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Engineering Education on the Rocks

By Ed Sperling -- 4/8/2005

Electronic News

Electronic News sat down to discuss the future of engineering education in the United States with Jack Harding, chairman and CEO of eSilicon; Jim Hogan, general partner at Telos Venture Partners, and Belle Wei, dean of the College of Engineering at San Jose State University. What follows are excerpts of that conversation.

Electronic News: How does engineering education in the U.S. stack up against other countries?

Hogan: You have to separate two things: There are researchers and there are practitioners. On the research side, the United States probably does a reasonable job. What I worry more about are the practitioners, the people who actually do the work every day. For every researcher you need maybe 20 people to get the job done. That's where we're falling way behind.

Wei: In terms of investment in higher education, China's investment is significantly higher. For us, the funding level has been cut across the nation. Last year we took a study tour of 25 students to China. During that tour, they had opportunities to meet their counterparts in Taiwan and China. The students got together and compared notes, and the conclusion was that the students there work very hard. Usually they take six to seven courses per semester, while here our students take four or five courses. They used similar textbooks and the same EDA tools. Our students realized they have to work much harder just to be competitive.

Hogan: They also more than likely go on to higher degrees [in China], whereas here they don't. They get through faster. In California, if you're going to a state university you're going to take six years and then maybe go on to graduate education. They complete their masters program by their mid-20s, which allows them to enter the workforce with a higher education a lot sooner in their careers.

Harding: As a business operator, I'm typically more concerned on a tactical basis with practitioners rather than researchers. But I don't think we should think the research side here is working. If you look at all the major electronics innovations over the past 30 years, with the exception of the semiconductor -- which you can argue was indirectly government funded because of the pull-through to buy them at \$1 million apiece -- everything else came out of government funding based upon the Cold War. In the mid-'80s, when it was deemed the Cold War was over, it became much more popular to invest in the biosciences because clearly it was more politically correct to say we're going to cure cancer than find the next semiconductor -- or worse, that we're going to make the

next weapon system. There's been a dramatic decrease in the funding that major research institutions had enjoyed for years. Consequently, professors have been under enormous pressure to show results in four to five years, instead of 30 years or never, if they want to get funding. That pressure has showed up in producing patents that are royalty-generating. Now professors are saying, 'Look, if I'm going to live with this kind of pressure I might as well go over to Intel or IBM and triple my pay. And while I'm at it, I think I'll take my best students with me because, after all, that's my staff.' So what we've done is undermine our ability to long-term, high-risk research, which also has high reward. And we've also cannibalized our educational institutions. That certainly undermines our educational competitiveness.

Electronic News: The decrease in funding has been going on for quite a while, but at the same time our universities and colleges seem to be pricing themselves out of existence. Is that happening in the engineering curriculum?

Wei: That is being driven by enrollment decline. Here in California, Fresno combined its college of engineering with its college of science. Last year, San Francisco State was talking about eliminating its engineering program. In general, it's expensive to run engineering programs because you have laboratory components. Also, the pay is higher than that of an English professor. During budget crunches, it's very tempting for administrators to eliminate engineering programs. When it comes to higher degrees, a very high percentage of the students in those programs are from other countries. Whenever there is an opportunity gap between the source country and America, then we can attract students to study here and then stay here after they graduate. A case in point is Taiwan. After the mid-'80s, there were not a lot of graduate students from Taiwan. There are two reasons for that. One, because of the economic growth in Taiwan, they started their own graduate programs. Two, economic growth has created opportunities for Taiwanese students. There is no point in leaving the country. That will happen with China and India, too, as they catch up in their technology development. If they do study here, they will probably get their education and return.

Harding: In 1995, the Council on Competitiveness published a number that 53 percent of all technology grad students were foreigners. At the time, there was an increasing percentage returning to their countries. So we are left with the worst of all worlds. We are educating the world's graduate students with public funds and then they're leaving the country to go back and compete with us. If you fast forward, that's precipitated the whole offshoring, outsourcing phenomenon we're experiencing today. The talent is simply not here as a percentage of the growth we're experiencing in the tech sector.

Hogan: At the same time, we've made it harder for them to stay here because of the immigration policies. Having a PhD isn't a ticket to stay. You have to find a job, you have to be sponsored by someone, and in a downturn there aren't a lot of people doing that. If you have a PhD, and maybe a masters, as well, you should automatically be allowed to stay. We've educated these people and they leave. Using my experience as an example, our children don't want to be engineers.

Wei: It's also tied to the science education, as well. You need good teachers, interesting materials to instill interest in science and math. But the starting salary of a science teacher is \$36,000 a year and the median housing price here is over \$600,000. I've met lots of former science teachers working for technology companies.

Electronic News: Who's responsible?

