

into which this country was straight-jacketed. The results are clear today for all to see. While we certainly did not go as far as producing a Lysenko or an Elena Ceaucescu, Indian science did not take off because it was not allowed to find its true measure according to the dictates of merit, which is, in effect, the scientific free market.

The real tragedy in this era of liberalization is that while politicians have

felt the need to abolish the licence-control-permit Raj in the financial and commercial sectors, they have not deemed it important enough to extend their experiment into the educational and scientific arenas. Perhaps it is better this way – from the excellence exemplified by the work of Raman and Ramachandran, Indian science has drifted into obsolescence and is finally mired in irrelevance. It only remains for

it to be totally drowned in the sewage of its own bureaucratic procedures, managerial wisdom and willful self-contradictions.

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NEWS

Promoting physics education: The Orissa example

Things and beings, all need to be taken care of. So do, and in a very special way, physics teachers and physics education.

Physics with its intrinsic beauty has always attracted the best of brains all the world over. Orissa, too, has experienced the same pattern and thus has managed to contribute its own share to growth of physics teaching and research in the country. Despite the strong challenge physics meets on account of the growing attraction towards managerial and administrative professions, its catch has not vanished as yet. Recognition of the seminal role physics plays in the development of science, technology and philosophy calls for attempts to present the subject to the young minds in its full glory, to the extent possible, in spirit and form. This also requires, on the part of physics teachers of the state, putting together of minds on one forum. Orissa Physical Society (OPS) is striving to achieve this. OPS was created in December 1971 in the Department of Physics, Utkal University, through the initial efforts of B. B. Deo by an act of will of a large number of physics teachers of colleges and universities of Orissa.

To have an idea about the size of the constituency it caters to, it is worthwhile to mention that about 310 colleges in Orissa offer science at higher secondary level and about 165 colleges impart physics teaching at degree level under the Utkal, Sambalpur and Berhampur universities of the state. The Orissa University of Agriculture and Technology (OUAT) also runs higher secondary and degree level science

courses. Apart from the three university departments of Utkal, Sambalpur and Berhampur, postgraduate courses in physics are also offered at four autonomous colleges – Ravenshaw College, Cuttack; Regional Engineering College, Rourkela; Khallikote College, Berhampur; Gangadhar Meher College, Sambalpur – and also at Fakir Mohan College, Balasore, Maharaja Purna Chandra College, Baripada. There are about 1200 teachers engaged in teaching physics at various college and university departments. Apart from this, the Institute of Physics, Bhubaneswar (funded by DAE, Govt. of India), primarily engaged in physics research and predoctoral teaching with a faculty and research scholar strength of about 60 persons, also lends strength to OPS in terms of membership (about 250) and academic and financial aspects.

While gradually enlarging its net, the members of OPS have put their minds and efforts together in restructuring and modernizing the physics curricula and prescribing text books at +2, +3 and postgraduate levels from time to time. The recommendations of OPS have, by and large, been accepted by the Council of Higher Secondary Education and the four universities of the state. Consequently, the courses of studies now stand among the best in the country. This provides the students of the state a level ground to compete with their counterparts elsewhere, inside the country and abroad.

The annual meetings of OPS are always organized as a miniseminar/conference of college and university

teachers. These include a small number of advanced-level review talks by researchers in the field delivered at a level that can be easily grasped and understood by the college teachers. This helps college teachers to update their understanding in the subject. Sometimes, this also motivates and helps them to decide on an area to pursue advanced study and research.

Also, as a matter of tradition introduced since the 9th annual convention in 1987, an eminent scientist of the country is invited to address the inaugural session and shed light on new developments in his area or deliberate on history/philosophy of science or science policy of the country, as the case may be. Speakers have included S. P. Pandya, PRL, Ahmedabad (1987), J. Bhattacharya, Indian Institute of Astrophysics, Bangalore (1988), Rajat Kumar Bhaduri, Mc Master University, Canada (1989), H. S. Roy, RRL, Bhubaneswar (1991) and S. Ramaseshan, Raman Research Institute, Bangalore (1994).

