

**EETIMES** ONLINE**EE Times:****U.S. holds own vs. China, India engineer grads**

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San Francisco -- The numbers don't add up. China and India are not turning out nearly as many engineers annually as commonly believed, Duke University researchers report, and the ones they do graduate are probably not as well-trained as their U.S. counterparts.

In testimony this month before the House Committee on Education and the Workforce, the researchers said their study of engineering-school graduates showed far less disparity in numbers among the three nations than reported elsewhere.

"It's contrary to what everyone else is saying," said Vivek Wadhwa, executive-in-residence and adjunct professor at Duke (Durham, N.C.).

Looking at all computer science and information technology degrees from four-year schools, Duke's initial study, released in December, came up with 137,437 engineering graduates for the U.S., 112,000 for India and 351,537 for China. Subsequent research shows China's numbers to be even lower.

The Duke researchers did conclude that China is increasing its production of engineers, however.

By comparison, stats for 2004 engineering-school graduates are often given as 352,000 for India and 600,000 for China. The National Academies, which advise the U.S. government on science, engineering and medicine, peg American numbers at 70,000.

While determining the number of graduates from U.S. engineering schools is straightforward, comparing them with their Chinese counterparts isn't.

China and India include graduates of two- and three-year programs in their compilations, the researchers found. And China, in particular, defines "engineer" more loosely than the United States, including technicians and information technology specialists in the term.

The Duke researchers provoked a minor tempest when they released their initial results late last year. Their study challenged the assumption that China and India are leagues ahead of the United States in engineering graduates.

India has three times the population of the United States and China, four times.

After the study's release, a visiting Chinese scholar told Duke team members that their December numbers--obtained from China's Ministry of Education--were not accurate. So the researchers then contacted half of China's 400 engineering schools for a clearer picture.

They found that classification methods differed from school to school, not province to province, as they had

previously thought. "Each school reported it as they wanted to," Wadhwa said. "There was no standardization of degrees."

Of the 200 universities contacted, the 30 larger ones that provided 2004 data said they had a total of 29,205 students in fields they classified as engineering.

At the end of the day, Duke was unable to come up with clear comparisons between China and the United States. But the data for 2005 engineering graduates from 77 of the Chinese universities contacted showed "significant increases" over 2004, Wadhwa said.

There are China-specific reasons for the disparities in their engineer count. One is government involvement.

"The ambiguity of numbers is a problem with Chinese statistics and business in general, because of the really top-down nature of the Chinese government," said George Haley, an industrial marketing professor at the University of New Haven, Conn., who interviewed 29 CEOs in China for his book *The Chinese Tao of Business: The Logic of Successful Business Strategy*, published in late 2004.

The government tells institutions that a certain number of engineers are needed. With that mandate, institutions will find a way to come up with the required number--or even more--he said.

Moreover, narrowly focusing on graduation rates ignores bigger issues, such as quality. China may be increasing its numbers of engineers--a necessity, given its growing economy--but with a factory-like approach, he said.

"My conclusion is that China truly is graduating more engineers than the U.S. in raw numbers, and that those numbers are very high," Wadhwa said. "However, their focus is on quantity, not quality."

Haley agreed. "If you were to speak to any multinational tech executive working in China, they would tell you only about 10 percent of Chinese engineers are capable of working up to multinational standards," he said.

Chinese companies can do remarkable work with fewer people than a U.S. project might have, but Chinese engineers typically have limitations in creating new world-class technology, Haley said.

Rather than worry about outsourcing--a reality in any case--U.S. universities and industry should focus on which skills are needed and how to develop them, Wadhwa said. Expertise in fields like systems biology and genomics will give the U.S. a long-term edge, he said.

And employers should look hard at salaries, Wadhwa said. In Duke's case, 30 to 40 percent of students in its master's of engineering management program accept jobs outside the profession. "If the money was there in engineering, you bet these kids would be getting into engineering," he said.

There's another consideration, said Duke engineering-school dean Kristina Johnson. Engineers need to have a historical perspective and to understand public-policy implications of their work.

"There's a fuller context to this great research," Johnson said. "If we thought of the dynamic engineer as a liberally educated person of the 21st century, we would never have enough."

Engineering education needs to intersect social sciences and humanities to get to that point. "Whatever country does that first will create a citizenry that's able to address the problems of the world in a more holistic context," Johnson said.

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