

Expenditure Management in Higher Education

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Preface

The National Institute of Public Finance and Policy (NIPFP) is an autonomous organisation, whose major functions are to carry out research, undertake consultancy work and impart training in the area of public Finance and Policy.

The Study on Expenditure Management in Higher Education was entrusted to the Institute by the Department of Education, Ministry of Human Resource Development, Government of India. The study was carried out by A.K. Ghosh with assistance by Anuradha Bhasin. Editorial inputs were provided by Rita Wadhwa.

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EXECUTIVE SUMMARY

1. In 1996, an Expert Committee, under the Chairmanship of Dr. Vaidya Nathan Ayyer, Additional Secretary to the Government of India, was set up by the Government of India to review the revised pattern of funding scheme operating in the Indian Institutes of Technology (IIT's), Indian Institute of Management (IIM's) and Indian Institute of Science (IIS), Bangalore. The scheme is for funding the non-Plan expenditure of these institutions. One of the important points noted by the Expert Committee was that the present level of fees charged from IIT, students was "abysmally low". The Committee observed that the revision in fees in 1997-98 was not enough. It felt that the tuition fee should be linked to the actual cost of education, and the fees structure should be periodically reviewed so that it can be adjusted in consonance with the increase in cost during the relevant period.
2. The fee revision was a major recommendation of the Committee and it emphasized that its recommendations regarding fees structure was a "crucial element of the viability of the new funding scheme," and an essential step for moving towards the goal of operational autonomy for these institutes.
3. In the above context, the present study was undertaken by the National Institute of Public Finance and Policy (NIPFP) for estimating the cost of education per student, and for suggesting guidelines for recovery of the cost.

Indian Institute of Technology

4. One of the major reasons for the high cost of teaching in the IIT, Delhi was found to be the top heavy faculty composition with a large number of Professors and Associate Professors. The faculty composition is basically oriented towards post-graduate teaching and research, and this leads to higher teaching cost per student at the undergraduate level.
5. In IIT, Delhi, a significant amount of expenditure incurred on a large number of centres in the institute – centres not contributing much to

teaching and academic research – add to the teaching cost per student at the undergraduate level.

6. The study found that these centres, set up at different points of time to promote research and development were expected to become “centres of excellence”. However, they failed to live up to expectations and have become rather a financial drain on the system, and are not in tune with the IIT's identity as a teaching institution. The academic and sponsored research done by them is also not much. This study recommends that that the centres be funded and monitored separately.
7. The Expert Committee had recommended an increase in the student intake in IITs and IIMs to reduce the education cost, per student. For achieving a reasonable cost of education per student, a doubling of the number of students in IITs from the 1996-97 level had been recommended. According to the Expert Committee, “The Directors of the IITs were of the unanimous opinion that the facilities of the IITs, which have been developed at a tremendous cost to the national exchequer, were not optimally utilized.” They had stressed that an increase in student intake, which was possible with only a marginal augmentation of facilities, should be seriously considered to increase the use of the quality manpower. IIT, Delhi has seven departments teaching eight undergraduate programmes. Mechanical engineering department is the biggest department and teaches two undergraduate programmes. Keeping in view the recommendations of Committee, in this study, the additional investment required as part of Plan expenditure to allow a larger student intake in the Mechanical Engineering Department of IIT, Delhi was intensively examined. A series of discussions were held with the head of the department, faculty, and laboratory in-charges, and visits made to the laboratories.
8. The Mechanical Engineering Department had initially prepared a Plan of Rs.9.65 crore for upgradation of infrastructure and asked for 2830 sq. mtr. of additional space. It was decided to rework the Plan with the following objectives in mind:
 - i. to make marginal and essential augmentation to their infrastructure so as to enable them to double the intake of undergraduate students;
 - ii. to phase the additions to infrastructure and additional intake of undergraduate students over a period of 5 years; and

- iii. given the existing low student-teacher ratio, to desist from asking for additional faculty.
9. After a series of in-house deliberations, and interchange of ideas with the study team, the Mechanical Engineering Department agreed to double the student intake at the end of the Ninth Plan period in a phased manner. They also scaled down their Plan fund requirement to Rs.2.88 crore (from Rs. 9.65 crore) over a 5-year period ending in 2002-2003.
10. A detailed report was prepared by the Mechanical Engineering Department showing the phasing of year-wise requirement of funds, planned additions to infrastructure, and intake of additional students. The space requirement was also brought down to an additional 500 sq. mtr. for an expenditure of Rs.30 lac.
11. The study came to the conclusion that on the same basis as that of the revised Plan for the Mechanical Engineering Department, a sum of approximately Rs.2 crore of Plan grant would be a reasonable amount for doubling the intake of the student in the existing undergraduate programmes over a 5-year period. This sum did not include the amount required for additional classrooms and hostel facility. Some support was also needed for other departments which offered undergraduate programmes, not in engineering, but in science and humanities. It was estimated that a sum of approximately Rs. 5 crore might be required for these additional requirements.
12. On the basis of the estimate for IIT, Delhi, it is projected that with an additional investment of about Rs.100 crore as part of Plan projects, the student intake in undergraduate programmes in the IITs could be doubled. This figure compares with the Plan proposals for the Ninth Plan of more than Rs.200 crore made by each of the IITs, the major focus of which is on doubling the student intake in the undergraduate courses.
13. This study indicates that if, with collaborative support from senior faculty members of various departments, a detailed and critical study is made of the infrastructure requirements, with an eye to economy and cost effectiveness, it is possible to arrive at a fairly modest estimate of the additional investment needed in order to double the undergraduate student intake in the IITs.

14. This study also came to the conclusion that there was no point in having a combined project for additional intake of students both at the undergraduate and post-graduate levels, as the problems of the two programmes were quite different. The post-graduate programmes, unlike the undergraduate programmes, did not attract the best of students, and also did not have a good market. Therefore, for induction of post-graduate students, more emphasis should be placed on sponsored students. Therefore, Plan proposals for strengthening the post-graduate programmes, including Ph. D, should be conceived after an in-depth examination of the requirements of the market. Linkages and collaborative work with other research establishments could be useful in this context.

Re-evaluating the Objectives

15. Many of the IITs were set up more than 35 years ago. It has become important to review their objectives, particularly with regard to the relative emphasis to be placed on postgraduate courses and research work *vis-à-vis* undergraduate courses. In trying to maintain the dual focus on postgraduate courses/research and undergraduate courses, the annual cost per IIT, student has increased, such that the subsidy per undergraduate student is almost one lakh rupees. In contrast, the annual per student costs in other institutions that have been more recently set up, such as the Regional Engineering Colleges (RECs) and BITS Pilani, are far lower.
16. The majority of graduates of the IITs, which were set up to meet the needs of domestic companies, do not opt for a career with industry. Most of the technical manpower for domestic industry is provided by technical institutions other than the IITs. The most popular courses at the IITs are the undergraduate programmes. They attract the best talents in the country. The anomaly, however, is that the IITs spend proportionately larger amounts on their postgraduate programmes, which have relatively fewer job opportunities and are not as highly regarded. The revised objective also needs to take into account the impact of globalization and its effect on research and development (R&D), so that the institutes are able to meaningfully contribute to domestic industry.

The Plan Proposals of IITs

17. The IITs Ninth Plan proposals are very ambitious, and are aimed at strengthening the existing undergraduate and postgraduate programmes,

introducing new programmes at these levels, and consolidating and augmenting research and development.

18. Almost all the IIT's proposals emphasize graduate teaching and research, a view that may not be sustained by the market and is further complicated by the absence of an articulated national strategy on the development of science and technology. Until the need for postgraduate programmes is clearly established and adequate funding is arranged, it may be prudent to focus on increasing the intake of undergraduate students, for which there is an unfulfilled demand, and which will increase revenues.
19. After analysing the Ninth Plan proposals of the IITs, this study recommends a project approach towards the Plan fund requirements for each of the three goals: the additional intake of undergraduate students in existing programmes; increasing students intake and augmenting postgraduate programmes; and modernising and strengthening research and development activities. The projects, which will be spread over a five-year period, will list the investment required to build the infrastructural facilities needed for these goals, and will be worked out in sufficient details to establish proper linkages between inputs and outputs and to allow a cost-benefit analysis. The projects will specify the additional infrastructural requirement annually, and the Plan funds and the resulting output over five years.

The Indian Institutes of Management

20. The IIMs at Calcutta, Bangalore and Ahmedabad have financial strengths, which can be enhanced through appropriate financial planning to make them self-sufficient in meeting their non-Plan expenditure by the end of the Ninth Plan.
21. The financial positions of IIM, Ahmedabad, and IIM, Calcutta, have improved after the implementation of the fee increases. Surpluses generated in the non-Plan budget have led to increases in an already large corpus of funds. Given their limited expenditure liabilities, their dependence on the government for non-Plan grants does not seem to be justified. By increasing student enrolment in existing and new courses, they can soon become self-sufficient in meeting their non-Plan expenditure. Their Plan grants should be utilised towards developing infrastructure to enable them to enrol additional students. Accordingly, this study recommends that the block grant amount be reduced over the

next four years and discontinued in the Tenth Plan period.

22. The study recommends that the institutes prepare plan proposals to double their student intake during the Plan period. The release of non-Plan grant each year should be conditional on concrete steps being taken in this direction. A Memoranda of Understanding could be prepared each year laying down the steps to be taken to achieve mutually accepted goals, and grants should be given only after evaluating the effectiveness of the measures taken towards achieving these objectives. The link between management of Plan and non-Plan expenditure currently does not exist. This link should be established with a view to not only achieve self-sufficiency in carrying out non-Plan expenditure but also build up corpus funds.
23. According to projections for 1997-98, the revenues of IIM, Ahmedabad, were expected to fully cover its expenditure. There would be a surplus, if block grants and force majeure amounts were included. Given the sizeable corpus fund, it should not be difficult for IIM, Ahmedabad on its own to meet its Plan expenditure in the Tenth Plan period.
24. During the Plan period, it may be worthwhile for IIM, Ahmedabad, to concentrate on two projects: the Management Development Programme in International Management, and strengthening its library and computer facilities.
25. During a visit to IIM, Bangalore, it was found that the institute planned to increase its student enrolment by introducing a part-time postgraduate diploma in Software Enterprise Management and by increasing enrolment in the postgraduate programme by 30 per cent. During an interaction with the Director and Dean of the Institute, it was found, however, that the project was in the conception stage and needed to be given a concrete shape. The projects have a lot of potential not only in meeting the emerging needs in the field of management in Bangalore, but also for generating sufficient funds to make IIM, Bangalore self-sufficient in meeting its non-Plan expenditure. The project required a Plan fund support of around Rs.9 crore to develop the necessary infrastructure, and was recommended to the Department of Education for funding (Annex II).
26. The practice of a matching government grant with the previous year's "savings" in IIM, Calcutta, which is in a comfortable financial position, needs to be reviewed. The "savings" have resulted primarily from receipts

under block grants, matching grants and force majeure payments, rather than an excess of revenue receipts over non-Plan expenditures. This report recommends that the force majeure payments and matching grants be replaced with a fixed block grant amount, which should be the only financing extended by the Ministry of Human Resource Development.

27. IIM, Calcutta would be financially independent if it doubles its student intake into its most lucrative programme, namely the Postgraduate Diploma in Business Management (PGDBM) course. This report recommends that a phased increase in student enrolment be made a pre-condition for the release of the Ministry's block grants from 1998-99 onwards.
28. Much of this increased enrolment in IIM, Calcutta, in the three-year evening programme for working professionals, leading to a PGDBM, would require a modest amount of new infrastructure and faculty. The Management Development Institute, which is running at full capacity, could be expanded with funds specifically earmarked for this programme. An allocation of Rs.1 crore in the Ninth Plan to modernise and enhance technological facilities would enable the institute to get more teaching aids and computing facilities, and gear up for the additional entrants.
29. IIM, Calcutta can become self-sufficient for meeting its revenue expenditure by increasing its intake of students in its postgraduate diploma courses by at least 33 per cent in the next four years. A Memoranda of Understanding should spell out the extent to which additional revenue should be generated under each of these activities.

The Indian Institutes of Science

30. The IIS, Bangalore's request for large amounts of Plan funds have not been accompanied by a detailed list of priority projects, thrust area of research, and teaching needs. Without these details, it is difficult to meticulously work out the minimum fund requirement. The reformulated Ninth Plan proposal gave priority to financial outlays on funding research in identified thrust areas, teaching needs, and strengthening supercomputer research and education. But the details needed to calculate the fund requirements in each of these areas for a five-year period are missing. Such calculations also have to take into account the funds that were made available in the past and are likely to be available in the future. At an early stage, the Government should indicate the likely amount that can be

made available to the IIS during a Plan period for these three areas, so that the IIS can prioritise its requirements appropriately.

Interim Interaction

31. Constant interaction with the senior officers of the Department of Education, and sharing the important findings with them have been a major feature of this study. For example, the case for establishing the 3-Year Part-Time Post Graduate Diploma in Software Enterprise Management at IIM, Bangalore was projected to Secretary, Department of Education in January, 1998, immediately after a visit to IIM, Bangalore (see letter enclosed at Annex – 1). It is understood that the Ministry of Human Resource Development subsequently approved this programme.
32. The Ministry of Human Resource Development also showed a good deal of responsiveness in the various suggestions made regarding upgradation of facilities in the IITs as the study was being carried out. In the context of increasing the student intake in the Ninth Plan, a copy of the letter written by the Secretary, Ministry of Human Resource Development to all the Directors of IIT's (Annex – II) attests the extent of interaction among the Department of Education, Senior Consultant, NIPFP, and the Directors of the various institutions covered by this study.

Conclusion

33. For assessing the efficacy of expenditure management at IITs, IIMs and the IIS, it is necessary to study the following:
 - The effectiveness of the programmes undertaken by these institutions;
 - The extent to which the infrastructure is optimally utilized, and whether a marginal addition to investment in specific areas could increase the efficiency of the institutions, and bring in significant additional revenues. Expenditure management cannot be de-linked from generation of additional revenue; and
 - The link between non-Plan expenditure and Plan expenditure;

Selecting programmes on the basis of market demand can help the institutions not only to meet the needs of emerging sectors, but also to make themselves financially sound.

34. Both Plan and non-Plan grants should be considered together. Self-sufficiency in meeting non-Plan expenditure and independence from non-Plan grants can be achieved by selective plan proposals and allocations. Plan components funded by the Government for a few more years should give a window of opportunity to bolster the corpus funds and be self-sufficient in meeting non-Plan expenditure.
35. The basic aim of expenditure management in IITs and IIMs should be the achievement of self-sufficiency in resource management in five years. Given the level of tuition fees, the size of the corpus funds already generated and the comparatively modest requirement of additional infrastructure, the IIM's can achieve self-sufficiency at a fairly fast pace.
36. The graduate-PG-research at IITs is neither attractive nor remunerative enough for the students, and results in a fall in quality. The management of IIT's agree with its conclusion. Industry is largely not interested in IIT, kind of research, and the nuts-and-bolts kind of research project does not interest the IIT, faculty. The position may deteriorate further with globalisation and import of a wide range of technologies. In this situation, the IITs can help in industry related research and development (R&D) by restricting the M.Tech programmes to only those who are sponsored by the end-users, with sponsors bearing the full cost of education. For energizing identified strategic research areas, and M. Tech can be followed by a Ph.D, if necessary. Ph.D programmes should comprise both research sponsored by industries and emerging areas of research. Considering the vast amount of resources invested in the IITs and the talents available, the gains to the nation from establishing proper linkages between the IITs, industry, and various other research laboratories and institutes should be considerable.