Hogan: It's a question of what should you expect of your government and what should you expect of yourself? The government can do a lot of things. They can make the immigration policy realistic so that we are competitive with the rest of the world. They also need to provide the infrastructure for tax incentives and things like that for parents that want to help their kids get through. We were contrasting universities in the Bay Area. When you do make some money and you buy a bigger house and send your kids to college, what do you do next? I don't think what comes to mind is endowing a university to tackle engineering problems. I don't think we have that culture yet in the engineering community.

Harding: At the corporate level, those institutions contribute billions of dollars annually to academia. Most of it goes to the large research institutions. A bunch of smart kids at Chico State are not going to get the same kinds of resources that one might find at MIT. But just like anything else, it's a competitive system and corporations invest for their own self-interest. If they see results, then they'll place those bets. There are a handful of organizations that are starting to make more social responsibility-type investments at the high-school level. The benefits may never be seen by those particular large companies, but they're large enough to make those gifts. Particularly in the biotech area, those companies need to seed 30-year investments in order to find the next great cure. So I think the industrial part of the economy is doing its part. This goes beyond social issues into cultural issues. Who is valued in our society? Who is deemed to make the greatest contribution? It's not the poor guy working in a lab 60 hours a week. It's someone who is entertaining us. As a country, we value our technologists far less than any other part of the world.

Wei: The company's role is to generate profit for its shareholders. It's an economic institution, not a social institution. When it comes to social issues, education is the government's responsibility and the citizens responsibility to make sure we an education system that is vibrant. That provides our young people with opportunities. We cannot expect Intel or big corporations to support education extensively.

Electronic News: But we also value our entrepreneurs more, don't we?

Harding: It's not so much that other countries don't value entrepreneurs. There's one significant difference. We allow our entrepreneurs to fail without disgrace. If other cultures would allow people to try something, and if that didn't work they could start another business, they'd be equally valued. The fact is, the vast majority of new jobs come from companies with less than 50 employees. That is a trend we're going to see globally. It's to our benefit that they are punished for failure.

Hogan: In Taiwan, a lot of the people aren't coming to the U.S. for graduate studies, but they're missing out on the U.S. experience -- the entrepreneurial experience. You just keep trying stuff until you get it right. You just get to keep on trying, and failure isn't the end. It's a learning experience.

Electronic News: Are universities entrepreneurial enough to make it more compelling to go to college, do research and get a piece of the action?

Wei: The possibilities definitely are there, but in an era of declining resources we have to

choose areas to focus our energy. When kids come to college, we have to give them support -- advising, mentoring -- that engineering is changing. There are areas we can work on. Entrepreneurship is one aspect.

Harding: I believe academia is doing its part already, partially directly and partially indirectly. If you look at the components of a vibrant technological economy, you find cooperation between government, industry and academia. If you look at our region, do Stanford and Berkeley do their part? Absolutely. Do Intel and Applied Materials and HP do their part? Absolutely. Does the government facilitate a friendly environment for entrepreneurship? In a state that is very bureaucratic and controlling, I would argue yes. There is a lot of unfriendliness toward young companies, but if you look at the big picture, a lot of accommodation is made at the state level to foster a vibrant entrepreneurial and innovative society. Consequently, you have to make two evaluations. Are the academic institutions and corporations doing their part? If they can create a vibrant infrastructure or cluster or ecosystem, the answer is yes. Do they have to write checks to do that? Not necessarily. There are barter opportunities without having to hand money from one group to another.

Wei: I beg to differ. As we said before, professors are being lured away to triple their salaries. We rely on talent as much as you rely on talent to make your business successful. We don't have resources to attract and retain the talent we need. To say that makes our job difficult is an understatement. Given the constraints, we do the best we can. We can introduce business topics into a technology curriculum to increase entrepreneurship. But that all takes resources.

Harding: So does that mean we need more government investment to boost salaries or that we should have more long-term investment to make the jobs more interesting so they'll forego higher salaries?

Wei: If government doesn't invest adequately in education and a professor walks in to me and says he is expecting his third child, his mortgage is high, and he has been offered three times his current salary, how can I tell that professor to stay? You need a certain economic standard. We're talking about engineering PhDs, not PhDs in divinity. They don't get into education to get rich, but you do expect you can maintain a living standard.

Electronic News: So shouldn't there be more of an exchange program between universities and industry, whereby people teach for a while and then go back into business? And people who come up with patents should be able to cash in on those, shouldn't they?

Hogan: That's a research university. That's the difference between Stanford and Fresno State. A professor in San Jose may make the same scale as in Chico. If you're a professor at Stanford and you've got a bunch of grad students, they're your assets. They'll start companies, you'll benefit from that as board member and hold a bunch of founder shares, and you'll make a lot of money off that. That's an option available to them that isn't available to the practitioners of the world.

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