering colleges go to foreign-born students.⁴⁰ In the 2003 U.S. science and engineering workforce, 25% of all college-educated workers and 40% of all doctorate holders were foreign born.⁴¹ Over half of the doctorate holders in several fields who resided in the U.S. were foreign born: computer science (57%), electrical engineering (57%), civil engineering (54%), and mechanical engineering (52%).⁴²

The number of foreign-born students coming to study in the STEM fields in the U.S. has begun to rise after sharp drops in the period following 9/11. Illinois sustained its population of these students. In 1999, foreign-born students made up 2.98% of all Illinois college or university students; in 2004, that number increased to 24,135 or 3.1%. In March 2006, a survey of the Council of Graduate Schools reported an 11% increase in foreign applications; however, applications are still down by 23% since 2003.⁴³

Foreign-born scientists, technologists, engineers, and mathematicians—for a long time considered the backbone of medicine and other fields—appear to be going outside of the U.S. for advanced study and employment, leaving a gap in the U.S. educational pipeline and workforce. Increasing numbers of students are graduating in STEM fields outside of the U.S. and finding positions elsewhere as well. In China during 2004, about 2.8 million students graduated from universities, and 70% found jobs in China, thus turning China into an exporter of higher education graduates.⁴⁴ In 2004, students from India comprised the majority of foreign students in the U.S.⁴⁵ Many, after graduation, returned to India's "Silicon Valley" at Bangalore. The U.S., once the major producer of STEM graduates, has increasing competition from China and other countries in not only educating the STEM workforce but in recruiting them for the workforce.

CHAPTER I

Increasing Numbers of Foreign-origin Patents

Along with the availability of a highly skilled STEM workforce, the number of patents is often used to assess the infrastructure needed for innovation. From 1994 to 2004, there has been a steady increase in the percentage of U.S. patents granted with a foreign origin, including foreign-owned companies and foreign-inventors.⁴⁶

Figure 7 Percentages of U.S. Patents of Foreign Origin 1994-2004