Cost of Education in IIT, Delhi

SUGGESTED GUIDELINES FOR COST RECOVERY

The Indian Institute of Technology, Delhi, was set up in 1963 to provide training and education at the B.Tech/M.Tech/M.Sc and Ph.D levels in engineering and applied sciences, including management. The institute also undertakes sponsored research, development work, and consultancy.

This section aims to estimate IIT, Delhi's average annual expenditure on each student and to recommend an appropriate fee structure for various courses. Costs are based on 1996-97 accounts and relate only to recurring expenditure. Much of the expenses incurred are not amenable to easy and exclusive identification as these expenditures benefit all programmes. It is, however, possible to estimate the approximate cost of education per student for different programmes by making some realistic assumptions.

Costs have been ascertained for five programmes: the undergraduate (B.Tech) dual degree, postgraduate (M.Tech), academic research (Ph.D), as also sponsored research and consultancy activities. There are 13 academic departments and 10 centres at IIT, Delhi, which has a student population of around 3,000. The total faculty strength spread over various departments and centres, is approximately 500.

ASSUMPTIONS AND ESTIMATES

1. The faculty spend an estimated 70 per cent of their time on teaching and 30 per cent on research and development work. This estimate is based on an internal study by IIT, Delhi to estimate per student costs in 1989-90, and supported by discussions with the Dean and Deputy Director. Based on this, 70 per cent of the expenditure on pay and allowances of the academic section (departments) faculty has been apportioned to teaching, and 30 per cent to research and development. Teaching costs have further been apportioned among undergraduate, postgraduate, and Ph.D students on the basis of a faculty ratio (explained below). Based on the same internal study, the faculty in nine centres spend approximately 30 per cent of their time teaching postgraduate and Ph.D students and the remaining 70 per cent on R&D work. On this basis, 70 per cent of the expenditure on pay and allowances of the faculty under the Institute Research Programme

(centres) and Centre for Studies in Resource Engineering is apportioned to research and the remaining 30 per cent to teaching. The latter (30 per cent) is redistributed among the postgraduate and Ph.D students on the basis of the faculty ratio. The departments and centres have staff to support their faculty members, and their pay and allowances are also apportioned on a similar basis as that of the faculties in the departments and centres.

2. Operational costs and the pay and allowances of the administrative section have been charged on the basis of the student ratio. The concept of "equivalent unit of students" has been adopted to bring full-time and part-time Ph.D and M.Tech students at par. The detailed assumptions are given below.
3. Expenditure on departmental conferences and seminars are incurred equally for postgraduate and Ph.D students only. Expenditure on consumables in the centres is assumed to be incurred for teaching and research on the basis of faculty work. Hence the faculty ratio is used to divide this expenditure among the various heads. Because of the support they provide to the faculty, the pay and allowances of the workshop staff has also been apportioned according to the faculty ratio. Based on the assumption that the library staff devote equal time to undergraduate, post-graduate, and Ph.D students, expenditure on their pay and allowances is also divided equally. Based on the assumption that the workload is determined by the number of students, the pay and allowances of the administrative and maintenance staff is apportioned to under-graduate, post-graduate, and Ph.D students on the basis of the student ratio. For the same reason, the pay and allowances of the hostel staff is divided on the basis of the hostel occupancy ratio. Scholarships are distributed among students on the basis of actuals. Expenses on physical education, NCC, and NSS are given to under-graduates only. Expenditure on conferences and seminars is allocated equally among post-graduate and Ph.D students.
4. The hospital caters to students and non-students, so half the hospital and medical expenditure has been apportioned to student support and the other half to miscellaneous expenditure.
5. **Student Ratio:** Part-time students use the facilities less than the regular students. To apportion costs, it has been assumed that one part-time student is equal to 0.4 regular students. The adjusted figures for student enrolment are given below:

STUDENT ENROLMENT

	<i>Regular</i>	<i>Part-time</i>	<i>Adjusted</i>
Undergraduates	1,356	0	1,356
Post-graduates	665	506	867
Ph.D	160	376	310

6. The **faculty ratio** is the ratio of the cost of teachers for different teaching programmes. Differences in cost of education among undergraduate, postgraduate and Ph.D students arise out of three major differences: (i) student enrolment in the different programmes; (ii) teacher-student ratios; and (iii) the fact that postgraduate work requires input from more senior faculty members than do the other courses.

The faculty ratio has been calculated based on: i) teacher-student ratio specified in the institute's manual, which is 1:8 for undergraduate courses, 1:4 for post-graduate courses, and 1:3 for Ph.D courses, and ii) the ratio of the salaries of a professor and assistant professor, which is 1.3:1.

Based on these, the faculty ratio is calculated as:

FACULTY RATIO

	<i>No. of Students</i>	<i>Teacher-Student Ratio</i>	<i>No. of Teachers Required as per Norm</i>
B.Tech	1,356	1:8	170
M.Tech	867	1:4	217
Ph.D	310	1:3	103

The difference in the distribution of faculty time between undergraduate, postgraduate, and Ph.D courses means that the composition of teachers would differ among the courses. An estimated 60 per cent of undergraduate and postgraduate teachers are assistant professors and the remaining are professors. In the Ph.D programme, 60 per cent of the teachers would have to be professors. This results in the following break-up:

FACULTY REQUIREMENT

	<i>Assistant Professors</i>	<i>Professors</i>
B.Tech	102	68
M.Tech	108	109
Ph.D	41	62

Using the ratio between the salaries of a Professor and an Assistant Professor, the faculty ratio is:

$$\text{B.Tech: M.Tech: Ph.D} = 102*1 + 68*1.3 : 108*1 + 109*1.3 : 141*1 + 62*1.3 = 190.4 : 249.7 : 121.6 = 0.34 : 0.44 : 0.22$$

7. Pay Ratio: The pay ratio is based on the sum of pay and allowances of the academic and administrative sections charged under different heads. It works out to undergraduate:postgraduate: Ph.D = 0.42 : 0.40 : 0.18.

8. Occupancy Ratio: The ratio of undergraduate, postgraduate and Ph.D students residing in the hostels of IIT, Delhi is 9.5 : 3.5 : 1.

9. Maintenance includes expenditure on the following items: stores, works and building, land and gardens, security, police and fire fighting, and sanitation. Miscellaneous expenditure includes expenditure on hospital and medical (50 per cent), kindergarten school, campus school, guest house, canteen subsidy, membership fees, and a central school.

Findings of the Study

- The main findings are given in Table 5. The total recurring expenditure of IIT, Delhi in 1996-97 was approximately Rs.40.47 crore, of which around Rs.15.23 crore was for undergraduate, Rs.13.89 crore for postgraduate, Rs.6.43 crore for Ph.D and Rs.4.92 crore for sponsored research and consultancy.
- The present study calculates the recurring annual cost per student in IIT, Delhi during 1996-97 as Rs.1,12,286, Rs.1,60,264 and Rs.2,07,528 for undergraduate, postgraduate, and Ph.D courses, respectively. Excluding the expenditures on hostel accommodation, student support and miscellaneous items, the educational cost per student for the respective courses was Rs.98,136, Rs.1,48,299 and Rs.1,96,151, respectively.

- If the Fifth Pay Commission recommendations increase the pay and allowances in IIT, Delhi by a conservative 25 per cent per annum, the study estimated that the educational cost per student would increase to Rs. 1.08 crore, Rs. 1.63 crore and Rs. 2.16 crore for undergraduate, postgraduate, and Ph.D students. respectively, in the same year, without taking into account the arrear payments.
- Table 6a gives the recurring educational cost at IIT, Delhi for 1996-97. This cost has been calculated for five degrees: B.Tech, Dual Degree, M.Sc, M.Tech, and Ph.D. It has been assumed that the postgraduate section of the Dual Degree occurs only in the fifth and final year of the programme and that, on an average, a student takes four years to complete a Ph.D. The educational cost, over the entire duration of the respective programmes, is approximately Rs.4.86 lakh for a B.Tech degree, Rs.7.07 lakh for the Dual Degree, Rs.3.39 lakh for M.Sc., Rs.2.5 lakh for M.Tech., and Rs.9.75 lakh for the Ph.D degree (case A).
- These costs are based on the assumption that costs escalate at the rate of 8 per cent over total expenditure (including pay and allowances revised at 25 per cent). The educational cost per degree has also been estimated -- in Case B -- by taking the pre-revised costs in 1996-97, and then increasing them by 12.8 per cent, each year. The cost figures in cases A and B are comparable.

Table 6b estimates the total recurring cost per degree for IIT, Delhi. This comes to around Rs.5.6 lakh for a B.Tech. degree, Rs.8 lakh for the dual degree, Rs.3.8 lakh for the M.Sc., Rs.2.7 lakh for M.Tech. and Rs.10.3 lakh for a Ph.D.

An important point that this study brings out is the high cost of the dual-degree programme compared to the B.Tech programme. The former seeks to give a B.Tech-M.Tech dual degree over five years and the additional recurring cost for this additional year of teaching is around Rs. 2.4 lakh per student. The dual degree programme requires careful consideration as the benefits of the additional expenditure may not be commensurate (*see appendix 1*).

This study also shows that a higher proportion of resources is spent on postgraduate programmes compared to undergraduate programme. While this is typically the case in most institutes, attention needs to be drawn to this as the IIT's M.Tech and Ph.D programmes are not as attractive as their undergraduate programme and usually do not attract top-calibre students, as was clear from discussions with IIT, faculty. These courses' relative unattractiveness is a result of

the course content and the absence of job opportunities to compensate for the time and effort spent in acquiring the additional qualification.

The IIT, Review Committee of 1986 observed that most employers prefer, and consequently pay a higher compensation to a B.Tech from an IIT, than to an M.Tech. "So these courses do not have any added market value and it is mostly a non-IIT, B.Tech wishing to have a degree from an IIT, who joins the graduate programme without any special aim or plan to serve any specific needs" (Para 4.3.1 of Review Report). These observations have not lost their validity. The IITs continue to stress the importance of postgraduate programmes for maintaining their standards of excellence, but are unable to attract excellent students for their courses.

The postgraduate emphasis of the IITs is reflected in their programme-wise expenditure pattern and in the faculty structure. Table 4 shows the change in faculty composition in IIT, Delhi over time.

FACULTY COMPOSITION IN IIT, DELHI

<i>Year</i>	<i>Professor</i>		<i>Assistant Professor</i>		<i>Lecturer</i>	
	S ¹	P ¹	S ¹	P ¹	S ¹	P ¹
1980 ²	74	88	172	159	153	86
1984 ²	159	117	205	169	96	85
1997	203+52(Associate Prof.)		111	11		

¹ S denotes sanctioned; P denotes in position.

² Figures taken from *IIT, Review Report*, 1986.

The faculty composition has become more top heavy, leading to higher cost for the M.Tech and Ph.D courses. It is, however, not possible to recover the same percentage of cost from postgraduate students as from undergraduates. Thus, postgraduate courses are most heavily subsidised, even though the programmes generally do not attract very good students. This anomaly has to be resolved by making the M.Tech programme more attractive and completely job-oriented. The Ph.D programme should concentrate on getting sponsored candidates, where sponsors bear the costs. The per student cost of the undergraduate programme should be brought down by doubling the intake of students in this programme. Some attempt has been made in this direction, but with inadequate enthusiasm.

Today the IITs are free to adopt the faculty composition they consider appropriate, but an increase in the number of postgraduate courses needed to justify the higher number of professors and associate professors. The trend shown in the table above would only lead to increasing costs of education per student and higher subsidisation per student, particularly at the post-graduate level. There should be a sanction for faculty strength category-wise instead of just overall limits.

The cost of research in IIT, Delhi during 1996-97 was around Rs. 5 crore, which is high in view of its limited effective national impact. The IIT, Review Committee (1986) observed that it was, "dishcartening to note that very few research projects are sponsored by industry (public or private sectors) although there are a number of industrial consultancy assignments". The IITs are not entirely responsible for this as there is a long ignovative chain and they can be "only the first link". The IITs success in research would depend on the strength of the other members in the chain of innovation, and would be enhanced if the industrial climate created a demand for capabilities such at those available at the IITs. There should be closer links with CSIR and DRDO laboratories on the one hand, and industries on the other.

Another reason for the high cost of education in IIT, Delhi is the large number of centres in the institute, which contribute little to teaching (and academic research), but have a high degree of expenditure every year. In our study, we have allocated 30 per cent of this expenditure to teaching, which is like an overhead on the departments and inflates the total cost of teaching, without giving adequate benefits in terms of additional number of students taught.

Centres in IIT, Delhi

A unique feature of IIT, Delhi is the proliferation of centres; no other IIT has as many centres as does IIT, Delhi, which has ten altogether:

- a) Centre for Applied Research in Electronics (CARE)
- b) Centre for Atmospheric Sciences (CAS)
- c) Centre for Biomedical Engineering (CBME)
- d) Computer Services Centre (CSC)
- e) Centre for Educational Technology (CET)
- f) Centre for Energy Studies (CES)
- g) Industrial Tribology, Machine Dynamics and Maintenance Engineering Centre (ITMMEC)
- h) Instrument Design and Development Centre (IDDC)

- i) Centre for Polymer Science and Engineering (CPSE)
- j) Centre for Rural Development and Technology (RDAT)

These centres, set up at different points of time to promote research and development — academic and sponsored, were expected to become self-supporting ‘centres of excellence.’ However, they have failed to live up to expectations and have, in fact, become a burden and financial drain on the system. Several points of conflict have arisen between the 13 departments and the centres:

- The centers’ faculty have far lesser teaching hours than those in the departments. At present, there are 140 faculty in the centres and 320 in the departments. According to an internal study in IIT, Delhi, the average teaching load per department faculty member for the academic session 1997-98 was almost twice that of a centre faculty member: department faculty earned an average of 11.2 credits for teaching compared to 5.9 credits earned by a centre faculty member. Some faculty members in the centres did not undertake any teaching for the whole of 1997-98.
- Neither have the faculty in the centres compensated for their lower teaching load by undertaking more academic research. The number of sponsored projects and consultancies conducted by faculty in these centres is also not substantially higher than their departmental counterparts. Further, the average number of project guidance per departmental faculty was 0.8 in the academic session 1997-98, compared to the average per centre faculty of 0.6. Given this, it is open to question as to whether the centres in IIT, Delhi are contributing in proportion to the expenditure incurred on them.
- Differences in appointments and promotions have also created problems among the faculty. There is an inherent inequity in the qualification requirements of departmental and centre faculty. While a non-Ph.D holder cannot become a departmental professor, there are center faculty members who are only B.Tech graduates and hold positions equivalent to professors. Promotional prospects in the centres and departments also differ: stagnating departmental faculty members who lack adequate qualifications have often been promoted to an appointment in a center.

