

CHAPTER FIFTEEN

**EXPANSION WITHIN THE COUNTRY
AND OPENING CAMPUSES ABROAD**

*“Cultural background surely
plays a part in shaping identity;
but it does not determine identity”*

*Maxine Greene
(1918 -)*

CHAPTER FIFTEEN

EXPANSION WITHIN THE COUNTRY AND OPENING CAMPUSES ABROAD

It is widely accepted that IITs are the most sought after destination for students aspiring to get into higher education in engineering. It is also evident that countries outside India have expressed interest in deriving the benefit of IIT-like education for their students. Consequently, the two issues which have assumed much importance at the present time are: (1) the expansion of the undergraduate intake in the IITs in India and (2) IITs operating campuses abroad. These issues are discussed in this chapter.

15.1 THE NEED

Several distinguished IIT watchers have advocated large expansion of the undergraduate intake. Their arguments commonly run as follows:

1. IITs have developed into the most outstanding set of institutions for engineering undergraduate education in the country. The public perception is that none of the others in the group of 1200 or more engineering colleges is even close to the IIT calibre. (It may be noted that admissions to IT BHU are made through JEE for nearly three decades now). Most of the 10+2 students would therefore like to have IIT education.
2. Nearly 1.8 lakh students appear at the Joint Entrance Examination (JEE). Among them, about 10,000-11,000 students deserve IIT education because it is only for those whose ranks are lower than this that there is a big drop in performance.
3. Unless the quality of undergraduate education is high, it is not possible to supply the engineering institutions, including the best of them like the IITs, with quality intake for the post-graduate and research programmes.
4. The number of students taken in by the IITs, which is around 3500 every year is 1% of the total undergraduate intake in engineering colleges. This has to be compared with the 40% of the total engineering intake that gets into the 50 top institutes in USA.
5. India is a nation of more than 1 billion people. And the number of youngsters coming out of Higher Secondary Schools (HSS) and Junior Colleges (JCs) exceeds 10 million. Out of this, the country should be in a position to turn out atleast 40,000-50,000 engineering graduates of the IIT quality, i.e. about 15-20% of the total engineering B.Tech.s that the country produces annually.
6. Going up the educational ladder, the number of Ph.D.s in engineering that India generates per year, which is around 750, cannot be accepted as satisfactory.

What emerges is that while the base is vast and enlarging, we are not doing well in terms of scale as we move up to higher levels of quality higher technical education.

15.2 PERTINENT STATISTICS

Let us have a relook at some of the pertinent statistics. The seven IITs together have produced in the year 2002-03 about 2275 B.Tech.s, 3675 M.Tech.s and about 445 Ph.D.s. Presently on rolls are 11,700 undergraduates (all 4 years), 9500 Post-graduates (all categories and all years) and about 3800 Ph.D. scholars. With a total faculty strength of 2375, the teacher to student (on rolls) ratio works out to 1:10, which is about the optimum for a good institution.

The students on rolls in the individual IITs is shown in Figure 15.1. IITB has the highest number of students, while IITG has the lowest number of students on rolls. Among the older IITs, the difference between IITK and IITB is notable (IITK has 3557 students compared to IITB with 4600 students). The scope for expansion in absolute terms is highest in IITG, IITK and IITR.

During the last 3 years, as has been pointed out in Chapter 8, the growth in the intake of Post-Graduate (22%) and Ph.D. students (49%) has been significantly larger than the growth in the undergraduate intake (less than 1%). In this context, IITB has the highest PG+Ph.D.: UG ratio (1.5) while IITG has the lowest (0.5). Among the older IITs, IITKGP has the lowest PG+Ph.D.: UG ratio (0.72).

We have commented earlier in Chapter 8 about the likely disparity in quality of the students admitted to the B.Tech., M.Tech. and Ph.D. programmes in view of the significant differences in selectivity among them. Also, the effect that larger population of PG and Ph.D. students in the campus may have on the general student climate is to be kept in view.

However, IITs have preferred to increase the PG intake. Three possible explanations for this are: a) Expansion of UG is constrained due to shortage of physical infrastructure and faculty, b) increase in PG:UG ratio improves faculty research output and c) Additional funds became available. However, further increase in PG:UG ratio may erode the IIT brand unless special attention is paid to enhance the quality of PG and Ph.D. intake. (This issue has been discussed at length in Chapter 8)

A look at the placement statistics across IITs points to an interesting trend. IITs with higher throughput had a greater difference between UG and PG placement (see Figure 8.6) (this interpretation is subject to revision when more complete data on placement become available).

