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FROM BRAIN DRAIN TO BRAIN FLOW: The New Economy of Innovation Turbulence

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At one time in the recent past, leaders in developing countries and in international organizations decried the “brain drain” that led the best and brightest in what we used to call the “third world” to emigrate to the West to take advantage of superior educational and employment opportunities. The United States was the destination of choice, both for these reasons and because other societies were seen as less hospitable to immigrants. These foreign-born students became successful professionals and entrepreneurs after graduation, and their children, in turn, became some of the highest-performing students in American schools, changing the culture, which became aware of the “tiger mom” effect. Then, in an unexpected turn of affairs, partly due to the politicization of the immigration issue, the United States started denying work visas to graduates, telling talented foreign students, “Go home, and take your degree with you.”

As any student of innovation knows, promoting innovative thinking is, at best, an inexact enterprise. One of the few certainties, however, is that innovation happens at edges, where turbulence promotes mixing, more often than at the stable center, where people and ideas have greater homogeneity. In genetics, this translates to environmental stress that makes it possible for a mutation that is favorable to changed conditions to confer a survival advantage. In academia and industry, the concept is more akin to cross-pollination, as a newly minted Ph.D. leaves her institution to take up a teaching or research post at another university, government laboratory or company.

In the early days of the scientific revolution when Gallileo, Kepler, and Brahe were changing our view of man's place in the universe, travel was difficult and dangerous, and correspondence and publishing (even if officially suppressed) had to suffice. By the time of Newton, however, scientists and scholars regularly traveled across Europe, and the great debates raged among thinkers in Europe and, to a lesser extent, America. The Colonies had Franklin, and, after devoutly religious rioters (in Birmingham, England) burned his house to the ground, Joseph Priestley, too. It may not have been the Royal Society, but the study of natural philosophy enlightened debate in Philadelphia at Franklin's American Philosophical Society, at Mr. Jefferson's University in Charlottesville, where five of the original eight faculty members came from England, and in the Yard at Harvard as well.

In the 150 years that followed, however, few scholars and fewer innovators emigrated beyond the European-American axis. Vast stores of technical and scientific knowledge in China, India and the Islamic world remained out of sight and largely out of mind as the West advanced scientifically, technologically and economically. Even in the period leading up to and after World War II, when many academics and innovators left Europe and emigrated to the United States, almost no Japanese, Chinese, Korean, or Indian professors, inventors or students were seen on

American campuses or in industry.

It may be argued that globalization is not best exemplified by the search for cheap labor, but rather, by the search for great brains. Beginning in the 1970s, students from rising Asia—India, South Korea, China and Japan—appeared on American campuses in increasing numbers. Many of these students stayed in the United States after graduation, teaching, working in corporate research laboratories, and starting new companies.

This educational trend has both continued and quickened...today more than half of all foreign Ph.D. students in American universities come from just three countries: China, India and South Korea. The difference is that after graduation, the United States now largely refuses to allow them to remain. For the most part, these graduates return home. For instance, it has been reported that over 80 percent of the science, technology, engineering and mathematics (STEM) professors at the Korea Advanced Institute of Science and Technology hold Ph.D.s from American universities.

We are now seeing the emergence of a globalized innovation revolution, but one that is advancing at the expense of the United States. In countries where our new doctorate degree holders are welcome, the mixing of ideas is generating, “innovative, high-impact scientific outcomes” according to *The Scientist* magazine.¹ Journal publisher Elsevier has followed the effects of migrating scientists by reviewing papers published over the past 15 years. Reporting its “Global Brain Migration” study at a recent meeting in Chicago, researcher Nick Fowler showed that movement of international students and faculty are reshaping the world of innovation.

According to Elsevier’s data, researchers from European Union (EU) nations cross borders at the highest rates, and Northern EU institutions produce the greatest numbers of scientific publications. Switzerland, Sweden, Denmark, the Netherlands and Finland lead the world in this measure. The United States ranks 9th on the list, with India and China ranking lowest. This is changing rapidly, however, as Elsevier reports that both the quantity and quality of Chinese papers in applied research fields such as chemistry, engineering, computer science and materials science are improving.

By measures other than paper publishing, the United States clearly still leads the world, as scientific papers measure basic and applied research output, but are unrelated to much of the research needed to bring advances to market, which happens more frequently in industry. Measures such as patent applications are a poor barometer of innovation because of distortions caused by differences in the legal and bureaucratic institutions that issue and govern them. A better measure is the turnover in new product introductions and market penetration times. By this measure, Korean electronic giant Samsung is a world-leader, having displaced both Motorola (US) and Nokia (Finland) as the leader in mobile telephones in just a few years.

The conclusion of *The Scientist* in its recent editorial is one that those who fashion United States immigration policy would do well to heed:

Countries that lay out the welcome mat for foreign research talent and allow their own researchers to go abroad freely do better than closed research economies in every sense. ... Only through expanding the shared global knowledge-base will we be able to ignite the spark of innovation behind new industries that will create jobs, stimulate economic growth, and solve the world’s most pressing problems, resulting in more vibrant, prosperous, and peaceful societies.

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¹ <http://the-scientist.com/2012/08/14/opinion-encouraging-brain-migration/>