The centres are not in tune with the identity of the institute as a teaching institution. Further, the academic and sponsored research done by them is not substantial. The centres have, thus, become an overhead cost on the departments and are inflating the cost of education. If the centres are separated from the IIT, the latter’s output would be barely affected but its expenditure would be

substantially reduced. It would be worthwhile to fund the centres separately and have their activities monitored. We would recommend that, as of now, the centres be asked to become financially self sufficient and pay their faculty and staff from the funding they receive from sponsored research and consultancy.

Cost of Education at IIT, Delhi: Comparison with IIT, Kanpur's Study

IIT, Kanpur's study to estimate the per student annual cost of education was based on the expenditure figures for the financial year 1995-96. It divided costs into direct costs and overheads, and apportioned the overhead cost into various categories. Our study followed a different method and apportioned cost on the basis of estimated time spent by faculty and staff on various courses, the number of students actually present and other assumptions. Despite the different methodologies used, the results from the two studies are similar.

The IIT, Kanpur study estimated that the total expenditure for 1995-96 which was allocated between different programmes was Rs.3,029 lakh, of which Rs.1,033 lakh was estimated to have been spent on undergraduate programmes and Rs.1,583 lakh on postgraduate programmes, M.Tech, and Ph.D; Rs.418 lakh was estimated to have been the amount spent for research (other than student research). The average estimated annual cost per undergraduate student was estimated to be Rs.84,600, per M.Tech student was at Rs.1,80,000 and per Ph.D student at Rs.24,000.

Our study of IIT, Delhi is based on the recurring expenditure for the financial year 1996-97. The total cost from the final accounts of the year is Rs.4,047 lakh as against IIT, Kanpur's total cost of Rs.3,029 lakh in 1995-96. Thus a total expenditure which has to be apportioned between four programmes *is around 33 per cent higher for IIT, Delhi, than for IIT, Kanpur* even though it is for the subsequent year (1998-99). If the average cost per undergraduate student in IIT, Kanpur is escalated by 33 per cent, the figure arrived at is of Rs.1,12,518. On the basis of the methodology for IIT, Delhi, the estimated cost per undergraduate student is Rs.1,12,286. These two figures are very close and increases confidence in the validity of the findings.

The amount allocated for research according to the IIT, Delhi study is around Rs.4.92 crore compared to Rs.4.18 crore estimated to have been spent for research in IIT, Kanpur. These are again very comparable figures considering that the total expenditure to be allocated is higher in IIT, Delhi.

For postgraduate programmes (both M.Tech and Ph.D), the Kanpur study arrived at a total cost of Rs.1,583 lakh. If this figure is escalated by 33 per cent, the total cost is Rs.2,105 lakh to be allocated between M.Tech and Ph.D programmes. The IIT, Delhi study arrives at a similar total cost figure of Rs.2,033 lakh. The cost per student would, however, vary for postgraduate programmes, since the number of students in these programmes varies between the two institutes. Overall, therefore, the results are quite close and comparable.

Limited Resources and Rising Cost of Higher Education

A large part of higher education will have to be justified on the ground of economic returns. Education is indeed an investment in human beings but as late V.M.Dandekar said, a distinction needs to be made between primary education and higher education. Primary education is investment in human beings "with emphasis on human beings."¹ Higher education is also investment in human beings but "with emphasis on investment". As investment "it must be judged by its economic returns" (*ibid*). In other words, the market must support it *vis-a-vis* other forms of investment.

This point needs to be kept in mind particularly in regard to the cost of postgraduate education in the IITs. The quality of M.Tech programmes has been adversely affected by the calibre of student intake, which in turn is a function of the limited market for M.Tech students. The IIT, Review Committee (1986) para 4.3.1 observed that these courses do not have any added market value, that mainly non-IIT, B.Techs who want an IIT, degree join the graduate programme without any special aim to serve any specific needs.

No steps have been taken since the recommendation of the IIT, Review Committee to rectify this situation and the M.Tech and Ph.D programmes continue to suffer. The issue needs to be addressed urgently given their relatively far higher annual student cost compared to the B. Tech. programme. With uncertain job prospect, it would be difficult to levy tuition fees based on the same percentage formula as in the B.Tech programme. The high government subsidy for such programmes cannot be supported for any length of time. There is, therefore, considerable force in the argument that M.Tech programmes should be restricted as far as possible to those who are sponsored by users who should bear the full costs of education.

¹V.M.Dandekar: *Reform of Higher Education, Economic and Political Weekly*, November 16, 1991

The M.Tech programme has to become research oriented. Strategic emerging areas of research need to be identified for which both M.Tech to be followed by Ph.D programme may be necessary. These areas could be identified by an apex body like the IIT, Council and, as recommended by the IIT. Review Committee, 1986, a separate budget may be set aside to promote the development of research in these areas. Thus one can make a distinction between two types of M.Tech programmes: one on the basis of sponsored candidates for relevant topics for users, and the other for emerging areas of research which can be subsidised by the government.

A similar distinction can be made for Ph.D courses, between strategic emerging areas of research and those which cannot be classified as such. The second category should be undertaken by sponsored candidates (para 4.4.1 of the IIT, Review Committee recommendations). To limit the per degree costs, sponsored research should be completed within two to three years, which should not be difficult as topics would probably have a practical orientation. Research in emerging areas can go up to four years.

In the undergraduate programme, the aim should be to gradually recover the entire cost from the tuition fees, which will require a phased approach. In the Ninth Plan period the aim should be to recover half the cost through a two-pronged approach: One, to reduce the cost of education by doubling student intake and two, to keep constant the faculty strength which already has a very favourable ratio.

It is also necessary to encourage more consultancy and sponsored research work so that 40 per cent of salary and supporting departmental costs are borne by sponsored research and consultancy work and 60 per cent of the cost is allocated to teaching instead of the current 70 per cent. By aiming at recovery of 2 per cent of the cost of education for B.Tech students, the annual fees per student is Rs.30,300. If the annual cost of education were reduced to around Rs.65,000-70,000 for a B.Tech student, a marginal increase over Rs.30,000 would make it possible to recover half the cost of education through tuition fees.

All students will not be able to bear the incremental cost irrespective of whether it is Rs.30,000 or Rs.35,000 per annum, and so there should be liberal provisions for bank loans for those enrolled in B.Tech courses. It has, however, to be kept in mind that a large percentage (up to 40 per cent) of IIT, B.Tech graduates settle abroad, and for this and other reasons there may be a problem recovering loans after a student graduates. IITs could enter into an agreement with

banks whereby the original degree certificate is given to students only when the loans are repaid.

Suggested Guidelines for Recovery of Cost

It is estimated that the per student cost of education in IIT, Delhi for the year 1996-97 was around Rs.98,000, Rs.1,48,000 and Rs.1,96,000 for undergraduate, postgraduate, and Ph.D students, respectively. Adding expenditure on hostel accommodation, student support and other miscellaneous items, the per student cost increases to Rs.1,12,000, Rs.1,60,000 and Rs.2,08,000, respectively. The annual recurring educational cost per degree – assuming that pay and allowances increased by 25 per cent over 1996-97 figures with the Pay Commission recommendation and that cost escalation takes place at the rate of 8 per cent per year – comes to about Rs.1,21,000 for the B.Tech., Rs.1,41,000 for the dual degree, Rs.1,69,000 for M.Sc., Rs.1,67,000 for M.Tech., and Rs.2,44,000 for the Ph.D degree.

In view of these high levels of expenditure, the need for the IITs to generate more income is being expressed for a long time. This is particularly relevant in the context of the relative emphasis on subsidising higher education and financing primary education in a country with high levels of illiteracy. The IIT, Review Committee (1986) had recommended that, "approximately a third of the operating cost (of IITs) should be met by their own generation. In relation to the cost of education in the IITs, the tuition and the academic fees charged is negligible." The Committee recommended that these fees should have a more reasonable relationship with the costs of an IIT, education.

In this context, the Review Committee on Revised Pattern of Funding Scheme (1997) noted that, "the present level of fees charged from IIT, students was abysmally low and barely covered 1 per cent of the actual cost of education but that as per a recent decision of the Council of IITs, the fees have been raised from 1997-98." The Committee felt that even after the proposed revision for 1997-98, the IITs needed to raise their fees further as it was highly desirable that students who are the major beneficiaries of the institutions should contribute about 25 per cent of the actual cost of their education. The Committee further recommended that the fee structure be periodically reviewed (say, every three years) so that the fee level is adjusted in consonance with the increase in the cost of education during this period."

Recovery Rates

Keeping in view the above we have tried to explore what the recovery rates should be per student in each of the five programmes (B.Tech, Dual Degree, M.Sc, M.Tech and Ph.D) under four scenarios (Table 6).

Scenario 1 has been computed on the basis of students paying 25 per cent of the expenditure on education incurred on them. In this case each B.Tech, Dual Degree, M.Sc, M.Tech and Ph.D student would have to pay approximately Rs.34,300, Rs.39,300, Rs.46,300, Rs.45,750 and Rs.64,900 per annum. *Scenario 2* visualises the students paying one-third of the educational expenditure. This leads to each B.Tech, Dual Degree, M.Sc, M.Tech and Ph.D student paying roughly Rs.44,400, Rs.51,100, Rs.60,400, Rs.59,700 and Rs.85,200 per annum, respectively. In *Scenario 3* the educational fees are kept equal for students in all three courses. If we assume that each student has to pay 33 per cent of the educational expenditure incurred on an undergraduate student, then the cost per student in all categories works out to about Rs.40,500 per annum.

For all the three scenarios we have said that the students should bear 50 per cent of expenditure on hostel pay and allowances (Rs.2,150 per student), full expenditure on hostel electricity charge (Rs.970 per student) and 20 per cent of expenditure on student support (Rs.840 per undergraduate student and Rs.837 per postgraduate and Ph.D student). Since they themselves are the sole consumers of the electricity used in the hostels, students can be asked to bear the full cost of this. However, as students do not recruit hostel staff, they can only be made to pay part of this expense. Student support is in the nature of welfare services and it is fit that the state should shoulder a major part of the burden. Miscellaneous expenditure is incurred for giving additional benefits to the staff and has no direct relation to students. Therefore, students need not bear any part of the miscellaneous expenditure.

Scenarios 1 and *2* are not feasible as they require postgraduate and Ph.D students to pay considerably more than undergraduate students, which may not be acceptable as the latter have a higher market value and the higher tuition fees would make the postgraduate programmes more unattractive. Furthermore, it may be argued that the postgraduate and undergraduate programmes generate considerable externalities in the field of domestic research and development and deserve some degree of cross-subsidisation. The same tuition fees may be charged for postgraduate students as from undergraduate students. This will make the percentage of total cost recovered from the postgraduate and Ph.D students less than that recovered from undergraduate students. *Scenario 3*, with these

modifications and as reported in Table 6, looks a more acceptable option than the other three. Recovery, as reported in *Scenario 4*, is somewhat high to be feasible.

Cost Effectiveness of Expenditure in the IITs

THE NEED TO RE-EVALUATE OBJECTIVES

This part of the study proposes to assess the cost effectiveness of educational expenditure in the Indian Institutes of Technology. Broadly speaking, effectiveness can be measured by the degree to which an organisation approximates to achieving its goals. Only through an evaluation of the extent to which an activity successfully achieves its goal is it possible to judge how effective that activity has been. Effectiveness of an educational institute is also measured by the quality of education imparted, but the criteria to judge quality are difficult to quantify. Evaluation of effectiveness in education is therefore, not an easy task.

The debate about the criteria for judging effectiveness may be much more about controlling the direction of the education system than about the best means of evaluating its performance. Although the quality of education and the direction in which the system is moving are both important in judging the cost effectiveness of expenditure in these institutions.

OBJECTIVES OF THE IITs

For any analysis relating to the effectiveness of activities conducted by institutes of excellence, one has to keep in view the objectives or goals for which these institutions were set up. In an attempt to check whether the objectives for the IITs have been formally listed, the *IIT Act, 1961*, was consulted.

The *Act* says that "whereas the objects of the institutions known as the Indian Institute of Technology, Bombay, the Indian Institute of Technology, Kanpur and the Indian Institute of Technology, Madras are such as to make them institutions of national importance, it is hereby declared that each such institution is an institution of national importance." it did not specify anything about objectives in the areas of education and research.

Declaring that an institution of national importance does not, by itself, hold one to understand its objectives, some help was found in the 'Foreword' to the Bill of IIT, signed by Humayun Kabir, the then Minister for Education, under the Statement of Objective and Reasons. In his opening statement relating to

objective and reasons in forwarding the Bill, Humayun Kabir said that "In order to provide facilities on an extensive scale for post-graduate courses, advanced work and research in the various branches of science, engineering, and technology, for which facilities in the country were inadequate, the Sarkar Committee recommended in 1945 that four institutions on the lines of the famous Massachusetts Institute of Technology, U.S.A, be established, one in each of the four regions of the country."

The foreword also stated that all the four institutions would provide first degree courses in addition to facilities for postgraduate studies and advanced research. This requires cooperation between work at the postgraduate level and the first degree level for the mutual benefit of both, and results in a fuller utilisation of the facilities in these institutions. One of the important tasks was also to meet the present and future needs of industry and technology.

From the tenor of Humayun Kabir's forwarding note one gets the impression that the accent was on postgraduate courses, advanced work and research, and that education at the undergraduate level was a secondary objective. Of course, to the extent that it meets the requirements of the present and future needs of industry and technology, teaching at the undergraduate level is justified, but the emphasis clearly was on postgraduate courses and research activity in science, technology, and engineering.

The Report of the N.R. Sarkar Committee (1948) discussing the scope and size of the proposed High Technical Institution had stated that, "It is felt that as a number of technical graduates far in excess of output of existing colleges would be required for post-war industrial and governmental projects, it is necessary to provide undergraduate instruction in the main branches of technology. Further in view of the fact that facilities for postgraduate study and research in engineering and technology are totally inadequate in this country, it is also necessary that these institutions should produce research workers and technical teachers." These high technical institutions were to be set up on regional basis. The Committee clearly placed more emphasis on the need to train a large number of technical graduates of a very high quality. One of its recommendations (no.21) also said that the proportion of undergraduate to postgraduate students should be 2:1.

Between 1948, when the N.R Sarkar Committee Report was submitted and 1961, when the IIT, Bill was introduced, there is a clear shift of emphasis from undergraduate training towards postgraduate courses and research.

The IITs in their plan documents and in other documents have clearly stated their aim to maintain the 1:1 ratio between postgraduate and research work on the one hand and undergraduate students on the other.

In their endeavour to conduct both postgraduate research work and undergraduate courses, the IITs have a very low teaching staff-student ratio. The Madan Committee norms prescribe a ratio of 1:10, but even this is low in comparison with developed countries. According to the Report of the High Powered Committee, "one aspect that should be taken into account is the desirability of using the services of postgraduate students as teaching assistants in return for the scholarship/assistantship given to them in postgraduate institutions, as is being done in developed countries. In the meantime, it should be possible to reduce the staff-students ratio in degree institutions from 1:10 to 1:15 and in diploma institutions from 1:11 to 1:20."