A more realistic comparison of faculty output is provided in Figure 15.2. More students per faculty (especially PG and Ph.D.) may be contributing to higher number of publications. However, there is higher disparity at higher levels of workload arising from a larger number of students on rolls. Among the five older IITs, there may actually be a trend of decline in faculty research output with increase in student strength per faculty. (This interpretation is subject to error on account of data being limited).

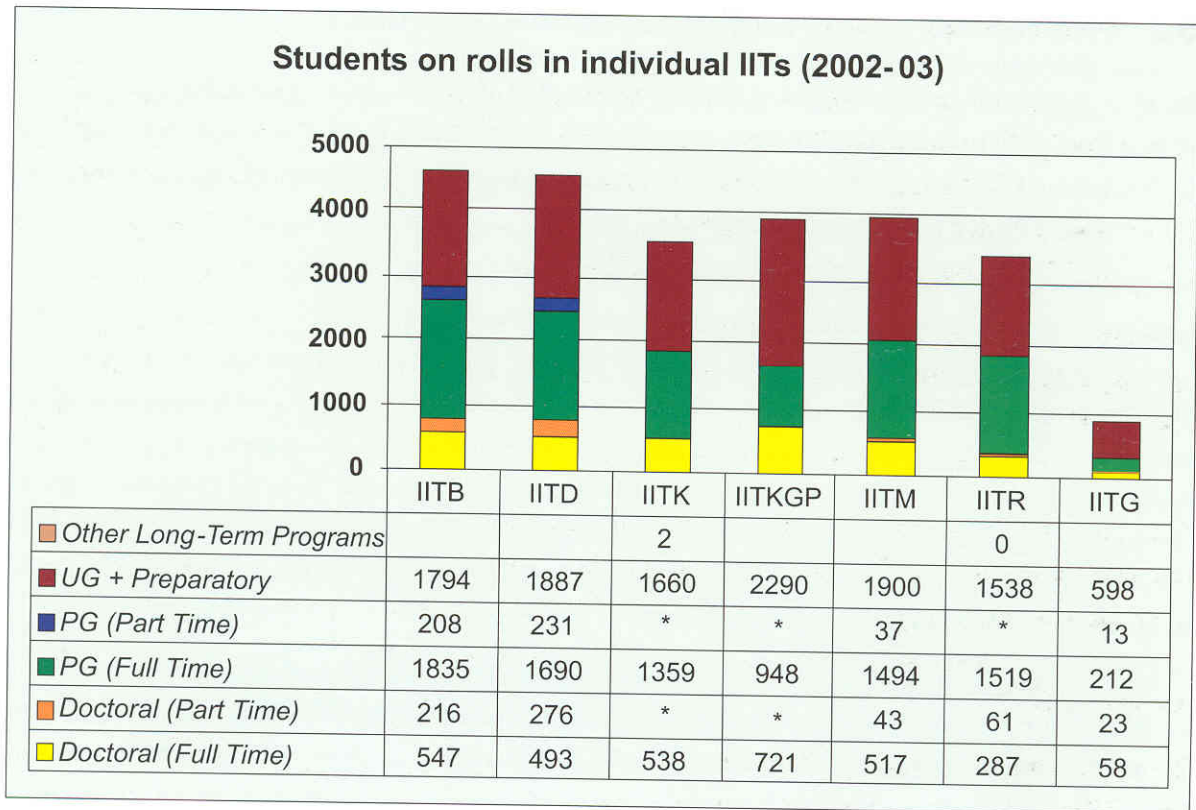


Figure 15.1: Students on rolls in individual IITs (2002-03) (* Data not separately given)

