

Meeting the Science and Engineering Workforce Challenges in the post-9/11 Era

Prem S. Paul

Vice Chancellor for Research and Dean of Graduate Studies
University of Nebraska-Lincoln

There is a complex interaction between science and public policy, as public policy can either benefit or hamper scientific progress. The National Defense Education Act (NDEA) of 1958 resulted in the creation of NASA, an agency that has provided funding for the training of thousands of scientists. Our nation has benefited tremendously from this policy. Unfortunately, post 9/11 events—particularly an increased scrutiny of graduate students—have fostered a perception of the United States as an unwelcoming place to pursue graduate studies. This appears to have led to reductions in the number of applications by foreign nationals to pursue graduate studies and postdoctoral experiences in the United States.

Indeed, recent changes to the regulations governing the ability of international students to come to the United States to pursue graduate training in science and engineering disciplines has resulted in notable declines: from 2003 to 2004, the overall number of applications decreased 28%, admissions fell 18%, and enrollment dropped 6%. These reductions are attributed primarily to problems international students encounter obtaining visas.

The availability of science and engineering (S&E) talent has many implications for our global economic competitiveness. The United States has been a global leader for decades. The primary factors in this longstanding global leadership have been the creation of innovation through research and development (R&D) investments in science and technology and the

availability of scientific talent. There is a concern our leadership position may be in jeopardy. A number of Asian and European countries are increasing their R&D investments, thus increasing the overall competition for talent. We as a nation have been depending more and more on the international workforce as the number of American-educated students in science and engineering has been on the decline. Restrictive post-9/11 policies have made it increasingly difficult for international graduate students and scientists to come to this country, whether it be to pursue graduate study, work as a visiting scientist, or to participate in international meetings; this enhances the perception that the United States is not as welcoming a place for international students, postdocs, and visiting scientists as in the past.

Current State of the S&E Workforce

Though the United States has been a leader in the number of S&E doctoral degrees granted, other countries are catching up. Alarming, the percentage of American S&E doctoral degrees awarded to U.S. citizens/permanent residents has been on the decline since the early 1980s. In 1966, 78% of all S&E doctorate holders were born in the U.S.; by 2000, that number had decreased to 61%. In addition, the number of S&E doctoral degrees collectively awarded by European countries has exceeded the number of those awarded in the U.S., while the number of Ph.D.s awarded by Asian countries also is on the increase.

Authorship trends of published scientific papers represent an important measure of international standing in science and technology. Since 1966, the number of scientific papers published by authors from western Europe has surpassed the number published by authors from the U.S. Unless these trends can be reversed, more and more R&D will go offshore, moving high paying jobs to other countries.

Talent is Key to Innovation

The Council on Competitiveness asserted in its workforce study that talent is the nation's key innovation asset and recommended building a strong base for scientists and engineers. The study also concluded the demand for scientists and engineering talent far outstrips supply. The number of jobs requiring technical training is growing five times the rate of other occupations,

and the average age of the members of the science and engineering workforce is rising. New entrants into S&E fields are not replacing retirees in sufficient numbers. A quarter of the current S&E workforce members are 50 years of age or older, and many will retire at the end of this decade.

Where will the talent come from?

I had the good fortune of serving last year on an ad hoc committee of the National Academies COSPUP committee on Policy Implications of International Graduate Students and Postdocs in the United States. It made me aware of the important role the S&E workforce plays in our future and our global competitiveness. Some of the major recommendations of the report are:

The U.S. must maintain its current quality and effectiveness in science and engineering. We should attract the best graduate students and postdocs regardless of national origin. The U.S. should make every effort to encourage domestic student interest in S&E programs and careers.

The overarching goal for universities and other research institutions should be to provide the highest quality training and career development to both domestic and international graduate students and postdoctoral scholars of truly outstanding potential.

Positively, a significant percentage of foreign-born students earning doctorates from U.S. institutions end up staying here, contributing to the

nation's S&E innovation and, subsequently, the economy. This number increased to 71% for 2001 Ph.D. recipients. Recent trends indicate some countries are aggressively recruiting talent back home by increasing their R&D investments.

In order to stabilize and increase our S&E workforce, we must intensify our efforts to prepare and encourage K-16 students to pursue undergraduate and graduate studies in S&E related fields. Lack of interest in S&E begins early, and special emphasis may need to be placed at the middle school level to keep students engaged. American high school students routinely perform below their peers on international mathematics and science tests. Special incentives similar to the NDEA initiative of 1958 must be launched to provide incentives to students to pursue S&E education and careers. Incentives also are critical in reaching out to underserved and under-represented students as they constitute an increasing percentage of our

population. The college-age population will be as much as 40% racially or ethnically diverse by the year 2020.

In summary, the United States must attract and train the best domestic and international talent in science and engineering in order to maintain its global leadership position. Without sufficient talent, our ability to provide global S&E leadership is jeopardized.

References

- Council on Competitiveness. 2004. *Innovation: The New Reality for National Prosperity*. 21st Century Innovation Working Group.
- . 2004. *Innovate America: Thriving in a World of Challenge and Change*. National Innovation Initiative Interim Report.
- The National Academies. 2005. *Policy Implications of International Graduate Students and Postdoctoral Scholars in the United States*.