The conclusion is inescapable that the cost of undergraduate courses has become very high in IITs mainly because of trying to follow both the objectives.

M.TECH PROGRAMMES

One of the conclusions of the IIT, Review Committee (1986) was that M.Tech programmes are generally unable to attract high calibre students, and that this has affected the quality of postgraduate programmes in these institutes. "The limited market for those who get M.Tech training is both a cause and an effect of this vicious circle" (p. 22). Given that these observations are widely shared, it is difficult to understand why the IITs still insist on maintaining the 1:1 ratio between undergraduate and postgraduate students.

RESEARCH IN THE IITS

The IIT, Review Committee (1986) came to the conclusion that research conducted by the IITs did not appear to have an effective imprint on the national scene. Few of the research projects are sponsored by industry and consultancy is based on the resourcefulness of individual faculty members. It felt that "consultancy work should be awarded by industry to the IITs on an institutional basis rather than to individual faculty members....."(p. 26). The result is, as the Review Committee observed, industry now prefers to opt for international collaboration rather than look to the IITs to solve their problems. The malaise has gone deep and we have to look for ways to strengthen the linkage between IITs and industry.

NEED FOR A REVIEW OF OBJECTIVES

More than 36 years have passed since these institutes were set up, in fact IIT, Kharagpur was established 40 years ago. It has become important to review their objectives relating to postgraduate courses and research work *vis-a-vis* undergraduate courses for the following reasons:

- In trying to maintain its dual focus on postgraduate courses/research and undergraduate courses, the annual cost per student even at the undergraduate level has increased to an estimated Rs.1.10 lakh, which is very high. The amount recovered through tuition fees is much less. Thus the element of subsidy per undergraduate student is approximate Rs.1 lakh.
- The annual costs of other institutions like the Regional Engineering Colleges (RECs) and BITS, Pilani, which have since been established, are far lower at around Rs.30,000 per undergraduate student. A government notification dated December 18, 1997, setting up a committee for the intake of additional students at RECs observed that the, "per student cost of a REC graduate is fairly low compared to an Indian Institute of Technology (IIT)."
- The faculty structure of the IITs has become top heavy, with a large number at the professor and associate professor levels. This kind of pyramidal structure pushes up the cost of education for B.Tech students. It may be justified for conducting research and postgraduate courses but not otherwise.
- Most IIT, graduates do not opt for a career with industry; most of the technical manpower for domestic industry is provided by technical institutions other than the IITs. To quote from an approach paper of the Planning Committee: "Not many students graduating from the IITs and IIMs tend to take up a career with industry, at least at the initial stages: the majority prefer to take to higher education, go abroad or opt for an administrative and management career. Thus, the bulk of the technical manpower for our industry is provided by the so called 'other' institutions, and yet almost all of them perennially suffer from inadequate infrastructure (such as laboratories, libraries, and even classrooms), a shortage of qualified teachers, etc. For these colleges and universities, there has to be special effort and emphasis on interaction with industry, and focused regional/state-level linkage mechanisms will have to be set up."

A high-powered committee needs to be set up to analyse the objectives of the IITs in the present scenario, to deal with the emerging challenges of the twenty-first century. The new objectives will keep in the impact of globalisation and its effect on R&D, so that IITs are able to meaningfully contribute to the activities of domestic industry. The committee may *inter-alia* examine whether the IITs should leave undergraduate teaching to other institutes and concentrate on postgraduate courses and research work, as many other institutions of national importance, such as the IISc, IIMs and IRI, do.

The last comprehensive review of the IITs' goals was made by the IIT, Review Committee in 1986. On the undergraduate and postgraduate student population, the committee's view was: "Neither the Sarkar Committee nor the IIT Act laid down precisely the relative emphasis between undergraduate and postgraduate programmes. However, in 1974, based on the recommendations of the previous Review Committees, the visitors issued orders directing IITs to try to achieve a 1:1 ratio between the undergraduate and postgraduate student population". It is not entirely correct to say that Sarkar Committee did not bring out the relative emphasis between undergraduate and postgraduate programmes: paragraph 21 of the Report states that "the proportion of undergraduate to postgraduate students should be 2:1." Nothing can be more unambiguous than this statement regarding relative emphasis.

This is also what was expected since the Sarkar Committee clearly visualised that the demand for technical graduates in post-war industrial and government projects would be greater than the output of technical colleges. Creating facilities for postgraduate study and research in engineering and technology was given less emphasis as is evident from the statement following their reservations relating to the growing gap between demand and supply of technical graduates. It stated that, "Further, in view of the fact that facility for postgraduate study and research in Engineering and Technology are totally inadequate in this country, *it is also necessary that these institutions should produce research workers and technical teachers.*" From the statement it is clear that there was less stress on postgraduate study and research, and this was further emphasised by specifying the ratio of undergraduate to postgraduate students as 2:1.

The main aim was to establish close links between the requirements of industry and planning for technical education, as is evident from the committee's recommendation on the location of the IITs. Paragraph 8 of the report states, "It is considered to be of fundamental importance that a right relationship between the public, industry, and education should be established and maintained. For this

reason, the government felt that the proposed institutions should be so located as to be within easy reach of large industrial areas even though climatic condition may not altogether be favourable." They recommended that the institution in the east should be located as close to Calcutta as possible, within a radius of 20 miles and preferably on the Hooghly). For the same reasons, namely to meet the needs of industry and to establish clear linkages, the committee recommended that the institute in the west be located near Bombay, and the one in the north near Kanpur to cater to engineering requirements, in particular that of the CPWD.

The committee also clearly specified the basic undergraduate courses and approximate number of graduates annually in each discipline. This was an excellent attempt at educational planning linked to emerging technological challenges and growing industrial needs. The needs for specific cluster of industries were reflected in the basic undergraduate courses recommended; for example, aeronautical engineering and metrology were recommended in the eastern institution and not in the western institutions. For the western institutions textile technology, naval architecture, and marine engineering were recommended, which did not figure in the recommended courses for the eastern institutions.

Regarding postgraduate courses the committee stated, "the numbers in each subject cannot be fixed at this stage *though the total number should be roughly half the undergraduate enrolment.*" The 1:1 relationship between the undergraduate and postgraduate programmes was a subsequent development, the specific reasons for which are not known. Table 4.1.3 from the Review Committee report brings clearly illustrates this:

FACULTY COMPOSITION IN IIT, DELHI

Year	Professor		Assistant Professor		Lecturer	
	S ¹	P ¹	S ¹	P ¹	S ¹	P ¹
1980 ²	74	88	172	159	153	86
1984 ²	159	117	205	169	96	85
1997	203+52(Associate Prof.)		111		11	

¹ S denotes sanctioned; P denotes in position.

² Figures taken from *IIT, Review Report*, 1986.

The aim perceived by the IITs, as stated by the Review Committee 1986, was to produce a calibre of engineering professionals, unlike other institutions, who were engineer-scientists rather than engineer-managers. "This training of engineer-scientist belongs specially to the domain of the IITs. Engineer-scientists are expected to be mostly employed in research, design, and development and in teaching". In response to this, the committee stated that "the malady lies in the inability of Indian industry to absorb the type of engineers produced by the IITs in appropriate research, development, design or academic positions" (para 4.2.1.). This malady persists even today; the aim of producing engineer-scientists has not proved successful as there is no demand for them. Therefore, instead of questioning the IITs' goals in producing engineer-scientists the committee went on to state, "Nevertheless, the IITs should continue to produce manpower requirements of engineer-scientists through their B.Tech programmes as the Indian technological scene is repeatedly changing and will need such a product in the near future".

As regards programmes, the Review Committee observed, "M.Tech programmes are generally unable to attract students of better quality...the quality of post-graduate programmes in the IITs are adversely affected by the calibre of the present student intake. *The limited market for those who get M.Tech training is both a cause and effect of vicious circle. Most employers prefer and pay better an IIT, B.Tech graduate than an M.Tech. So these courses do not have any added market value and it is mostly a non-IIT, B.Tech wishing to have a degree from IIT, who joins the graduate programme without any special aim or plan to serve any specific need.* The stipend helps in buying time until he or she gets employment. Therefore, it is perhaps worthwhile to restrict M.Tech programmes as far as possible only to those who are sponsored by the user. It would be more meaningful and practical if dissertation topics for these programmes are undertaken and monitored jointly with the user-industry". The Review Committee felt that the only purpose served by the M.Tech programmes was to equip technical teachers with in-depth specialisation to enhance their teaching ability. It listed data for the period 1977-83 which showed that there was a high degree of wastage, as only 6,000 of the 11,000 available seats in the IITs postgraduate programmes were being utilised.

After such a severe indictment of the M.Tech programmes and its laudatory remarks on the B.Tech programmes' success in increasing the number of scientist-engineers, it is surprising that the Committee did not question the aim of a 1:1 ratio between undergraduate and postgraduate enrolment. Based on their view that M.Tech programmes should be confined to those sponsored by users, it would have been logical to increase this ratio. There is no mention of M.Tech

students' role in research except to quote approvingly from the recommendation of another committee that the postgraduate degree should be a mandatory minimum qualification for recruitment to many engineering positions in industry, R & D organisations, electricity boards, PWDs, post and telegraph and the railways.

It discusses at length the direction of research to be carried out by these institutions, recommending that research should be conducted by faculty members. Regarding strengthening of research activity it states "research work pursued by the IITs did not appear to have so far, an effective imprint, on the national scene." The report observes that very few of the research products were sponsored by industry although there were a number of industrial consultancy assignments. It cited the industry's ability to import turnkey products as a deterrent to encouraging organisations like IITs to conduct research to solve industrial problems. However, the IITs can at best offer only a research solution to some problems, beyond which there is a long innovative change starting from basic research to applied research in industry, enabling it to formulate prototypes, which then lead to production. The IITs can only be a first link in the innovation chain, and cannot be expected to set up pilot plans.

One, therefore, wonders how research activity can flourish in the IITs. If the research activities of the IITs are not very productive, if the M.Tech programmes are unable to attract the right kind of students and there are no proper employment opportunities for them, then has the time come to review the basic objectives of the IITs?

Indian Institute of Technology, Delhi

During the Ninth Plan period, Indian Institute of Technology (IIT) Delhi proposes to increase enrolment from its current 3,000 to 5,500 students, while keeping the undergraduate-postgraduate ratio at 1:1. It proposes to double the undergraduate intake to around 800 students at the JEE entry level. The Plan document states that, "This will be accomplished by increasing the intake in some of the existing disciplines and also by starting a few new programmes". The institute also proposes to introduce a five-year dual degree programme with a first degree in a main discipline followed by a postgraduate degree in a specialisation. This new programme will increase the number of M.Tech students by around 400 students. Additional M.Tech students will also be admitted in the existing and new M.Tech programmes.

In the B.Tech programme, over the next five years, the institute proposes to introduce a new course in Polymer Science and Engineering and dual-degree programmes in Engineering Analysis and Design, Civil Engineering, Business Administration, Instrument Technology and Design. In addition, 16 postgraduate programmes will also be initiated by the departments and centres of the IIT, Delhi.

This will involve substantial expenditure on modernisation teaching facilities, and creating additional teaching and hostel facilities. The institute has asked for approximately 100 faculty and additional housing facilities, in addition to library facilities, extra power, and water requirements, and additional administration. It has also asked for a second campus of about 100 acres with plans to ply buses frequently between the two campuses.

The Institute's Ninth Five Year Plan proposal asks for a sum of Rs.200 crore with a component of Rs.100 crore for the proposed enhancement of student intake. The financial requirements for increasing student enrolment over the next five years are as follows:

	<i>(In Rs .crores)</i>
• Upgradation of teaching equipment including computational facility	30
• New hostels	20
• Additional classrooms	2
• Faculty housing	10
• Library facilities	6
• Land for second campus	11
• Additional laboratory requirements for the department and administrative working	10
• Salary of additional faculty (100)	5
• Power and water	6
• Total	100

Clearly IIT, Delhi's Plan proposals are over ambitious and too expensive. In view of the present resource crunch the fund requirement has to be scaled down to feasible levels. During discussions with the Director and others, it was agreed that this study performs a detailed review of the plan proposals of the departments of Mechanical Engineering and Physics, which were among the largest departments with substantial plan projections, and were willing to increase student enrolment only with substantial additions to facilities.

An intensive interaction was carried out with these two departments over a period of five months involving visits to their laboratories and discussions with the heads of departments, faculty, and laboratory-in-charges. The departments were asked to rework on their plans based on the following objectives:

- to make marginal and essential augmentation to their infrastructure to allow them to double undergraduate enrolment;
- to phase the additions to infrastructure, requirements of Plan grants and additional enrolment of undergraduates over a period of five years. to clearly bring out the input-output linkages;
- to make only essential additions to infrastructure so as to restrict the Plan requirements to a feasible amount; and
- not to ask for new faculty, as the current student: teacher ratio is relatively low and needs to be increased.

MECHANICAL ENGINEERING DEPARTMENT

The Mechanical Engineering Department, which is the largest engineering department had initially prepared a Plan for Rs.9.65 crore for upgrading infrastructure, based on 2,830 sq.m of additional space. After our interactions, the Department Head re-evaluated the proposal based on the above objectives. The essential requirements for doubling undergraduate enrolment were identified and prioritised. The outcome was that the department decided to increase student enrolment in mechanical engineering and manufacturing science and engineering from 52 and 16 in 1995-96, and 68 and 29 in 1997-98, to 100 and 30 by the end of the Ninth Plan. They also scaled down their plan funds requirement to Rs.288.39 lakh over five years (1998-99 to 2002-03) with annual phasing of requirements and planned additions to infrastructure. In addition, they reduced their space requirement to 500 sq.m, which would require an additional sum of Rs.30 lakh.

The department's phased prioritised plan requirements are as follows:

<i>Year</i>	<i>(In Rs. lakhs)</i>				
	<i>1998-99</i>	<i>1999-2000</i>	<i>2000-01</i>	<i>2001-02</i>	<i>2002-03</i>
Phased grants	62.03	64.26	52.0	57.5	52.6
Total grant		288.39			

These annual requirements are based on the detailed action plan that the department prepared which identified, annual additions to laboratory equipment and consequently the number of additional students who could be taught in each course due to such investment. (The appendix contains the executive summary of the Ninth Plan proposal for grants to this department to enable an increase in undergraduate student intake.)

IIT, Delhi, presently has seven departments teaching eight undergraduate courses. Mechanical Engineering is the largest department teaching two undergraduate programmes — mechanical engineering and manufacturing science and engineering, with a combined intake of 97 students (1997-98). The undergraduate programmes in other engineering departments have around 60 students each. From the mechanical engineering department model it is clear that for each department of 60 B.Tech students, a sum of approximately Rs.2 crore is a reasonable amount for doubling the intake of undergraduate students in existing programmes. Thus the seven departments of the institute could prepare projects for doubling the intake of students in their existing undergraduate programmes over the next five years for a total of around Rs.15 crore.

This sum, however, does not include the amount required for additional classrooms and hostel facilities. Some support would also be needed for other departments in the sciences and humanities, which do not offer undergraduate engineering programmes but will be required to teach the additional students. Approximately Rs.5 crore may be earmarked for these additional requirements.

