The Skills Race in Science and Technology: What it Will Take to Win
by John Yochelson

Published in the San Jose Mercury News
September 7, 2005

Last week 15 of the most influential U.S. business organizations issued a national call to action to double the number American baccalaureate degree holders in technical fields by 2015. Prompted by slippage in homegrown degree production, uncertain access to foreign-born talent, and exploding global capacity in science and engineering, the business coalition urged a cabinet-led "Education for Innovation" initiative. Four fundamentals will determine whether the United States will be able win the skills race:(1) a clear understanding of why we have fallen behind; (2) a firm grasp of U.S. interests; (3) inspired federal leadership; and (4) grass roots engagement.

Why we have fallen behind. The erosion of U.S. human capital in technical fields over the past two decades is well documented. No single explanation accounts for these trends. Labor market economists see career attractiveness as the controlling factor. If smaller numbers of Americans are majoring in technical disciplines, it is because the anticipated rewards of becoming a physicist, chemist, or engineer do not measure up to those of business, law, or medicine.

In contrast, international students have flocked to U.S. universities to study science and engineering because they are not foregoing significant opportunities to do so. Their influx, economists point out, has averted overall shortages in the U.S. technical workforce--holding in check upward pressures on salaries in most fields. The solution lies in changing the signals that labor markets send.

An alternative view sees failure on the U.S. supply side as the heart of the problem. This perspective resonates with many educational reformers and employers, who contend that the pool of American tech talent would be much larger if the nation's K-12 enterprise did a better job in providing foundation math and science skills. They add that economic and cultural barriers persist in higher education, weeding out students instead of nurturing their development. Insufficient numbers of qualified American students have prompted U.S. universities to look elsewhere. The solution lies in strengthening the U.S. educational pathway into technical careers.

Clearly, both of these explanations ring true. Cite evidence on wages Building capacity in science and engineering requires a well-conceived strategy of market intervention, system-wide improvement in K-12 math and science education, and a concerted effort to develop more American talent in colleges and universities.

Where U.S. interests lie. The U.S. has derived great strength from being at the center of networks – alliance, grade, international finance, and education. We want to maintain this position while also expanding opportunities for American students. The U.S. interest lies in:

- Produce a critical mass of homegrown talent in all technical fields, including math and science teaching.
- Attract the best and brightest minds to U.S. universities and laboratories
- Compete on the quality rather than the size of the U.S. technical workforce

The business coalition paper grows out of concern that the we are not producing sufficient domestic talent.

There is no substitute for federal leadership to lead a national tech talent initiative. Congress and the executive branch have powerful tools to apply including federal investment in R&D, immigration policy, scholarships, loan subsidies, outreach programs, and educational research grants. Only the federal government can deploy these tools strategically and provide the vision needed to mobilize a nationwide effort.

The need for federal leadership. Nevertheless, we cannot simply wait while the wheels of our federal system begin to move. We must act – as many are already doing – on the local and state level to initiative change and make progress. Public and private sector leadership on the state and local level can and must play a pivotal role if we are to win the skills race. Dozens of metro areas across the country are natural platforms for action. These hubs of innovation, in which knowledge-based industries cluster, need no convincing about the talent imperative. They compete ferociously for human capital and are on the firing line to expand local education and workforce opportunities. Community-based leadership can bolster a national tech talent initiative in three important areas.

First, local and state leaders are well positioned to address our most serious vulnerability – underperformance in K-12 math and science education. When they act strategically, they can make a telling difference in our highly decentralized, $450 billion K-12 enterprise. DuPont, for example, spearheaded the statewide adoption of an inquiry-based science program that helped close the minority achievement gap among 3rd and 4th graders in Delaware. Second, efforts to attract talent into technical fields gain an edge when they are linked to widely recognized local and state needs.

A case in point is the University of California's pledge to double the number of its undergraduates committed to K-12 math and science teaching over the next five years. The university will leverage public and private sector leadership, including a personal letter to every entering freshman from the president of the UC system and the governor of California, to support this focused intervention. Third, community-based efforts to build capacity in science and engineering provide a wellspring of insight into what works. Many pockets of excellence have vast potential to deliver results if their underlying design principles are implemented on a national scale. Here are some concrete examples:

- **Joint degrees**. Historically black institutions in Atlanta with long records of achievement in producing technical talent have teamed up with Georgia Tech to offer joint degree programs in cutting-edge disciplines. The resources of other major research universities could put more minority students on a fast track.

- **Community-based best practices**. The Kauffman Foundation in Kansas City and Lilly Foundation in Indianapolis have both supported nationwide searches for K-12 math and science programs that are capable of "moving the needle" on student achievement in area schools. A collaborative of like-minded metro areas could accelerate the transfer and implementation of effective programs.

- **Online feedback**. Oregon State University has produced a survey instrument to get feedback in real time from first- and second-year engineering students on the

quality of their educational experience. This approach to combating high attrition from engineering majors, especially among underrepresented groups, deserves wide attention.

- **University-K-12 partnerships**. San Diego State University guarantees admission and financial aid to all students who complete a rigorous college prep program in California's largest secondary school (7-12) school district. This kind of visionary compact has the potential to drive system-wide change nationwide.

- **Scientists in the classroom.** The Department of Defense is piloting an interdisciplinary materials science program in schools near research facilities in Maryland and New Jersey. A signature feature of the initiative is collaboration between DoD volunteer scientists and classroom teachers. This model could be implemented by many technology-based organizations.

- **Strategies of inclusion.** Carnegie Mellon University has achieved large, sustained increases in the number of women in computer sciences by adjusting admissions requirements and adding a hands-on component to the curriculum. Concerted efforts along the same lines could be made elsewhere and in other fields.

These kinds of initiatives are no substitute for federal commitment, but building on them could spell the difference between meeting the talent imperative and falling short.

John Yochelson is president of Building Engineering and Science Talent (BEST) and former president of the Council on Competitiveness. San Diego-based BEST has reported to Congress on the nation's most effective K-12 and higher education programs in science, technology, engineering, and mathematics for historically under-represented groups.