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CORRESPONDENCE

Globalizing Indian science

After the very healthy discussion on the proposed NSU, your readers must be fed up with NRIs solving their problems. I will not offer help with problems but point to new opportunities already intrinsically present in India.

As a technology and science policy analyst and involved ineluctably in the international aspects thereof, I have had occasion to add up many nations' advantages and disadvantages in the 'R & D industry'. I believe that India has a unique opportunity with a short-time window for its exploitation. The empirical fact is that India has produced from its inefficient, far from ideal university–IIT–CSIR system a vast pool of technical talent at the M Sc–Ph D level. Moreover, these scientist-engineers all speak passable English, in a world technoculture which also operates in English.

These two factors, large numbers of scientists and English, are India's unique assets. In what 'industry'? Fundable R & D. Today's research enterprise with FAX, Federal Express and 747s for transport is more globalized than *any* other sector. Why? Our commodity is knowledge – the lightest, most fungible, most rapidly moved of all commodities. We have already seen the software industry moving in a big way to India. My vision is for something much more comprehensive.

I think that sooner or later some private entrepreneur will build – with public sector contributions of, say, land and infrastructure – a network of (say four) major R & D laboratories in various parts of India. The focus of these labs will be longer-term (1–5 years) targeted (my word is 'telestic', purposeful) research of direct significance and directly coupled to ongoing research within the supporting institution (industry or government). Who will be the customers? First and foremost, Western (and Japanese) industry. Next, emerging Indian middle- and high-tech industry. Next, Middle East and South Asian industry. Next, India and regional governments.

Why do I believe that this is a very sure bet? Look at the data (approximate). It costs \$150,000–200,000 per supported person per year for a research scientist in the West. In India my figure is near \$5000. In the USSR it is \$2000. Today, in the fields I know best (materials, chemistry) the capital cost per workplace for all the major (i.e. used for 90% of the work) required apparatus is amazingly modest (\$20–50 k). It is imperative that such labs avoid the edifice complex and Taj-Mahal-equipment to impress sightseers. Sophisticated measurements can be rented in India or abroad.

This is hardly a revolutionary concept. The Tata lab in Pune started by my good friend E. C. Subbarao is a step in this direction. What I am suggesting is a much larger version of Fraunhofer–MITI-type labs run by private entrepreneurs in India, committed to serving at a national as well as global level and run by a private-public consortium.

Geographic, transportation and climate factors will be essential in selecting locations. But one could examine the Novosibirsk (FSU) or Tsukuba (Japan) models for long-range hopes. What is needed is for India's R & D community to pursue this kind of 'applied' science goal and find financial backers from any part of the world.

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Solar eclipse

Readers may be aware that a total solar eclipse (TSE) visible from parts of India will take place on 24 October 1995. In spite of the fact that a TSE is one of the most breathtaking natural phenomena, a vast majority of Indians would miss seeing it, haunted as they are by the age-old myths and superstitions about such phenomena. This is tragic since eclipses are the earliest natural phenomena to have been understood and taken out of the realm of superstition and brought into the domain of science. Only an unscientific attitude, on the part of the people, deprives them of an experience of a lifetime. Moreover, an expression of such an attitude on a societal scale only helps reinforce irrational beliefs in people's minds.

Vigyan Prasar, an autonomous organization set up by the Department of Science and Technology for undertaking large-scale science popularization tasks, has decided to create national awareness on the scientific aspects of a TSE using a variety of science communication means, including attempts at demolishing the various myths and superstitions associated with this grand phenomenon. The occasion would also be used as an opportunity to spread awareness about other astronomical phenomena and in general about our solar system and other objects in the sky.

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There has been much discussion in these columns and outside, of the state of science in the universities and how to improve it. One laudable effort in this direction was the setting up of the Inter-University Consortium for DAE Facilities at Indore. Without much fanfare, a good beginning has been made in encouraging and facilitating high-quality experimental work by university staff and research students. The following report on the Annual Day at this Centre gives some feel of the nature of the efforts there, as well as the visitors, often working in other areas, who have already been attracted to Indore. One hopes this process will continue and give rise to flourishing experimental activity in an exciting academic atmosphere in the years to come.