BASIC APPROACH

It has been seen that the IITs proposals for the Ninth Plan, which encompass different initiatives, are for more than Rs.200 crore each. These, *inter alia*, include strengthening of the existing undergraduate and postgraduate programmes, introduction of new programmes at these levels and consolidation and augmentation of research and development. For these initiatives some common activities like modernisation and upgradation of infrastructure, additional faculty, more faculty houses and students hostels, additional space for class rooms and laboratories, have been asked for.

In dealing with the Plan fund requirements the following approach has been suggested: Each IIT, could make one project for the additional intake of undergraduate students in existing programmes, another project for increasing intake and augmentating postgraduate programmes, and a third for modernising and strengthening R & D activities. Some of the infrastructure required for these

activities could be common and the overlapping infrastructure should be clearly taken into consideration to avoid multiple counting.

Preparing different projects for different initiatives has the advantage of :

- Enabling the IITs to Plan their activities and requirement in greater detail and this will cut unnecessary fat. Need identification and prioritisation mean that plans are more modest.
- Bringing out the input-output linkages better and facilitating better supervision and evaluation of the IITs.
- Enabling prioritisation among initiatives so that in a specific Plan period some initiatives can be given more funds than less important ones. Availability, at a later date, of additional funds would enable other projects to be given more funds.

The above approach was discussed with the Director of IIT, Delhi on February, 23, 1998 at a meeting where the Dean of postgraduate studies was also present. The Director agreed with the view that instead of a five-year plan proposal, plan allocation could be considered in the context of specific plan project. The Ministry of Human Resource Development gave priority to doubling the intake of undergraduate students; based on the detailed plans prepared by the Mechanical Engineering Department, it would be worthwhile to prepare similar plan projects for all the departments offering undergraduate courses during the Ninth Plan period and give these utmost priority.

A meeting has been arranged with all relevant faculty members at IIT, Delhi on March 6, 1998, to discuss the approach and the methodology to be adopted. The head of the mechanical engineering department would explain the methodology they adopted to prepare the project document. The institute Director also stated that some of the departments would like to adopt new programmes which have become relevant through emerging technologies. It was felt that new programmes could be introduced without additional infrastructure, since some of the old programmes would have to be dropped. He also expressed the need for a project to increase student enrolment in M.Tech programmes, to retain the undergraduate-postgraduate ratio, on which the character of the institute was based.

Any release of plan fund for IIT, Delhi during 1997-98 should give priority to the mechanical engineering department, as it has already prepared an

action plan for doubling its intake of undergraduate students. The amount sanctioned to the institute should have an amount earmarked for this department as plan funds for 1997-98, which could be adjusted against their requirement of Rs.62.03 lakh for 1998-99. From 1998-99 onwards plan funds might be released to the departments based on their action plans.

SUGGESTED PLAN OUTLAYS

Based on the priorities, the suggested plan outlays for the three projects for each IIT, should be:

- The project for doubling the intake of undergraduate students in existing programmes should be prepared for around Rs.20 crore, including additional facilities for classrooms and hostels. This should enable the IITs to admit about 1,250 more students in their undergraduate programmes.
- The project for increasing intake of students for augmentation of the postgraduate programmes should be prepared for around Rs.10 crore for the Ninth Plan period including laboratory and hostel facilities.
- The project for modernising and strengthening of R & D activities should be allocated Rs.10 crore.

The total Ninth Plan requirement for each IIT, will come to around Rs.40 crore.

RELEASE OF PLAN FUNDS DURING 1997-98

Based on the approach and recommendations on the basic structure of the plan projects, the release of the following funds is recommended. These amounts should be adjusted against the respective plan projects, which should be submitted in three months' time. Rs.2 crore may be released during 1997-98 for the project for doubling the intake of students in existing undergraduate programmes. Rs.1 crore each may be released for augmenting and increasing intake in M.Tech programmes and for modernising and upgrading R & D facilities.

IIT, Mumbai

The IITs and other institutions offering technical courses are at present faced with the challenge of meeting the escalating cost of salaries, materials, services, maintenance, library books and journals, replacement of instruments and equipment, upgrading and modernising facilities. At the same time, they have to

maintain the quality of their education. Along with this is the fact that the cost of education per student per annum of the IITs, even at the undergraduate level, is several times higher than the cost in other engineering colleges with a B.Tech programme. This is primarily because of the IITs' high operating costs. With the current government subsidy amounting to around 80 per cent of operating costs, it becomes imperative to improve the cost effectiveness of IIT, education.

According to one study conducted by IIT, Kanpur, the annual cost of education in 1995-96 for different levels of students were as follows:

- Undergraduate Rs. 85,000
- M.Tech Rs. 1,85,000
- Ph.D Rs. 2,40,000

With the escalation in costs in the last two years and the impact of the Pay Commission recommendations, per unit costs have approximately gone up by 30 per cent and as a result the annual cost per student has increased as follows:

- Undergraduate Rs. 1,10,500
- M.Tech Rs 2,40,500
- Ph.D Rs 3,12,000

These figures are probably not very different for IIT, Bombay.

In view of the high per student cost, increasing cost effectiveness can be achieved by increasing enrolment. Here, it may be worthwhile to note the recommendations of the Review Report on the Revised Pattern of Funding Scheme submitted to the government in February 1997:

"The Committee recommends that with a view to spread the fixed costs and optimise utilisation of resources, the student intake in the institutes may be increased. It is proposed that the intake may be doubled over the next 3-5 years with a view to optimally utilise the costly resources available at these institutes and to increase the output of quality manpower being spawned into the industrial sector. The increased intake should not only be in the existing areas offered by the institutes but should also cover newer initiatives in the emerging areas of technological, scientific and social importance to the country as well as tailor made programmes for industry using the distance mode of education" (Recommendation No.9).

The Report also states that the IIT, Directors "were of the unanimous opinion that the facilities of the IITs which had been developed at tremendous cost to the national exchequer were not being optimally utilised. They stressed that an increase in student intake was possible with *only marginal augmentation of facilities* and shall be seriously considered with a view to increase the base of quality manpower."

IIT, Bombay's Ninth Plan proposal has to be considered against these recommendations. It notes that the institute's emphasis during the Ninth Plan would be to consolidate what has been achieved and to reach out in several new directions. One area in which 'considerable growth' is planned, is in increasing student enrolment in stages from the present strength of 3,000 to approximately 5,000 by the end of the Ninth Plan period. Much of this additional intake would be for the five-year integrated M.Tech programme. In the three-semester M. Tech programme, the institute plans to start a number of new courses, many which are evening and weekend postgraduate diploma courses for working professionals.

If the future emphasis is on a five-year integrated M.Tech programme then the cost per student would further increase. The issue therefore, needs to be debated. A note on the subject has since been submitted to the Secretary of Education.

The plan projection of IIT, Bombay's Ninth Plan proposal is for a very large amount of Rs.219 crore. The institute received Rs.3.42 crore as plan grants in 1996-97. During the Eighth Plan period, total plan grants for IIT, Bombay probably did not exceed Rs.20 crore. During discussion with the Director of the institute on December 12, three points regarding this Plan proposal were emphasised upon:

- The Plan projection should be worked out with much more rigour so that the projected amount does not seem unreasonable when compared with the past trend. A very ambitious Plan may not receive serious consideration and would remain an exercise on paper.
- It could be preferable to present in a project format, the proposed plan expenditure on the induction of new students. This would enable the consideration of all the facilities that are required for increased enrolment in an integrated manner, and would facilitate cost-benefit analysis. If the cost of additional infrastructure for the project is kept to a minimum, the probability of getting approval would be high, and so would the certainty of flow of funds for the project during the remaining years of the plan.

- The Plan expenditure should be worked out annually as a phased programme for the remaining years of the Plan, so that the linkage between additional inputs (by way of additional infrastructure) and the output (in terms of induction of additional students) is clearly established.

The Plan proposals earmark Rs.65 crore for strengthening academic programmes. From the brief description in the Plan document, it appears that the amount is specifically intended to increase student enrolment. The estimate includes hostel accommodation for about 2,000 additional students (Rs.28 crore), additional space for the existing departments/centres (Rs.5 crore), faculty housing (Rs.10 crore) and a complex for the inter-disciplinary and thrust area programme (Rs.5 crore). A further Rs.15 crore is required for meeting the recurring expenditure on the salary component of 100 additional faculty members and additional assistantships during the Plan period.

Clearly this segment of the Ninth Plan proposals are for increasing student intake in IIT, Bombay. In this regard, it is important to keep in mind the following observations:

- An increase in faculty strength should to be proposed only where absolutely essential. The norm on staff/student ratios in the IITs is already higher than in other engineering colleges. Further, revised pay structures have raised the cost of hiring teachers. Unless economy is exercised in the induction of additional teachers, it would be impossible to achieve cost effectiveness in technical education in the IITs.
- Infrastructural costs have to be substantially reduced through reduced scales and other economy measures so that the amounts projected look reasonable.

STRATEGY FOR INCREASE IN STUDENT STRENGTH

IIT, Bombay' strategy for the Ninth Plan period is:

- Increase student strength by 2,000, from present 3,000 to 5,000 by the end of the Ninth Plan period.
- Much of the increase would be through a five-year integrated M.Tech programme, where both a B.Tech and M.Tech degree would be given at the end of five years, instead of awarding a B.Tech degree after four years as it currently does.

- Introduce a number of new specialisations in a three-semester M.Tech programme.
- Introduce a number of M.Tech-level evening and weekend courses for working professionals which will lead to a postgraduate diploma (DIIT) from the institute.
- Increase faculty strength by 100 to meet the needs of increased enrolment and the new programmes. The recurring expenditure on staff salaries and additional assistantships for M.Tech and Ph.D students is estimated to be Rs.15 crore over the Plan period.
- Plan for additional infrastructure to meet the needs of new students, such as hostel facilities, a lecture hall complex, faculty housing, is estimated to cost Rs.50 crore.

While executing this strategy it is important to keep the following considerations in mind:

- The kind of resource requirement projected in the institute's Ninth Plan document is not likely to be available for any IIT. The estimates have to be reduced substantially to merit serious consideration for Plan allocation.
- The institute has to think seriously about making the dual degree programme the main plank for expanding student enrolment. This strategy would entail a longer course period for students at considerable extra cost without commensurate benefits. It runs counter to the objective of reducing the cost of education for IIT, students, which was the aim of the proposal for doubling student enrolment. While the demand for B.Tech course remains unfulfilled in the IITs, they should aim at increasing enrolment in these courses, rather than offering a dual-degree course. The M.Tech degree, which would be a one year course, would be a whittled down version of the current M.Tech course spread over three semesters, and would lose its value as a degree. One can in fact make a case for two-year M.Tech courses, as IIT, Kanpur has.
- The institute's current very low student: faculty ratio should be improved upon to make it more cost effective.
- Introducing new courses would be costly and have to be thought of carefully, given the objective of reducing the cost. Where existing courses have ceased

to be relevant and need to be restricted, the same should always be done without additional faculty members or marginal addition of faculty members.

Given the above considerations, the following strategy is suggested for IIT, Bombay for increase student enrolment, upgrade its facilities and strengthen its research and development programme. The strategy would also be relevant for other IITs to prepare separate Plan projects for:

- Doubling the intake of students in existing undergraduate programmes;
- Increasing the student intake in M.Tech programmes; and
- Modernisation and strengthening research and development activities.
- The existing courses can be restructured, where required, only if it requires marginal augmentation of infrastructure and no new faculty. The maximum emphasis should be placed on offering M.Tech-level courses (leading to a DIIT) to working executives. As these would be offered in the evenings and on weekends they ought not to require much additional infrastructure. However, marginal additional infrastructure, if required for conducting such courses, should be funded, as these courses would increase resource generation and strengthen linkages with industry.
- Following the IIT, Delhi model, the projects should broadly be confined to the following amounts:

• Increasing undergraduate student enrolment	Rs 20 crore
• Augmenting M.Tech programmes	Rs 10 crore
• Modernisation and strengthening R & D.	Rs 10 crore
Total	Rs.40 crore

The amounts above are more suggestions for each project. Within the aggregate amount of Rs.40 crore, each project's actual requirement can be modified keeping in view the specific requirements of the institute, as the projects get prepared

These amounts are to be adjusted, against the respective Plan projects, which should be submitted in three months' time.

RELEASE OF PLAN AMOUNTS DURING 1997-98

Based on the structure of the Plan projects suggested above, release of the following funds is recommended. These amounts can be adjusted against the respective Plan projects, which should be submitted in three months' time.

Rs.2 crore may be released during 1997-98 for the project pertaining to doubling of undergraduate student enrolment. Rs.1 crore each may be released for augmenting and increasing M.Tech student enrolment for modernising and upgrading research and development facilities.

Indian Institute of Technology, Madras

IIT, Madras could follow the same approach as IIT, Bombay for preparation of the Plan projects. The release of the amounts against the projects in 1997-98 should also be the same.

Indian Institute of Technology, Kanpur

IIT, Kanpur submitted its Ninth Plan proposal to the Ministry of Human Resource Development in May 1996. The Plan has the following components:

	<i>(In Rs. crores)</i>	
	Non-recurring	Recurring
New programmes and strengthening of existing programmes	46.00	8.95
Modernization/upgrading existing facilities	45.00	
R & D - consolidation & augmentation	50.00	
Computing and networking	15.00	
Linkages	5.00	
Infrastructure	88.50	
Total	249.50	8.95

These figures do not include the normal recurring operational expenses of the institute.

ASSUMPTIONS AND STRATEGY

The Ninth Plan proposals are based on the assumption that "due to opening up of the economy concomitant with global competition" India will soon need a large pool of manpower, with a high-calibre, postgraduate education to manage various aspects of its industrial and social development. The institute anticipated that "there will be a quantum increase in the requirement for postgraduate engineers and scientists with the exponential widening of the technological horizons." Institutes like IIT, Kanpur are particularly well positioned to meet this challenge, and the institute has therefore decided to establish postgraduate programmes "in selected new areas of critical national needs rather than expansion in traditional disciplines." Undergraduate teaching is given less emphasis but the proposal states that this should also be expanded as a corollary to the development of postgraduate courses, to maintain a 1:1 ratio between the undergraduate and postgraduate student population. Intake will only be in identified areas of manpower shortage and in areas of strategic national need.

The institute's emphasis on postgraduate teaching and research may not be sustainable by the market, a situation which is further complicated by the absence of an articulated national strategy on the development of science and technology. Until the need for postgraduate programmes is clearly established and adequate funding is arranged, it may be prudent to increase the intake of students at the undergraduate level. After all, it is the IIT, graduates who have a ready market. An adequate emphasis on the undergraduate programme will enable the institute to generate more resources for its revenue expenditure. The Ninth Plan proposal of IIT, Kanpur states that an "increase in student strength in existing areas implies only a marginal increase in existing infrastructural facilities. Newer areas would, of course, need additional inputs." In view of paucity of resources the Ministry of Human Resource Development may consider asking IIT, Kanpur to prepare a Plan proposal for doubling the student strength at the undergraduate level and in existing areas, provided the total amount required does not exceed Rs.20 crore.