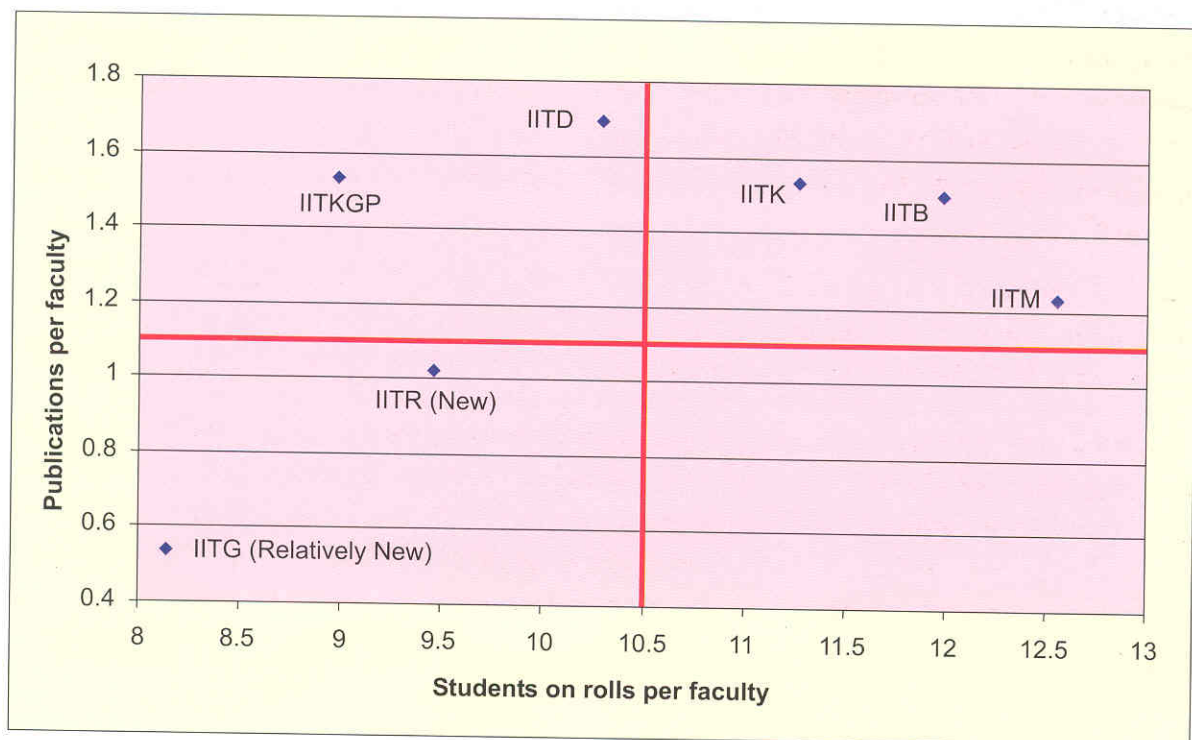


Figure 15.2: Faculty output (publications per faculty) and students per faculty in the IITs (2002-03)

15.3 THE ESSENTIALITY OF ADDITIONAL FACULTY

The data presented in the foregoing section shows that the IITs, as a system comprising seven entities, have presently a teacher-student ratio of 1:10. Individual IITs will obviously have variations of this ratio. It is clear, then, that increase in intake calls for induction of additional faculty. This presents the greatest challenge to the IIT system.

Doctoral research in engineering in the country in general has not picked up. The Committee is not going into the reasons except to echo the general observations which are that i) B.Tech.s in engineering are able to secure employment and ii) Industry has not shown a penchant for recruiting Ph.Ds. (This situation is clearly changing in the country). Whatever the reason, candidates trained in advanced engineering research are not available in large numbers from within the country. Therefore, IITs had to depend on those trained abroad for their faculty. There is also the issue of compensation that is frequently highlighted. Given this situation, candidates with a distinguished record for induction as faculty are not easy to come by. This is not to say that such individuals are not available at all, but are certainly not available in large numbers at the present time.

We have discussed the issues related to faculty in Chapter-6 and suggested a modest system of incentives. Any step taken to encourage good faculty to be taken into the IIT system will go a long way in helping the system. IITs also have to be assisted by way of visiting Professors, Adjunct Professors, Post Doctoral Fellows, Teaching Assistants (Senior M.Tech students and Ph.D Scholars) as well as by inviting experts from overseas. It is not necessary that every faculty position in the IITs has to be a permanent position. These have been discussed in Chapter-6 but deserve to be reiterated.

In summary, recruiting faculty is the most difficult hurdle to cross with respect to increasing the intake. The BOGs, the PAN-IIT Synergy Committee, and the IIT Council will have to pay the utmost attention to this issue.

With the changing international situation and the quality of life in India having significantly improved, IITs are bound to overcome this difficulty sooner than later. The prospect is certainly far better for the IITs than anyone else. Accordingly, this Committee would **recommend a steady growth in UG intake**. The brand quality of UG has been established and it is at this stage that the intake has to rise. However, abrupt or large-scale increase in intake may prove counter-productive. The magnitude of the growth in intake need not be identical in all the IITs and it is best left to be decided upon by each BOG. With PG and Ph.D. intake having improved, the attention has to be turned to further improving their quality.

We will now point out briefly cost implications of the increase in intake so that the decision makers have an idea in this respect.

