Indian Institutes of Technology: Report of the review committee–2004

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At the dawn of the current New Year, I happened to meet a relative's son who is just getting into his teens and is studying in the eighth standard. I asked him, what was his New Year's wish, it did not take him long to answer that his New Year's wish was to get admission to one of the Indian Institutes of Technology (IITs). Obviously, this will be his wish for few more years to come. One could be fairly certain that this wish or the dream of getting into one of the IITs is shared by lakhs of children in his age group across the country. This should not come as a surprise since the brand quality of IIT undergraduate education is firmly established not only nationally but also globally. In spite of this impressive track record, it is commendable that the Government of India through a memorandum dated 27 June 2002 appointed a committee[1] to review working of the Indian Institutes of Technology[2]. The report of the committee brought out in 2004 is the subject of this commentary. In my opinion the committee has done an excellent job in not only conducting the review but also in bringing out a very fine report. The report, which is 170 pages long and contains 16 chapters[3], is well organized and is easy to read and follow. There is an Executive Summary at the beginning and each chapter ends with a summary of recommendations. The terms of reference given to the committee are contained in the order which is appended to the report. It would have been useful if the present report contained, in an annexure, a summary of the important recommendations of the previous review committee headed by Nayudamma (report in 1986) and also their impact, when implemented, on the present status of the IITs. As compared to the Nayudamma committee review, which was done almost twenty years ago, the present committee had to consider certain newer issues like enhancing IIT–industry linkage, expanding the IIT brand through Intellectual Property Rights (IPR) and use of modern technology in education. On some of these topics, the report goes into considerable detail with a roadmap for achieving the final goals. An idea of all the topics covered by the review can be obtained by going through the list of chapter titles provided at the end. Here we will deal mostly with issues that are of academic nature.

As a first step of the review process the committee gathered a lot of statistical information. It is useful to consider some pertinent statistics taken from the report. The seven IITs together produced in the year 2002–03 about 2275 B Techs, 3675 M Techs and about 445 Ph Ds. The distribution of students on roll was, 11,700 undergraduates (all four years), 9500 post-graduates (all category of Masters students and all years) and about 3800 Ph D scholars. With a total faculty strength of 2375, the teacher to student ratio worked out to about 1 : 10, which is considered to be about the optimum for a good institution. From 1999–00 to 2002–03, the growth in the intake of post-graduate students (22%) and Ph D students (49%) was significantly larger than the growth in the undergraduate intake (less than 1%). During the same period, the total IIT faculty strength did not increase much and in 2003, the strength of 2375 was about 27% less than the sanctioned strength of 3263. Percentage of IIT faculty with at least one degree from one of the IITs varied from 28% for IIT-Kanpur to as high as 62% for IIT-Kharagpur. In 2003, nearly 1.8 lakh students appeared for IIT Joint Entrance Examination (JEE); the number selected was about 3750 including those admitted to BHU-IT and Dhanbad ISM with the selectivity for the IITs being less than 2%. Some of the statistics presented above will serve as the basis for further comments and observations.

The committee rightly points out that the system that has been put in place for the conduct of the JEE, which has become flagship of the IITs, should not be disturbed. However, the committee recommends some reforms, two of which are mentioned here; the first is that the candidates be admitted on the basis of one examination only and the second being that the level of the examination be made suitable for what can reasonably be handled by a bright school-leaving child without the need for intensive coaching. Even though the JEE ensures quality intake of undergraduate students, there are some aspects of the B Tech curriculum, which need to be looked into. The transition from a five-year programme to a four-year one has resulted in the reduction of Basic Science and Humanities and Social Science component in the total credit requirements. This is considered to be detrimental to the all-round development of students. In particular, it is noted that there is a case for increasing the Basic Science component, since advances in basic sciences are increasingly triggering modern engineering developments[4]. It was surprising to note from the information given in the report that the method of calculation of credits is not the same for all the IITs. Similarly, it is known that the grading patterns are not alike across the IITs. One would have expected uniformity among the various IITs in such core academic matters. In the committee's view, to handle issues of common interest to all the IITs, there is a need for setting up of an empowered PAN-IIT Synergy Committee. This new committee is supposed to report directly to the IIT Council, which is the highest decision making body in the IIT governing structure.

As can be gathered from the statistics provided, a large fraction of the total student population at the IITs consists of Post-graduate students. These students pursue Masters degrees with various nomenclatures involving a large number of disciplines. The committee feels that there is scope for rationalization in the nomenclatures adopted and as well as in the disciplines in which the Masters degree programmes are offered. In particular, it is recommended that the IITs should seriously consider dropping the 5-year B Tech–M Tech dual degree programme in favour of a new 4-year M Tech programme for the carefully selected B Sc graduates. I was personally involved in formulating the curriculum for such a programme in the Department of Mechanical Engineering at Indian Institute of Science (IISc). The programme known as 'Integrated M E Programme' was discontinued, but in my opinion, it was a highly successful programme.