The Ninth Plan document for IIT, Kanpur proposes to undertake new initiatives in order to increase student enrolment at the undergraduate and postgraduate levels. At the undergraduate level, the institute proposed to take in 420 students in its current B.Tech programmes, 390 in new undergraduate programmes and 1,220 students at the postgraduate level, out of which 260 students would be added to the existing postgraduate programmes. For the expansion of current programmes and to introduce new programmes, the institute

has asked for a sum of Rs.126.25 crore as non-recurring funds and Rs.8.95 crore as recurring funds (for additional faculty, staff, journals and fellowships). In addition, it has asked for funds for other non-recurring requirements totalling Rs.123.25 crore.

The increase of 420 undergraduate students will be divided among the existing B. Tech courses in the following way:

• Computer Science and Engineering from the present level of 30 students per year to 60 students per year (30 x 4 years)	120
• Electrical Engineering from the current intake of 75 students per year to 120 students per year (45 x 4 years)	180
• Mechanical Engg. from the current intake of 60 students per year to 90 students year (30 x 4 years)	120
Total	420

IIT, Kanpur's initiatives during the Ninth Plan include introducing new programmes at the undergraduate and postgraduate levels, strengthening the existing undergraduate and postgraduate programmes, modernising existing facilities, consolidating and augmenting R & D facilities, etc. Each of these initiatives have different objectives and requirements, and should be planned as separate projects with Plan fund requirements stated separately.

Given the fund crunch in the Ninth Plan period the project for doubling student enrolment in the existing undergraduate courses should be given priority Plan funding. This is in line with the recommendations of the review committee for revised pattern of funding which noted the underutilisation of infrastructure and high cost of education in IITs and recommended a doubling of student intake. Separate projects should be made for augmenting student enrolment in postgraduate programmes and for modernising and strengthening R & D activities.

With these considerations, the following strategy is suggested for IIT, Kanpur to increase its student enrolment, upgrade its facilities and strengthen R & D. It should prepare separate Plan projects for:

- doubling student enrolment in existing undergraduate programmes;
- augment and increase student enrolment in M.Tech programmes; and

- modernise and strengthen its research and development activities.

Restructuring the existing courses can be undertaken, where required, if it involves only marginal augmentation of infrastructure, and no additional faculty.

The IIT, Kanpur Plan document also proposes to increase intake at the postgraduate level by 60 students by introducing new DIIT programmes in four areas with 15 students in each area. This postgraduate diploma programme would probably cater to sponsored part-time candidates. IIT, Kanpur could devise a project for this and a sum of Rs.1 crore could be sanctioned for the Ninth Plan period. Following the IIT, Delhi model, the amounts for each projects should be as follows:

• Increasing enrolment in undergraduate courses	20 crore
• Augmenting M.Tech programmes	10 crore
• Modernising and strengthening research and development	10 crore
Total	40 crore

The amounts specified above are suggestions for each project. Within the aggregate amount of Rs. 40 crore, each project's actual requirement can be modified keeping in view the specific requirements of the institute, as the projects get prepared to take off.

RELEASE OF PLAN AMOUNTS DURING 1997-98 FOR IIT, KANPUR

Based on the structure of the Plan projects suggested above, release of the following funds is recommended. These amounts can be adjusted against the respective Plan projects, which should be submitted in three months' time.

Rs.2 crore may be released during 1997-98 for the project for doubling undergraduate student enrolment. Rs.1 crore each may be released for augmenting and increasing M.Tech student enrolment for modernising and upgrading research and development facilities.

Indian Institute of Technology, Kharagpur

The Review Report on the Revised Pattern of Funding Scheme had said that the Directors at the IITs unanimously agreed that the facilities of the institutes

were not being optimally utilised. They also stressed that an increase in student enrolment would require only a marginal augmentation of facilities and should be seriously considered for increasing the base of quality manpower. Further, an increase in enrolment would decrease the cost of education per student, as the fixed cost would be spread over a larger number of students. The Review Committee concurred with the views of the IIT, Directors and suggested that attempts be made to double the student enrolment in the IITs over a period of three to five years.

Surprisingly, however, the Director, IIT, Kharagpur did not agree with this. In his view, the institute did not have substantial underutilised capacity that would allow student enrolment to be doubled with only a marginal augmentation in facilities. The institute has negligible infrastructure in the emerging technological areas and would not be able to take up new initiatives in these areas without a substantial build up in infrastructure. Even to expand intake in the existing areas, IIT, Kharagpur would require a proportional increase in hostel rooms, classrooms, library, and equipment, and some increase in faculty. His views on the subject more incorporated in the report to the Ministry of Human Resource Development.

The Ninth Plan proposal for IIT, Kharagpur adds up to Rs.205 crore with the following break up:

	<i>(In Rs. crores)</i>
New academic programmes in departments, Centres, and thrust areas	57.20
Modernisation and upgradation of existing facilities	40.50
Research and development	39.80
Computing network requirement	7.39
Linkages with international institutions	85.00
Infrastructural requirements	59.30

IIT, Kharagpur proposes to increase its student strength at the undergraduate, postgraduate, and doctoral levels by 3,000 students, although the break up of this number between the different levels has not been specified in the plan. It would be unrealistic to aim at doubling student enrolment at the postgraduate level without first analysing the demand for such courses, particularly as the demand for the Ph.D programme is falling. It would be preferable to aim at doubling student enrolment in the undergraduate courses, which currently has an unfulfilled demand.

In view of the limited resources that can be made available as plan grant during Ninth Plan period, the Ministry of Human Resource Development could suggest that IIT, Kharagpur prepare a separate project to double its student intake mainly at the undergraduate level and only in existing areas. Two other project proposals should be prepared, one for augmenting and increasing enrolment in postgraduate programmes and the other for modernising and research and development activities. These projects should clearly specify the additional infrastructural requirement every year, and the plan funds and the resulting output over five years. The common requirements of additional classrooms, hostels, computing facilities should be suitably apportioned among the above projects to avoid multiple counting. Based on the IIT, Delhi model the cost of the project to increase student enrolment in the existing undergraduate programmes should be approximately Rs.20 crore; the projects for strengthening the M.Tech programme and increasing intake and modernisation and augmentation of R&D activities should be Rs.10 crore each.

The amounts above are suggestions for each project. Within the aggregate amount of Rs.40 crore, the actual requirement of each project can be modified keeping in view the specific requirements of the institute, as the projects get prepared.

RELEASE OF PLAN AMOUNTS DURING 1997-98 FOR IIT, KHARAGPUR

Based on the structure of the plan projects suggested above, release of the following funds is recommended. These amounts can be adjusted against the respective plan projects, which should be submitted in three months time.

During 1997-98, Rs.2 crore can be released for the project of doubling student enrolment in the existing undergraduate programmes. Rs.1 crore each may be released for augmenting and increasing intake in M.Tech programmes and for modernising and upgrading research and development facilities.

FIXING THE NON-PLAN GRANT FOR THE INSTITUTES OF HIGHER EDUCATION

To determine the level of block grants, the Review Report on the Revised Pattern of Funding Scheme (1997) recommended two separate models, one for the Indian Institutes of Technology and the Indian Institute of Science and another for the Indian Institutes of Management. For the IITs and IISc the base level would be determined by deducting pensionary liabilities from actual expenditure for the

financial year 1992-93 and providing for an annual compound rate of growth of 8 per cent. For IIMs, the base level would be determined by deducting the pensionary liabilities from their respective grant in RE for financial year 1992-93, and providing for an annual compound growth rate of 8 per cent. Thereafter, in both the models, the average of the amount worked out for the years 1997-98 to 2001-02 was to serve as the base level for the annual block grant for each year of the Ninth Plan.

The Committee's other recommendations were:

- The entire pensionary liability should be fully and separately provided for by the government (which is the reason for deducting the pensionary liability from the 1992-93 base, as a 8 per cent growth rate could not accommodate the increase in pensionary liability); and
- The government should pay for all additional liabilities arising from implementation of the Fifth Pay Commission recommendation as well as those of other related pay committees.

The genesis of the above-mentioned formula was during a meeting with the Director of IIT, Delhi on August 8, 1996 (see Annexure 1; a copy of the minutes is enclosed). At the meeting the following points related to block grants were agreed upon:

- The non-Plan grant for the Ninth Plan should be based on the non-Plan grant for 1992-93, with a cumulative annual escalation factor of 8 per cent;
- The Ministry of Human Resource Development will bear all pension expenditures; it will also bear all arrears and additional expenditures resulting from the Fifth Pay Commission;
- The institutes can increase their tuition fees so that approximately 20 per cent of total expenditure is met from the revenue so collected;
- The institutes will endeavour to generate part of the resources through their own efforts for future developments.

It should be noted that at the meeting the proposed base for the IITs and the IIMs was the non-Plan grant for 1992-93 and not actual expenditure. In a subsequent meeting of the committee, however, it was decided to make a distinction between the IIMs, IITs and the IISc, and to make a base for IIMs, the

non-Plan grant in the RE of 1992-93, and for the IITs and IISc, the actual expenditure in 1992-93. The reasons for the distinction have been listed in the Review Report, but the main point emphasised was the relatively better financial position of the IIMs compared to the IITs, as they could increase fees which the IITs could not. Further, the IITs had a much higher expenditure on maintenance, modernisation, and continual updating of their experimental facilities.

However, for whatever reasons the block grant recommended by the Review Committee has not yet been approved by the government. The non-Plan grants for 1997-98 have consequentially been made on an *ad hoc* basis, resulting in a lot of financial uncertainty for the directors of all the institutes. This state of uncertainty about their financial position should be tackled speedily to allow planning.

In this context, two suggestions are relevant:

- If adopting different models for determining block grants is difficult, the same model could be adopted for both; in this case, the base level would be the actual non-Plan grant made in the revised budget estimate (minus the pension liability) for the financial year 1992-93, instead of actual expenditures (minus the pensionary liabilities). Pension liabilities and additional liabilities arising from implementation of the Fifth Pay Commission, etc., should be fully paid by the government;
- If there are other difficulties in arriving at a block grant amount because of lack of consensus on the formula to be adopted, then instead of a block grant amount, one can arrive at a formula for an annual non-Plan grant.
- If the Ministry of Finance accepts the 8 per cent formula as a reasonable escalation for funding, then, instead of a block grant, an annual cumulative increase of 8 per cent of actual expenditure in 1997-98, without pensionary liability, can be arrived at, for future years. The amounts calculated on this basis could be the amount of annual non-Plan grant to an institute; pensionary liability can be reimbursed separately.

If the institutes are aware of the amount they are likely to receive annually for the remaining period of the Ninth Plan, they would be able to plan for their expenditure and resource generation. What is required is some certainty about the amount of grant to be released each year. The release of *ad hoc* amounts as non-Plan grants only leads to lack of proper planning for expenditure control. Further, if institutes know in advance that the annual non-Plan grant will increase by only

8 per cent over the previous year, they would be better able to control their expenditure on pay and allowances also, as there is relentless pressure to increase faculty and non-faculty staff. Given the time that has lapsed, it may be advisable to switch from the block grant to an annual grant based on a pre-determined formula on the lines suggested above.

In the context of the three IIMs, given their financial position and role in the education system, it is not only desirable but essential that they become completely self-sufficient in meeting their non-Plan expenditure by the end of the Ninth Plan. They can achieve this through proper financial planning. Because of fee hikes, the financial position of the IIMs, particularly IIM, Ahmedabad and IIM, Calcutta, has become fairly comfortable. They have also accumulated a sufficient corpus of funds which will further increase because of the surplus generated in the non-Plan budget. Given the high tuition fees and their limited liabilities on expenditure, their dependence on the government for non-Plan grants for any length of time cannot be justified. It has also been recommended that they improve their resource position by introducing new courses and increasing student enrolment, for which plan grants could be made. Thus, the block grant amount should be reduced over the next four years and should cease totally in the Tenth Plan period.

Need for Memoranda of Understanding

Some institutes are not as inclined to increase internal resources by doubling their student intake. For the IIMs, this step alone would enable them to be self-sufficient in meeting their non-Plan expenditure.

The institutes should be persuaded to prepare feasible plan proposals to double their student intake in during the Ninth Plan period. The release of non-Plan grant each year should not be unconditional; memoranda of understanding should be prepared each year laying down the steps institutes plan to take to achieve mutually accepted goals. Subsequent grants should be made after evaluation of the effectiveness of the measures taken towards achievement of objectives. The link between plan expenditure and non-Plan expenditure currently does not exist, and should be laid down.

Consultancy

The institutes have not exploited consultancy as a source of revenue. Some consultancies have been conducted on the basis of links that individual faculty members establish with parties interested in consultancy, but this has several

drawbacks as reflected in the author's letter to the Director of IIT, Kharagpur. Instead, consultancy should be taken up on an institutional basis and annual targets for these should be specified.

Indian Institute of Management, Ahmedabad

According to the projections in the review report on the Revised Pattern of Funding Scheme, the Indian Institute of Management (IIM), IIM, Ahmedabad's projected expenditure in 1996-97 excluding the pension liability was Rs.1,296 lakh, which almost matched its projected revenue. Projected expenditure was Rs.1,308.13 lakh and projected revenue was Rs.1,296 lakh for 1996-97. Actual expenditure and receipt figures were still not available.

Although the institute was not visited, according to the projections for 1997-98 their revenue is expected to fully cover the expenditure. There may not, however, be a surplus on this account as pension and revised pay liabilities would have to be borne. But if the block grant and force majeure amounts are accounted for, there would be surplus and the institute could contribute a significant amount to its corpus fund, which is in a fairly good position. If it increases postgraduate student enrolment by 331 over the Ninth Plan period, it should be able to meet the additional liability on revised pay and pension, and still be financially self-sufficient in revenue expenditure, as by then it should have a sizeable corpus fund. (To increase its student intake by 33 per cent, IIM, Ahmedabad may need to submit a plan proposal not exceeding Rs.3 crore.) It should not be difficult for the institute to meet its plan expenditure in the Tenth Plan period.

The Ninth Plan projection for IIM, Ahmedabad is for Rs.30.6 crore with the following break up:

1.	Management development programmes in international management	=	Rs. 5.90 crore
2.	Library (including computers)	=	Rs.10.41 crore
3.	Postgraduate programme in public management	=	Rs. 6.04 crore
4.	Postgraduate programme activities	=	Rs.2.25 crore
5.	Information technology	=	Rs.4 crore
6.	Replacement of existing equipment, etc.	=	Rs. 2 crore
	Total	=	Rs.30.60 crore

Limited resources mean that this ambitious plan cannot be accommodated. As a matter of fact, the IIM, Ahmedabad would be better off even while concentrating on two projects:

- The management development programme in international management
- Strengthening the library and computer facilities.

The institute should finalise these two projects and submit them as soon as possible. Costs for these projects should be no more than Rs.7 crore. In 1997-98, Rs.1 crore should be released for strengthening the library and computer facilities.

