

## Science, technology, and society – A broad perspective

There have been quite a number of commentaries in the recent issues of *Current Science* (2000, **78**, 381–382; 1279; 1281–1282; 1407; 1417–1418; etc.) on the status of S&T in India. It may be fruitful to complement and place them in a broad perspective.

The British model of university education, which has been inherited by India, is not suitable for the contemporary world. Indeed for a long time this has been felt by the British educational establishment itself. Herein lies the root cause of the failure of not only the Indian university education/research system, but also of those countries where it has been implemented. The history of British S&T in the last 150 years confirms this. Although England had a predominant position in S&T before this era and ample wealth to support it, progressively she lost her position to the continental nations, particularly to Germany. One only needs to consider optical, chemical and automobile industries to understand this. The most profound revolutionary theories of physics, quantum mechanics and relativity, came from Germany. The development of modern mathematics was also carried out mainly in the continent. Indeed up to the turn of the last century, English academics remained aloof to the fundamental developments in mathematics taking place in the continent.

A good indicator of the quality of an education system is the quality of the books written by the professionals belonging to that system. Nowadays, as a norm, it is hard to find books by British authors in S&T which have the same depth and breadth as those by the American, French, Japanese, German, or Russian authors (the Russian system is modelled after the German one). This is not surprising when one compares the respective education systems with each other.

In addition to adapting a better model, one should have national commitment for the system to succeed. This requires integrity and genuine dedication from all participants. The universities should be real engines of S&T progress because scientific and technological professionals are educated in these universities. Appointments to the university positions should be made strictly on the basis of merit alone. Remuneration should be based on performance, rather than on

factors such as age. Performance could be measured by the true impact of one's work. It is meaningless to lament the lack of performance of a corrupt system (*Curr. Sci.*, 2000, **78**, 1279; *India Today*, 31 July 2000, 57). Autonomous private universities should be allowed to function along with the public universities, to promote competition and diversity. High technology entrepreneurship should be stressed at every stage. Venture capital should be made available to promote emerging industries. Admitting foreign students may lead to improvement of international competitiveness and enrichment of campus life.

Not everyone choosing a scientific or technical field of study is aspiring to become a research scientist nor has the capability to do so. However, a vast army of S&T personnel is needed in India. The country needs an education system which is capable of producing both types of personnel. Encouraging free and fair competition amongst the existing institutions will naturally lead to the emergence of elite ones capable of accomplishing this.

Establishing and operating such an education system naturally requires reasonably large investments on the part of the country. While it is the responsibility of the society to understand that the investment in S&T is the best one, the scientific and technological community should contribute to the generation and consolidation of national wealth.

The most outstanding failure of the Indian society is her incapability to manage her resources wisely. While India spends enormous amounts of money on defence and other procurements, there is an army of Indian S&T personnel languishing without employment. A proper management would utilize the money spent on these procurements to gainfully employ Indians to build these equipments (for export as well). Building these items in India has, apart from being economical, several other advantages, the foremost being the acquisition of national technical capabilities and confidence.

There is no sense in blaming the Indian graduates working elsewhere. It is India's incapability, to gainfully absorb them into the national economic activity in a way that is advantageous to both parties, that causes the exodus.

Proper utilization of S&T personnel should be able to generate/save wealth which (or at least a small percentage of it) in turn could be invested back into the scientific research/development institutions. A society would invest in S&T, only if this investment yields profits. This can happen only if the S&T personnel are able to manufacture quality products at low cost, which are in demand worldwide. Only then will society be able to reap the benefits by utilizing these products or by selling them to other nations. If the only thing the universities are capable of producing are people with high-sounding certificates and pompous titles, but otherwise incapable of creating anything, then naturally the support will dwindle.

Emphasis on poverty alleviation at the expense of advanced S&T enterprises and national defence are misguided because, abandoning the former would lead to reduction of national wealth and the latter is essential for safeguarding wealth.

The notion that the 'western values' and the 'Greek tradition' are essential for successful practice of science is misleading. If one assumes that the western values are a unique product of the West, why is it that before the fifteenth century, when these values and the 'Greek tradition' were operative, the West did not show any outstanding S&T performance comparable to Asia, and in the words of the westerners, was in dark ages?. The Greek scientific tradition as per the West has been highlighted by Martin Bernal (*Black Athena – The Afroasiatic Roots of Classical Civilization*, vol. 1, *The Fabrication of Ancient Greece, 1787–1987*, Rutgers Univ. Press, New Brunswick, 1987). Asia and naturally India, are capable of advancement without European teachers, as our past clearly demonstrates.

The 'golden era' of Indian science admits another explanation which invokes neither the 'western values' nor the 'Greek tradition' nor European teachers. It coincided with the 'golden era' of world science, which happened to be the time when classical mechanics was being replaced by quantum mechanics and the theories of relativity.

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