On the face of it, a large increase (49%) in the intake of Ph D students or scholars at the IITs over a period of three years does appear impressive. However, as the committee points out, there are serious difficulties associated with this category of students. Considering the statistics for

Ph D student intake and output over a period of 1999–03, it is found that the intake numbers are consistently higher by a significant margin than the output. This clearly points to a large dropout among Ph D students; in the committee's opinion, poor quality intake and lack of motivation could be the main contributing factors to this disturbing trend. In this context, it is to be pointed out that the number of IIT B Techs opting for Ph D programmes in the IITs is worryingly small. In view of the above facts, it is not surprising that the annual Ph D output per faculty works out to be only around 0.2 and this low number has not changed appreciably since the time of Nayudamma committee review carried out almost two decades ago. The present committee considers the above state of affairs as a serious matter of concern and has recommended several measures to improve the situation. Some of these are: assuring career to highly talented youngsters who choose to pursue Ph D, instituting, for all IITs put together, 100 Golden Jubilee Research Fellowships with a monthly stipend of Rs 20,000 for attracting quality Ph D scholars. In addition, to tap a larger pool of students, it is suggested that the IITs could introduce an integrated Ph D programme, in select disciplines, for B Sc graduates along similar lines as being done successfully at IISc.

Next we turn to the most important issue, namely, faculty matters. As pointed out in the report, it is the faculty members and their academic stature which constitutes the core calibre of the IIT system and it is their intellectual value along with sustained efforts which drives the output. Therefore, attracting and retaining quality faculty is considered to be of prime importance in maintaining and furthering excellence in all the spheres of IIT activities whether it be education, research or industry–institute interaction. To be successful in this endeavour, the committee makes a very important recommendation as follows: a system akin to that prevalent at IISc for faculty induction and faculty assessment and promotion be followed at the IITs. The IISc system is thought to be considerably more flexible than that is in vogue currently at the IITs. The implementation of the new procedure is to be handled by establishing a separate Human Resource Unit headed by a Dean. In addition, it is noted that any mechanisms that can be put in place to zealously guard the faculty time would prove to be highly productive. One example of such a mechanism would be to establish a sizeable internal research grant, which the faculty can tap instead of applying for grants from external funding agencies.

In summary, what the committee has done is to first discover the present scenario of the IITs, then diagnose issues of concern, followed by design of strategies for change with an overall final aim of raising the levels of performance of the IIT system. It is hoped that the recommendations of the committee receive due attention for actual implementation.

Notes and references

1. The composition of the review committee was as follows. Chairman: Dr P. Rama Rao; Members: Dr R. Chidambaram, Prof. Goverdhan Mehta, Dr S. K. Joshi, Shri Anand Mahindra and Shri C. K. Birla; Special Invitee: Shri Subhodh Bhargav; Member Secretary: Joint Secretary (T), MHRD (Ex-Officio).
2. The IITs today consist of seven institutions, five older ones established at Kharagpur (1950), Bombay (1958), Madras (1959), Kanpur (1960) and Delhi (1961) and two newer ones set-up at Guwahati (1995) and Roorkee (2001).
3. The Chapter titles in the report are: 1. Why IITs are important to the Nation?, 2. Scope and objectives of the review, 3. A macroview of the IIT system, 4. Vision for the IIT system, 5. Governance of the IITs, 6. Faculty matters, 7. Research enhancement, 8. IIT educational system, 9. The undergraduate admission process: JEE, 10. Expanding the IIT brand through IPR, 11. IIT–industry linkage, 12. Technology in education and research, 13. Non-faculty employees, 14. Funding policy and the development of the IITs, 15. Expansion within the country and opening campuses abroad, 16. The special case of IIT Guwahati.
4. Dutta Roy, S. C., *Curr. Sci.*, 2000, **78**, 1183–1184.

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Taxonomy of rhizobia: Current status

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Taxonomy of rhizobia is in a state of flux. This has been driven by technological advances in all three criteria, morphological, physiological and sequence analysis, used in taxonomy.

Rhizobia interact with legumes to produce root nodules, site of biological nitrogen fixation, hence they have been classified and studied extensively. Earliest attempts to name them were made after the host plant[1]. Three decades later, Fred *et al.*[2] coined the modern name *Rhizobium* and proposed a classification based on nodulation range with emphasis on host plant. In sixties, Norris[3] grouped rhizobia according to their biochemical properties. These approaches, however, had their own shortcomings. Development of sequencing protocols in 1970s set the foundation of taxonomy as it is followed today. In 1980s Trüper and Krämer[4] proposed that sequence analysis of conserved genes or parts of genes could serve as a taxonomic chronometer. Thus, the nineties saw the beginning of an era of polyphasic taxonomy[5]. By 1994 it was evident that use of 16S rRNA sequence data would profoundly affect the relationships among bacteria[6]. Group rhizobia, very well exemplified this change. In the first edition of *Bergey's Manual of Systematic Bacteriology*[7] only two rhizobial genera (*Bradyrhizobium*, *Rhizobium*) with four species were described. Since then, extensive phenotypic and genotypic variations have been described in rhizobia. Use of PCR tools and sequencing methods has led to description of new, and re-organization of the existing genera. Till 2003, thirty six-rhizobial species distributed among seven genera were recognized[8]. In the following three years eight new rhizobial species have been described. Currently, there are 44 recognized species of nodule bacteria on legumes within 11 genera, 9 belonging to α-proteobacteria, *Allorhizobium*, *Azorhizobium*, *Bradyrhizobium*, *Devosia*, *Mesorhizobium*, *Methylobacte-*