Indian Institute of Management, Calcutta

A review of the financial performance of IIM, Calcutta between 1991-92 and 1995-96 reveals that it has substantially increased its revenue receipts, which have gone up by 445 per cent compared to non-Plan expenditure which has been allowed to increase by only 56 per cent during this period. As a result, in 1995-96 revenue receipts represented 100.51 per cent of non-Plan expenditure. In addition, the institute has generated a sizeable corpus fund, which has increased from a nominal amount in 1991-92 to approximately Rs.18 crore on March 31, 1996, and is now understood to be around Rs.33 crore. Table 1 provides a summary of the institute's financial performance for five years starting from 1991-92.

TABLE 1

	<i>(In Rs. lakhs)</i>				
	<i>1991-92</i>	<i>1992-93</i>	<i>1993-94</i>	<i>1994-95</i>	<i>1995-96</i>
Total non-plan expenditure	409.62	417.18	522.00	584.83	641.00
Total revenue receipts	118.42	140.85	285.61	432.66	642.92
Revenue as % of non-plan Expenditure	28.91	33.76	54.71	73.98	100.51
accumulation in corpus fund	39.10	58.48	262.90	583.50	1, ,219.32*

*excluding Rs.638.6 lakh matching grant, which is yet to be received from the Ministry of Human Resource Development.

Source: Dr.Subir Chowdhury's (former Director of the Institute) article in the first issue of the *IIMC Newsletter*.

Thus in 1995-96, the total earnings of IIM, Calcutta were more than the non-Plan expenditure and it could contribute the entire non-Plan grant of Rs.3 crore to the corpus fund.

Under the revised pattern of funding scheme, the Ministry of Human Resource Development is committed to giving a matching grant to the corpus fund against the amount of non-Plan grant saved and transferred to the corpus fund, and this has made the institute's financial position rather comfortable. Notably, during the period 1991-92 to 1995-96 there was a significant increase in IIM, Calcutta's student strength and tuition fees. A redeeming feature was that tuition and related fees from various courses formed around 57.4 per cent of the total non-Plan expenditure in 1996-97. In that year, the postgraduate diploma in management (PGDM) course alone accounted for Rs.309.61 lakh, which is higher than the block grant amount. If student enrolment continues to increase in the Ninth Plan period, IIM, Calcutta will be wholly self-sufficient in meeting its non-Plan expenditure by the end of the plan period. However, the institute is reluctant to expand enrolment on the grounds that it has expanded sufficiently and needs to consolidate. Further, there has been some difficulty in recruiting suitable faculty in the fields of marketing and finance.

However, consolidation does not seem to be tenable for the following reasons:

- It does not have much meaning in a dynamic context; either the institute expands its activities or it stagnates.
- Efforts are already on to recruit faculty members to fill vacant positions.
- Innovative measures could be explored to deal with the problems of finding suitable marketing and finance faculty. The institute did not find lack of appropriate faculty an obstacle during the period 1991-92 to 1995-96, when student strength was expanding. Further, other management institutes are expanding and proliferating, despite these difficulties.

From financial year 1995-96, the IIM,, Calcutta can reap dual benefits from the Ministry of Human Resource Development's non-Plan grant under the revised pattern of funding. The entire grant can be saved and transferred to the corpus fund as a saving and a matching grant for the same amount can be claimed the following year from the ministry. The financial position in 1996-97 (given in Table II) corroborates this position:

TABLE II

1996-97

(In Rs lakhs)

Total non-plan expenditure	Total revenue receipts	Revenue as % of non-plan	Contribution to corpus fund expenditure
698.35	774.53	110.9	613.45

The position in 1997-98(RE) is slightly different: the impact of the Fifth Pay Commission will raise non-Plan expenditure higher than revenue receipts. However, if the block grant and *force majeure* amounts likely to be received from the ministry are taken into account, there would be a projected surplus of Rs.355 lakh (RE) in 1997-98.

TABLE III

1997-98(RE)

(in Rs. lakhs)

Total non-plan expenditure	Total revenue	Revenue as % receipts	Surplus of non-plan expenditure
939.45	761.33	81.04	Receipts 761.33 +300.30(B.G) + 91.01(F.M) + 139.98(F.M.) + *1.60 <u>1294.22</u> Expenditure 939.45 surplus 354.77 or 355.00

*Government of West Bengal's share.

Based on the revised pattern of funding scheme, apart from the funding received under the block grant and force majeure, the institute also expects to get matching grants for savings, interest earned, and donations received. On this basis the IIM, Calcutta has projected the following requirements (RE) 1997-98:

	<i>(in Rs. lakh)</i>
Admissible amount as per revised pattern of funding	300.30
Matching grant for 1996-97	471.03
Matching grant for donation for 1996-97	50.41
Requirement under force majeure up to 1996-97	91.01
Requirement under force majeure for 1997-98	139.98
Matching grant for interest on endowment fund for 1994-97	201.45
Total requirement	1,254.18

If IIM, Calcutta receives all the grants and payments projected under force majeure in 1997-98, it could save not just Rs.355 lakh, but Rs.1,076 lakh. Continuing the revised pattern of funding scheme leads to a financial bonanza for the institute, where it is able to save more than its total annual non-Plan expenditure. It can put the entire surplus amount of Rs.10.76 crore into a corpus fund, call it a saving and claim a matching grant for the same amount in 1998-99, in addition to claiming amounts under the block grant and payments under force majeure.

Obviously, this pattern of funding is leading to a somewhat ridiculous situation and needs to be corrected. The very success of the scheme appears to have created a sense of complacency, with no urgency to take steps towards financial self-sufficiency and autonomy. Clearly, the package comprising the revised funding scheme with a block grant, matching grant, and force majeure payments is very attractive to institutes which can break even, such as the management institutes, and they would like to perpetuate the scheme. It is not difficult for them to save, as their revenue receipts are almost equal to non-Plan expenditure and the grant package allows them to transfer substantial amounts to the corpus fund and to claim a matching grant.

The revised pattern of funding scheme was begun to make the institutes self-sufficient in their operational expenditures by generating adequate receipts. To the extent that they have succeeded in doing so, the scheme has achieved its purpose. It need not be perpetuated, as it imposes a heavy burden on the exchequer.

Conclusions

- IIM, Calcutta's financial position is quite comfortable, even after allowing for the impact of the Fifth Pay Commission, if block grants are taken into account. The difference between non-Plan expenditures and revenue receipts was Rs.178.12 lakh (RE) in 1997-98, which is easily recovered by the block grant of Rs.300.3 lakh fixed under the revised pattern of funding scheme. This leaves Rs.122.18 lakh as savings which can be safely transferred to the corpus fund.
- The practice of a matching grant for the previous year's "savings" needs to be reviewed. Normally, savings are generated when revenue receipts are higher than revenue expenditures. In the case of IIM, Calcutta, the "savings" have resulted from receipts under the block grants, matching grants and force majeure payments, rather than from an excess of revenue receipts over non-Plan expenditures.
- Continuation of the scheme of matching grants and force majeure payments beyond 1997-98 may lead to an untenable position for the ministry because of the comparatively large payments, which would keep compounding. Instead of persisting with the force majeure and matching grant schemes, it may be preferable to fix a block grant amount which would be only financing what the institute would receive from the Ministry of Human Resource Development.
- The income profile shows that the PGDM course generates the highest revenue, estimated at Rs.3.09 crore (RE) for 1997-98 and Rs.3.48 crore (BE) for 1998-99. If student enrolment were doubled in this course, receipts would obviously double. This would allow the institute to cover whatever gap still remains between revenue receipts and non-Plan expenditure, and in addition enable it to generate a significant surplus, which could be transferred to the corpus fund. In sum, this will enable the IIM, Calcutta to be financially autonomous. The Ministry of Human Resource Development should insist on an increase in the student intake in phases as a pre-condition for the release of block grants from 1998-99 onwards.
- This calls for negotiation with the institute regarding the amount of block grants and conditions for release. One way to impel the institute to increase its student strength and institute other measures to increase revenue, could be to fix grants on a sliding scale. For the remaining years of the Ninth Plan, grants could be Rs.3 crore for the next two years and Rs.2 crore for the last two years. After negotiations on the grant amounts and conditions for their release, the institute can sign a memorandum of understanding.

The interest generated from the corpus fund is sizeable and growing. This should provide enough funds for the institute's infrastructural requirements during the Tenth Plan period.

The basic aim should be to make the IIMs – Calcutta, Bangalore and Ahmedabad – self-sufficient in meeting their non-Plan expenditure by the end of the Ninth Plan. The three IIMs should be persuaded to take steps to generate additional resources so that they become self-sufficient in the next few years. They should be asked to increase resources by raising their student enrolment, and by undertaking more short-term courses and consultancy work. For IIM, Calcutta, for example, there is a shortfall of Rs.1.78 crore (RE) 1997-98, if one excludes the block grant and force majeure amounts. This gap may increase to around Rs.2 crore by the end of the Ninth Plan unless steps are taken to generate more revenue through an increase in student enrolment, etc. IIM, Calcutta should be persuaded to generate an additional Rs.2 crore so that they go back to their position in 1995-96, when total non-Plan expenditure equalled total revenue receipts. Memoranda of understanding can be drawn up after they indicate the steps they Plan to take to generate this additional revenue before releasing the block grant. It has already been suggested earlier that the block grant amount also should be reduced gradually during the next four years, so that the institute is impelled to increase its non-Plan revenue, and this should apply to the other IIMs, in Ahmedabad and Bangalore.

Plan Proposals

IIM, Calcutta's Ninth Plan proposal is for Rs.37.90 crore. It has the following break up:

	<i>(In Rs. lakhs)</i>
Campus development	1,825.00
Modernisation & enhancement of technological facilities	530.00
Library	720.00
New faculty	320.00
Research centre, research project & publications	60.00
International & national conferences, seminars and special lectures	80.00
Faculty, officers and staff development	25.00
International collaboration and exchange programme	25.00
Restructuring of evening programme and other capital expenditure	205.00
Total	3,790.00

If the major component of the proposal for campus development which includes Rs.11 crore for an auditorium is excluded, the proposal would amount to approximately Rs.27 crore. The document containing the proposals, which was given to the author, did not contain much detail.

In examining the Plan proposals the following criteria may be adopted:

- The aim should be to make the institute self-sufficient in its operating expenditure as soon as possible; those investments which would enable them to do so, should be given priority.
- Proposals which would lead to an additional intake of students should be given priority.
- Proposals which could generate additional revenue should be given serious consideration.
- Expenditure which normally is classified as non-Plan should not be considered as part of the plan proposals.

As noted earlier, the Director and senior faculty of the institute were not keen to increase student enrolment in their PGDM and PGDCM courses, as the substantial increase in student intake in these courses in the last few years had already exerted pressure on faculty members and caused imbalances to develop in infrastructural support. The general consensus seems to be that IIM, Calcutta should first rectify the imbalances and upgrade facilities where required before expanding its student intake.

This is reflected in their Ninth Plan proposal document which says: "The focus of our efforts during the Ninth Plan period will be to consolidate the growth that has been achieved by undertaking serious efforts in modernizing, enhancing, and upgrading our facilities. The growth that was achieved earlier has also left a few gaps that will have to be filled to secure a proper balance in the expansion of physical assets of the institute."

There was, however, support for increasing enrolment in the three-year evening programme leading to a Postgraduate Diploma in Business Management (PGDBM). This course was launched in 1994, and upgraded the existing two-year evening Postgraduate Certificate Programme in General Management that had been offered since 1981. IIM, Calcutta is the only IIM which offers this course, which is equivalent to an MBA programme and has been recognised by the All India Council for Technical Education. Admission to this course is open only to working executives with excellent academic credentials, and at least two years' work experience. Demand is high for the course and the institute currently admits around 60 students per year. From the revised estimate for 1997-98, an

income of Rs.52.04 lakh is expected to be generated from this course, compared to Rs.309.61 lakh from the PGDM course and Rs.64.18 lakh from the PGDCM. Professor R. Ganguly, the programme co-ordinator, was quite hopeful that given the infrastructural support, they can succeed in doubling the intake of the students in this programme.

Students in the PGDBM programme are typically working people who attend classes after work, so teaching facilities have to be located not far from their offices. At present the institute's city office is in a popular business centre of Kolkata. The main constraint in expanding the programme is the limitation of space, however, this could be overcome by renting a new accommodation or, better still, by purchasing adequate floor area to accommodate about 120 students.

The PGDBM programme coordinator had indicated a floor area requirement of at least 5,000 sq. ft. The institute's Ninth Plan proposal also asks for Rs. 2.05 crore for "restructuring the evening programme and other capital expenditure," which may be agreed to. If needed, the IIM, Calcutta could recruit additional contractual faculty exclusively for this programme.

The institute's Plan proposal notes that the Management Development Institute centre in their campus is reaching capacity utilisation and that many programmes had to be turned down in the busy season for lack of available space. Rs. 1 crore may be provided during the Ninth Plan for expanding infrastructure specifically for the Management Development Programme, with the aim of doubling revenue received from this programme.

An allocation of Rs.1 crore in the Ninth Plan to modernise and enhance technological facilities would enable the institute to get more teaching aids and computing facilities.

Increase in student intake in PGDM courses

There has been a substantial increase in student enrolment in the PGDM course in the last few years. Student enrolment in the 1991-93 batch was 148 PGDM students, which increased to 263 students by the 1997-99 batch. The PGDCM course was introduced in 1994, and it earned Rs.309.61 lakh (RE) in 1997-98 against a total revenue of Rs.761.33 lakh. To become self-sufficient in its revenue expenditure, the institute will have to increase its intake of students in PGDM course by at least 33 per cent in the next four years, as proposed by IIM, Bangalore.

The PGDCM course generated Rs.64.18 lakh (RE) 1997-98. It will increase the intake of students by 33 per cent during the next four years. Similarly the PGDCM course should increase its intake by another 33 per cent during the next admission. In 1997-98 the revenue generated by the Management Development Programme was Rs.110 lakh (RE) and by consultancy and the in-company training programme was Rs.120 lakh. This programme should be strengthened with a view to doubling the revenue in the next four years. A memoranda of understanding should spell out the extent to which additional revenue should be generated under each of these activities.

If these strategies are followed, the institute would generate adequate amounts on the revenue account at the end of the Ninth Plan and there would be no need for a block grant from the Ministry of Human Resource Development during the Tenth Plan. As already suggested the block grant amount should be tapered off in the next four years in conformity with an increase in receipts from the resources mentioned above.

Release of plan funds during 1997-98

If the above approach is followed, a sum of Rs.1 crore may be released for IIM, Calcutta during 1997-98, which can be adjusted against the requirements for strengthening the PGDBM programme. The institute should be asked to prepare separate Plan projects within the suggested amounts for the Ninth Plan:

- additional infrastructure requirement of Rs.2 crore for the PGDBM programme with the goal of doubling student enrolment;
- additional infrastructure requirement costing Rs.1 crore, for strengthening the Management Development Programme with a view to doubling revenue over the next four years; and
- modernisation and enhancement of technological facilities limited to Rs.1 crore to upgrade the existing programme.

