Knowledge economy and higher technical education

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India becoming a knowledge superpower in the twenty-first century is some sort of a catchword in the media. This rhetoric is, however, not matched by actual realities or specific action plans.

Realities

In India, the churning out of four-year undergraduates in engineering, including MCAs is numerically healthy, but quality-wise it is poor. Last year, India produced about 250,000 engineers, the US about 70,000 and China about 600,000. These numbers are quoted extensively in the US media after a recent National Academy's report, mentioning that the US strength in science and engineering is slipping. It proposed action plans to strengthen US Science and Technology (S&T) education all the way from K-12 through Ph D[1].

In the Indian scene, two things are missing, namely the quality at the undergraduate level in large numbers and Ph Ds in sufficient numbers to teach at the engineering colleges or work in the industry. For example in the area of IT where India has made the mark, hardly about 50 Ph Ds in computer science are produced each year, which is a normal number in a good US public university[2]. Hence in spite of the reputation in the area of IT that the country has, knowledge creation in computer science as an academic discipline is low. Therefore, innovation in terms of products or even applications are few and the country still depends on foreign know-how for complex engineering projects outside of space and nuclear power. For innovation to happen there has to be proper synergy between engineering and IT at the postgraduate level, both within academia and the industry. In a limited scale it may exist in such tasks as designing indigenous cars or some other applications. The knowledge scenario is no different in traditional engineering disciplines. Unfortunately, IT is blamed for this situation, which is not fair. IT did what it could do best given the manpower available. Being primarily in the BPO and services sector, it requires a different type of training which is traditionally not imparted in an educational setting. This fact now being realized in the US and UC Berkeley is offering a certificate course in 'services science'. In engineering, it is quite possible that the Indian industry did not take up to IT whole-heartedly or it lacks faith in internal expertise for doing so. This is quite evident in a major sector of the economy, namely the power industry. Part of the problem lies in the poor quality of engineers being turned out and the syllabi in many engineering institutions have changed only incrementally over the years. Most of us know that except for IITs and a few other institutions, the quality of undergraduate training is poor, although the intake from the 10 + 2 system is good. The fact that 300,000 students took the JEE entrance exam recently for a mere 4000 seats is a sad commentary on the higher education system. This problem and possible solutions have been discussed elsewhere[3]. Basically we not only need a large number of good undergraduates, but also Ph Ds to train undergraduates. IT as we see it today is not knowledge economy-oriented. It is basically serving an important need of the West and has done that job well, adding some stature to one sector of the Indian economy. It has also resulted in a vast pool of middle-class people with good disposable income. While we should congratulate the IT industry, we should not ignore the basic problems of engineering education. The recent U. R. Rao committee report, which is yet to be published in full, has highlighted this issue clearly[4].

Strategies for success

How do we address this problem? Unfortunately officials at HRD Ministry as well as academicians seem to have avoided this problem all these years. We hear of efforts at e-education, distance education and education via satellite and taped videos in engineering. All these modes of education have not succeeded in other countries, but result in the waste of human and financial resources that India can ill-afford. Moreover, they cannot impart quality education, which is needed for a knowledge economy. We need to concentrate first on giving quality education in a traditional way to a large number of students. A number of options have been suggested such as scalability of IITs and IISc to have a reasonable student to faculty ratio like 20 : 1 or better, compared to the 10 : 1 ratio prevalent today. Concurrently, we can upgrade the existing institutions with a proven track record to the level of IITs. Academicians will be aware of such institutions that can meet these criteria. Currently, there are proposals to elevate seven colleges to IIT status. A wiser move would have been to elevate selected RECs first to IIT status. With minor changes in curricula, they can impart IIT-type undergraduate education immediately. The fact that they were given NIT status is unfortunate. Other colleges with proven track record, selected for upgrading can retain their name and be given IIT-type funding. Admission to all these should be through the same JEE, thus removing a big burden on the students. Bold policies in this direction must be examined right away in order to be effective from the coming academic year. There is well-published statistics to show that India has fallen far below China in terms of research in S&T. Tsinghua University, China alone turns out more than 2000 undergraduates in engineering per year, according to its website.

IISc, which is the flagship of research in sciences, must also start undergraduate programmes in engineering and the Integrated M Sc programmes in the sciences, with perhaps a greater share for science graduates. This is one way of exciting young minds about science. The experience at IIT Kanpur in the 60s, of having an integrated 5-year science degree programme, where excellent research in sciences was also done should be a convincing factor. There are few world-class institutions excelling in research without an undergraduate programme.

From the media reports, a shift system is reportedly being suggested by the Na-

tional Knowledge Commission to optimally use the classroom and laboratory space in the universities. The practice of tutorials must be abolished and postgraduate students can grade the homework. The Internet can be used effectively by the faculty to communicate with the students.

The present IITs must emphasize on research, particularly at the Ph D level in a vigorous manner. Good research always attracts good students, as the IISc experience has shown. Two factors are always mentioned, namely salary of faculty which the Government must address and the supposedly poor quality of students from engineering colleges. With a large number of IIT-type institutions, the latter problem will be solved automatically. Moreover the present GATE exam must be replaced by a simpler one like the present JEE. Engineers who have spent 1–2 years in the industry must be given an opportunity to enter the postgraduate programme.

India is at a critical point with a huge talent pool available, but poorly served by the current infrastructure. Unless imaginative ways are implemented immediately, we will stand to lose in a big way in the knowledge economy race. The industry, which has been on the sidelines so far, must also be encouraged to join this effort.

1. *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The National Academies Press, Washington DC, 2006, pp. 512. http://fermat.nap.edu/catalog/11463.html
2. Microsoft official wants India to revamp curriculum. *The Hindu*, 8 October 2005.
3. With more Ph Ds, India can be a superpower. Rediff.com, 10 March 2006.
4. Warning bells. *Frontline*, 13–26 March 2004, vol. 21.

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