–Editors

Annual Day of the Inter-University Consortium for Department of Atomic Energy Facilities

The Annual Day of the Inter-University Consortium for DAE Facilities was celebrated on 14 December 1994, at Indore. A one-day seminar on Science in India – Some Facets' was organized on this occasion. At the inaugural function, Prof. R. Srinivasan, Director of the IUC-DAEF, gave a brief report of the progress achieved in the last one year at the three centres of the IUC-DAEF. There are 70 on-going projects of university users at the Dhruva Reactor, Bombay, the Variable Energy Cyclotron at Calcutta and the low-energy accelerators at IGCAR, Kalpakkam. The work on the photoelectron spectroscopy beam line is progressing well and the PES beam line and spectrometer will be put on the synchrotron radiation source INDUS 1, which is expected to be operational in CAT by the middle of next year. A number of in-house facilities have been added in Indore and Calcutta, including facilities for doing work down to liquid helium temperature. There is a constant stream of university users on these facilities. In the last one year IUC-Indore centre has conducted seven workshops/short-term courses/discussion meetings and IUC-Calcutta centre has conducted six such meetings. Participants have been drawn from universities in different parts of India.

In his presidential address, Dr D. D. Bhawalkar, Director of CAT, traced the genesis of IUC-DAEF. The Department of Atomic Energy welcomed the idea of closer co-operation with the universities and has thrown open the major national facilities set up by DAE for the use of scientists from the universities through the IUC-DAEF. He was happy with the progress achieved by the IUC-DAEF so far and promised all co-operation from the DAE establishments to the efforts of IUC-DAEF.

Prof. Ramaseshan, in his keynote address, pointed to the dwindling resources for higher education and research in the universities. He said that unless higher education and research in universities are supported, the country will face a critical situation in the near future. He lauded the efforts of IUC-DAEF in setting up good measurement facilities in the Indore and Calcutta centres and hoped that university scientists would make full use of the opportunities provided to come out with quality experimental work. He said that, in the past, a culture of building equipment existed among the physicists in the country. Physicists raised in such a culture have played a crucial role in the development of atomic, space and defence research in the country. In the last few decades there has been greater and greater reliance on importing equipment for research in the universities and other institutions, and development work was confined to specialized agencies and laboratories. This is the major reason for the decline of experimental research in the universities. Prof. Ramaseshan said it is not enough to provide good facilities for measurement at a place like IUC-DAEF for use by scientists from universities. The IUC-DAEF should involve university people in the development of instruments and equipment. He also said that the training of scientists should be the job of universities. He wondered if the Department of Atomic Energy had not started its own training school but had helped the universities to run such training programs, perhaps there would have been a greater involvement of university researchers in DAE programs. Wishing the IUC-DAEF success in its efforts, he inaugurated the one-day seminar on 'Science in India – Some Facets'

In this seminar Dr Dasannacharya from BARC traced the development of neutron beam research in India from the late fifties when the APSARA reactor and later the CIRUS were built. He described how a variety of neutron spectrometers were built around these reactors and later around DHRUVA, and the improvements that have been made in these spectrometers to reduce the data collection time and to get a higher resolution. He also referred to some of the important results achieved in the last nearly three decades using the indigenously developed spectrometers.

Dr Bhawalkar dwelt on the development of laser technology in CAT. He described the fabrication of a high-power copper vapour laser and how the technological problems involved were solved. A nitrogen laser was developed and applied successfully for the treatment of tuberculosis and another for the detection of uranium by fluorescence to 0.2 parts per billion. A nitrogen laser is being used for detecting cancerous cells. A 2 GW 6 ns Nd-glass laser has been constructed in CAT for XUV laser-plasma studies. A laser power meter has also been developed.

Dr Rangarajan, Director, Master Control Facility of ISRO at Hassan, spoke about the Indian Space Programme – past, present and future. He talked about the satellite development programme of ISRO, which has resulted in improved communications and rural education, and the invaluable contribution of remote sensing to problems of mineral exploration, water resource and crop management, etc. He also dwelt on indigenous development of satellite launch vehicles.

Dr Kembhavi gave a succinct description of India's contribution to astronomy