Indian institute of Management, Bangalore

NON-PLAN EXPENDITURE

An abstract of the revised estimates for 1997-98 shows that the IIM, Bangalore's non-Plan expenditure should be Rs.1,219 lakh, and receipts should be Rs.1,913 lakh. Receipts include Rs.1,132 lakh as government grants, which

comprise Rs.452 lakh as a block grant (against the review committee's recommendation of Rs.397.38 lakh), Rs.365 lakh as a force majeure grant and Rs.315 lakh as a matching grant, which means that government's own revenue is Rs.78 lakh (RE) for 1997-98. With expenditure expected to be around Rs.12.19 lakh, this will leave a deficit of Rs.438 lakh in the non-Plan budget.

This situation has to be averted by increasing the block grant amount and the balance under force majeure. Increasing the block grant to Rs.300 lakh would still leave Rs. 138 lakh uncovered. The institute has claimed Rs.365 lakh under force majeure clauses; if a minimum of Rs.138 lakh is released under the force majeure grant, the deficit would disappear.

Matching grants go into the endowment fund and should not be used to cover the deficit. The institute's financial position is fairly precarious, as is evident from the amount in its endowment fund, and this should be kept in mind when deciding on the block grant amount. On March 31, 1997 the amount in the institute's endowment fund was only Rs.9.35 crore, which is very low when compared with, say, IIM, Calcutta. The amount was expected to increase by Rs.2.80 crore in 1997-98 on the presumption that the institute would receive Rs.365 lakh under force majeure grant.

An analysis of receipts shows that IIM, Bangalore generated Rs.355 lakh from its postgraduate programme, around Rs.350 lakh from its executive development programme, Rs.250 lakh from consultancy and related activities were Rs.75 lakh in 1997-98.

The institute proposes to develop the intake of students by offering a three-year, part-time postgraduate diploma in software enterprise management and by increasing enrolment in the postgraduate programme from the current 180 to 240. This would allow it to double its receipts under the postgraduate programme by another Rs.3.5 crore. If the institute were to further strengthen its executive development programme, it could increase income by Rs.50 lakh to around Rs.3 crore by the end of the Ninth Plan, allowing it to generate an additional Rs.4 crore and breakeven on its revenue expenditure.

NEW INITIATIVES

The institute developed a plan scheme after a discussion with the author. The expert committee on the revised pattern of funding scheme in the IIMs had recommended that "with a view to spread the fixed costs and optimise utilization of resources, student intake in the institutes may be increased. It is proposed that

the intake may be doubled over the next 3-5 years with a view to optimally utilize the costly resources available at these institutes. The increased intake should not only be in the existing areas offered by the institutes but should also cover newer initiatives in emerging areas of technological, scientific and social importance to the country as well as tailor made programmes for the industry."

IIM, Bangalore proposed to take the initiative by offering postgraduate education in the emerging areas of information technology and, if possible, to increase enrolment in the postgraduate programme. The institute identified information technology is one of the thrust areas. With its experience in the postgraduate programme and its strong base in information systems management, IIM, Bangalore is ideally placed to provide assistance to the software industry in meeting its educational and training needs. This could help tackle the managerial problems that arise from the current practice of thrusting software engineers with few years of experience into managerial roles. IIM, Bangalore also has an additional locational advantage; Bangalore being a centre of the Indian software industry has a large number of software professionals who could attend a part-time postgraduate programme

IIM, Bangalore, therefore, proposes to introduce a three-year, part-time postgraduate diploma in Software Enterprise Management. Initial indications from the software industry are very encouraging in terms of sponsoring participants for the programme. The programme will be self sufficient in meeting working expenses including faculty time, and will also contribute to other activities. The additional faculty (approximately 11) recruited for this purpose can help in other activities such as expansion of the postgraduate programme.

The institute plans to initiate the programme in 1998-99 with an initial student enrolment of 60, which can be accommodated within the existing infrastructural facilities. Enrolment will increase to 120, accommodated in two sections, from the following year. This will require additional classrooms as follows: one 60-seater classroom in the first year, three in the second year and six from third year onwards. In the first year, the institute could provide one classroom by reducing the activity level in the Executive Development Programme. But, from second year onwards, the increase in enrolment will depend on the availability of additional classrooms, for which the institute has asked for separate funding from the Ministry of Human Resource Development. Since all the students enrolled in this programme will be day-scholars, there is no need to increase the capacity of the hostels.

The institute also proposes to increase enrolment in the postgraduate programme from the current 180 to 240 by adding one more section of 60 students by 2001. This, however, will require an increase in the hostel capacity, which is currently fully booked. Three new hostel blocks need to be constructed before the postgraduate programme can increase its intake of students.

The existing facilities at the computer centre just about meet the requirements of the current postgraduate students and level of EDP activity. The postgraduate diploma in Software Enterprise Management will be heavily dependent on computing facilities, and the proposed increase in postgraduate enrolment will put an additional pressure on these facilities. The institute has asked for separate funding from the Ministry of Human Resource Development to augment its computing facilities.

Through these two initiatives, the current student intake will double from the existing 180 to 360: 240 in the postgraduate programme and 120 in the Postgraduate Diploma in Software Enterprise Management, with a minimal increase in the infrastructural facilities. These initiatives will require an enhancement in the existing faculty resources, especially in areas such as marketing, finance and control, information technology. The addition to faculty resources will increase the pressure on other facilities such as housing, computing facilities, secretarial assistance, which need to be augmented in the next three years.

Indicative Cost for Infrastructure

	<i>(in Rs. lakh)</i>
6 classrooms (Rs.70 lakh per classroom)	420
3 hostel blocks (Rs.60 lakh per block)	180
Expansion of the computer centre	70
Additional computers (100 at Rs.60,000 each)	60
Total	730
Additional faculty (approximately 11 at Rs.4 lakh each)	
First year (4 faculty)	16
Second year (10 faculty)	40
Third year onwards (11 faculty)	44
Total for five years	188
Grant Total	918

Apart from the above plan scheme, the IIM, Bangalore may also be asked to submit proposals to strengthen its Executive Development Programme under the plan scheme through an increase in classrooms, hostel facility, guest room facilities, which should not exceed Rs.1 crore.

Preparation of plans and release of plan funds during 1997-98

IIMB should be asked to finalise the Plan projects:

- (a) Postgraduate Diploma in Software Enterprise Management Rs.9.18 crore
- (b) Strengthening of the Executive Development Programme Rs.1 crore

Rs.2 crore may be released towards the first project which should be submitted in the next one month. The second project should be finalised and sent as soon as possible.

Dual Degree Programme in IITs

A perusal of the Ninth Plan proposals of the different Indian Institutes of Technology (IITs) reveals that they have plans to introduce five year integrated B.Tech-M.Tech programmes in a big way. For example, the Ninth Five Year Plan proposal of IIT, Bombay says, "Keeping in mind that there is a heavy demand after the Joint Entrance Examination, the institute proposes to substantially increase its intake through the JEE. Much of this additional input would be through a 5-year integrated M.Tech programme, in which a B.Tech – M.Tech double degree is offered at the end of five years. In the course of time, it is expected that this integrated programme will be an attractive alternative to the present 4-year B.Tech programme. "Similarly the IIT, Kharagpur document titled 'Resource Requirements under Ninth Plan' states, "the present thinking is to have mainly integrated dual degree programmes within and even across the clusters so that any student during his five to five and half years of stay can get a B.Tech and an M.Tech in different fields (for example a B.Tech in Mechanical and an M.Tech in Industrial or Manufacturing or aerospace or Ocean Engineering)." The Ninth Five Year Plan proposals for modernisation and expansion of IIT, Delhi also says: "The institute proposes to introduce a 5-year dual degree programmes with a first degree in a specialization. This proposal has an important merit in the fact that high quality JEE entry students will be available for specialised M.Tech programmes. Such an important input will elevate the level of the M.Tech programme. Such an important input will elevate the level of the M.Tech programme." (italics added.)

However, since 1996-97, the IIT, Bombay has introduced dual degree programmes in the following manner:

Intake of students in dual degree programme of IIT, Bombay

Department	1996	1997
Chemical Engg.	16	16
Electrical Engg.	35	32
Mechanical Engg.	37	37
Met. Engg. & Material Sc.	-	24
Aerospace Engg	-	9
	88	118

Such a significant shift in teaching focus should be done after wide discussion and careful consideration of the various issues involved. The IITs already have five year integrated programmes in M.Sc. and M.Tech (Biotechnology) with substantial intake. Now, they want to introduce the 5-year programme in their main engineering courses also and this more needs to be deliberated upon. The IIT, Review Committee (1986) had mentioned, "Start has already been made in a couple of IITs in designing integrated M.Tech programmes. The quality of and response to such courses need to be carefully watched before expanding the programmes." We are not aware of any such systematic study having been made before deciding to expand the integrated programme into the engineering disciplines as well.

Design of the dual degree course: IIT, Bombay is already offering the dual degree programme from the academic year 1996. The preamble to their dual degree document states that. "The curriculum includes practically all the course work required for the B.Tech programme, selected courses in the area of specialisation and intensive M.Tech project work spread over one full year. Students admitted to 4-years B.Tech programme and 5-year dual degree programme have one year of common course work." After successful completion of the 5-year programme students will be awarded a dual degree i.e. a B.Tech (discipline) and M.Tech (discipline with specialisation).

To judge the relevance of this dual degree programme we have to look back at the basic philosophy of setting up the IITs. Reading of the relevant report shows that this programme does not fulfill the basic objective. The N.R. Sarkar Committee (1948), which was the basis for setting up the IIT's first at Kharagpur and subsequently elsewhere in the 1960s, visualised the need for setting up these 'Higher Technical Institutes' basically to meet the needs of Indian industry and secondly for pursuing research. The committee in its report said, "It is felt that as a number of technical graduates far in excess of the output of the existing colleges would be required for post-war industrial and government projects, it is necessary to provide under-graduate instruction in the main branches of technology. Further, in view of the fact that facilities for post-graduate study and research in engineering and technology are totally inadequate in this country, it is also necessary that these institutions should produce research workers and technical teachers".

Over the years the IITs have come to be known primarily for their B.Tech programme. The best of the students come to IITs for undergraduate courses and the postgraduate programme is less attractive. But as the IIT, Review Committee

(1986) said, “the logic of the IIT, system derives from its involvement in PG and research work and manpower training to keep pace with technological growth.”

Probably the dual B.Tech and M.Tech programme seeks to address the above problem. But before such a systematic change is introduced it should be discussed as to whether the 5 year M.Tech students would be more relevant for Indian industry than the 4 year B.Tech students. Specially, the following issues should be deliberated upon.

- (a) If the present arrangement is totally replaced by the dual degree programme then it will change the basic character of the IITs into predominantly PG institutes. Currently, the IITs offer both UG and PG degrees and are renowned for the former. If the IITs stop producing B.Tech students then it will be deleting from its product range the best-seller. After all, Indian industry does need graduate engineers of top quality; this is vindicated by the fact that IIT, B.Tech students are in great demand in industry.
- (b) The Indian industry, lacking as it does a proper R & D set-up, demands more general engineer-managers than specialised engineer-scientists. This is because a general B.Tech student can be moulded to suit the specific industry requirement. An M.Tech student, who has already specialised, may not be as adaptable as his B.Tech counterpart. The Swaminathan Committee report (1994) noted that: “There is also a feeling in some quarters that too many postgraduates and Ph.Ds are being produced. The high dropout rate and the lack of enthusiasm on the part of most industries to hire postgraduates in engineering appear to indicate that the large investment of the government in postgraduate education may not be fully justified.” The IIT, Review Committee (1986) also states, “Most employers prefer and pay better an IIT, B.Tech graduate than an M.Tech.” So from a social cost-benefit point of view this extra investment of one year per student for the dual degree students is not called for.

The above point of overspecialisation has been very aptly put forward by Prof. Vijay Gupta of IIT, Kanpur in an article in “The Indian Journal of Technical Education” (Vol.18, No.4; Oct.-Dec. 1995). Prof. Gupta quoting Beeckmans says, “the fundamental purpose of an undergraduate programme should not be to train engineers but rather to produce broadly-educated trainees who will subsequently become engineers through a lengthy apprenticeship in a specific industry, involving on-the-job training and experience, company courses, and self-instruction.” Such generalised

training at the UG level is strategically desirable in a situation where rapid changes in technology makes future prediction of skill requirement difficult and implies that an engineer has to do jobs of different nature over his career. The B.Tech programme should therefore, be broad-based and should concentrate in teaching students the “engineering method, rather than the engineering content”. Specialisation should be introduced only at the PG level.

- (c) If at all the B.Tech programme has to be modified and made of five years duration then the increased time should be utilised to give on-the-job training to the students. The IIT, Synergy Sub-Group (1995) in fact recommended that, “the B.Tech programme should be extended to 5-years with the student spending the final year as an ‘intern’ in industry. This internship should form an integral part of the curricula and should be planned, implemented, and evaluated in conjunction with industry. This would have several advantages. For the student, it would provide ‘hands on’ experience in production planning manufacturing methods and QC procedures. For the industry, it would provide infusion of new ideas at minimal cost, with no commitment for continued employment. For the IITs, it would provide an additional source of revenue.”

Instead of spending another year to get an M.Tech degree, a B.Tech degree, along with an year of internship in industry, would make the student more relevant for industry.

- (d) Moving over to the dual B.Tech and M.Tech programme will mean that the state will have to compulsorily subsidise the education of an IIT, student for an additional year. As per a study by IIT, Kanpur, M.Tech programme per annum costs Rs.1.85 lakh per student (as on 1995-96) as against Rs.85,000 per B.Tech student. Today, because of escalation in cost during the last two years and the revised pay package, the cost per M.Tech student per annum may be in the range of Rs.2.20 lakh. Subsidy per student would then be around Rs.2 lakh per annum and additional hundred students under M.Tech programme would mean Rs.2 crore cost per annum for an institute. Why should the state bear this extra cost? What benefit does the society get in return? This issue becomes relevant as we are increasing the span of teaching and with it the amount of subsidy given per student, as he has to have a five-year integrated course instead of a four year B.Tech course.

- (e) If most of the combined M.Tech students after passing out take up jobs which currently the IIT, B.Techs are doing, then it would mean that additional expenditure for one year on each student would go waste. As it is, most of the IIT, graduates are not too willing to pursue a career with Indian industry which has to depend more on non-IIT, engineers to carry on its work. This is borne out by an Approach Paper of the Standing Committee on Industry-Institute Interaction constituted by the Planning Commission (May, 1996) which says, "Not many students graduating from the IITs and IIMs tend to take up a career with industry, at least in the initial stages; majority prefer to take to higher education, go abroad, or opt for administrative and management career. Thus the bulk of the technical manpower for our industry are provided by the so called 'other' institutions, and yet almost all of them perennially suffer from inadequate infrastructure (such as laboratories, libraries, and even classroom), shortage of qualified teachers etc."
- (f) A total shift to the dual degree programme would probably mean that engineering graduates from other engineering colleges would not be able to enter the IIT, system at a stage and get a chance to prove their excellence.

The point in favour of the dual programme appears to be that it would enable IITs to get brighter students for M.Tech and in adequate number which they are not able to get now. A student joining M.Tech is mentally inclined to go in for Ph.D. But a student coming through a dual degree programme would most probably not be inclined to go in for a research career.