OPS has also started the tradition of honouring and felicitating senior and eminent physics teachers of the state in the annual meetings in recognition of their achievements and signal contributions to physics teaching and research.

These apart, the teachers also deliberate on various other aspects of physics education like the growing menace of private tutoring, pros and cons of central valuation, easing of bureaucratic bottlenecks teachers face in attending refresher courses or other faculty improvement programmes and improvement of laboratory courses, etc.

In a bid to expand its area of activity, it is being envisaged to look at the high-school science curriculum and suggest changes wherever deemed necessary. Efforts are also being undertaken to launch a small magazine in physics in the regional language that will cater to the needs of school and college students. This should contain small articles on new and interesting findings in physics, life sketches of eminent physicists,

and clear expositions or novel ways of understanding various concepts of physics. OPS is also planning publication of a bulletin on research and review works and innovations in teaching and experimentation undertaken by college and university teachers

In summary, OPS is basically an exercise of soul-search on the part of the physics teachers of Orissa to see that they become useful instruments in not

just imparting sound physics teaching to the young minds but also in making them love physics. Odds, needless to say, are heavy. But that only makes the struggle more intense and more worth taking

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COMMENTARY

Industrial research and Indian industry*

S. M. Datta

The development of industry and its infrastructure has been a dominant concern in the planning and implementation of India's economic development programme over the last five decades. Traditionally, India had offered a rich economic heritage based on agrarian and extractive enterprise. However, the aspirations of the large and rapidly increasing population could no longer be adequately fulfilled by the cultivable land resources, which were fast reaching the limits of exploitation. Therefore, manufacturing industry provided the logical choice for improving the domestic product and providing gainful employment.

Prior to the Second World War, the political control of the developing world rested in the hands of a few dominant European powers. The concept of nation-states was mostly academic. The technology of manufacturing industry was proprietary and the risks attendant upon capital deployment were high. The economic development of the British Empire, of which India was an integral part, was focused in the United Kingdom itself, and India, like other far-flung parts of the Empire, found itself starved of capital and technology for manufacturing industry even for meeting the local needs. This supply-demand gap attracted the attention of

the flourishing trading community and was mainly responsible for the gradual transformation of the trading class into industrial entrepreneurs. The excellent framework of higher education built around the Indian universities provided trained manpower for managing these early industrial efforts. Thus, local entrepreneurship combined with the able and competent cadre of technological manpower provided a strong bias of self-reliance to India's industrial programme during the years of political awakening.

The objective of industrial development, in India as well as abroad, has always been to provide economic value-addition to the natural resources and their produce through the fulfilment of the consumption needs of the relevant population. It was recognized quite early that the efficiency of capital deployment could be leveraged by the combined application of scientific and economic knowledge. Consequently, technology has rapidly developed into a major economic resource. During the second quarter of this century, Germany, the United States, and Japan, recognized the crucial role of science in the entire process of economic development. These countries achieved significantly higher rates of economic growth by focusing the available pool of scientific knowledge on the growing needs of manufacturing technology. The validity of this paradigm is universal and applies equally well to the poorer countries of the world.

The quality and the magnitude of India's scientific and technical manpower abundantly proved itself during the Second World War. It was a logical step forward to harness these resources to the cause of India's economic development and, thus, the Council of Scientific and Industrial Research was born in 1942. Shortly after Independence, as the country launched itself on the path of accelerated development, the role of modern technology in providing solutions to the pressing economic problems came into clear focus and the onus of scientific and industrial research shifted rapidly from the universities to the CSIR-controlled laboratories.

Response from Indian industry

Indian industry has often been criticized by our scientific establishment, with a certain degree of justification, of being apathetic, if not outright averse, to industrial research. Yet, the universal lesson of the fundamental importance of science and technology in accelerating the pace of industrial development could not have been missed by the industrial establishment. Therefore, it is important to understand the reasons behind this lukewarm response.

The first, and probably the most important, reason has been the inability to obtain a complete technological package for any industry within India. This disadvantage extended to the supply of expertise needed to maintain and update

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