15.4 COST IMPLICATIONS OF INCREASING THE STUDENT INTAKE

15.4.1 Recurring Expenditure

Figure 15.3 shows a strong correlation between the direct expenditure per student and the total number of students on rolls (all categories of students). Between 1999-2003, this expenditure has

gone up from 0.38 lakh per student to above 0.72 lakh per student. The direct expenditure includes items such as students scholarships, hall subsidy, administrative expenses, department/lab. expenses, transport subsidies, student activities, computer facilities and others. This, in one sense, is a good thing that has happened. Bright students getting into the IIT system deserve to be cared for. This care has to be on par with that provided in the best of institutions around the world. Indeed, with their international brand image, IITs are in a position to attract overseas students as well.

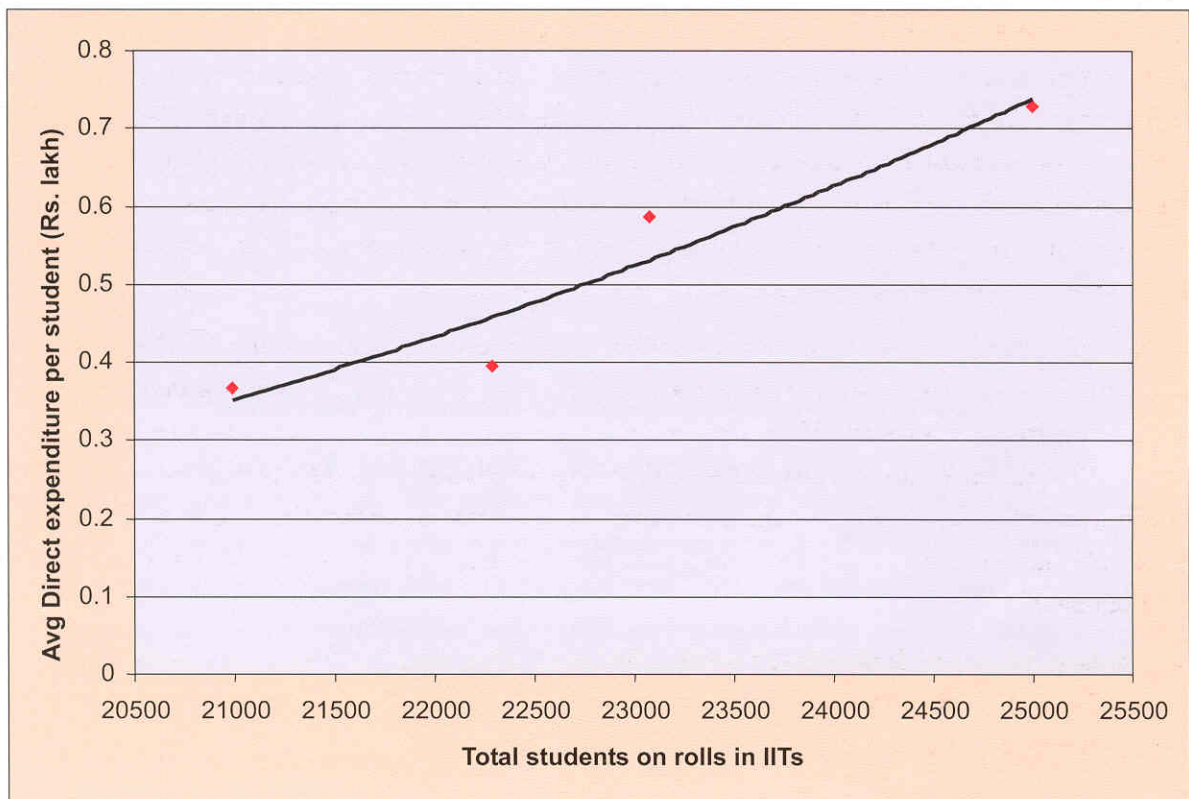


Figure 15.3: Direct expenditure per student for IIT system

The total non-plan expenditure per student has risen during these same years as follows:

1999-2000 (Rs.1.57 lakh), 2000-01 (Rs.1.50 lakh), 2001-02 (Rs.1.83 lakh) and 2002-03 (Rs.1.97 lakh). This increase is represented in Figure 15.4. A factor contributing to higher cost structure is likely to be the faculty mix of IITs. It was shown in Chapter 3 that IITs have an inverted pyramid structure, with more Professors compared to Associate or Assistant Professors.

15.4.2 Capital Expenditure

a) Construction

Enhancement in the student intake will necessarily require the creation of additional infrastructure like additional hostel accommodation; provision for power and water supply; additional space for

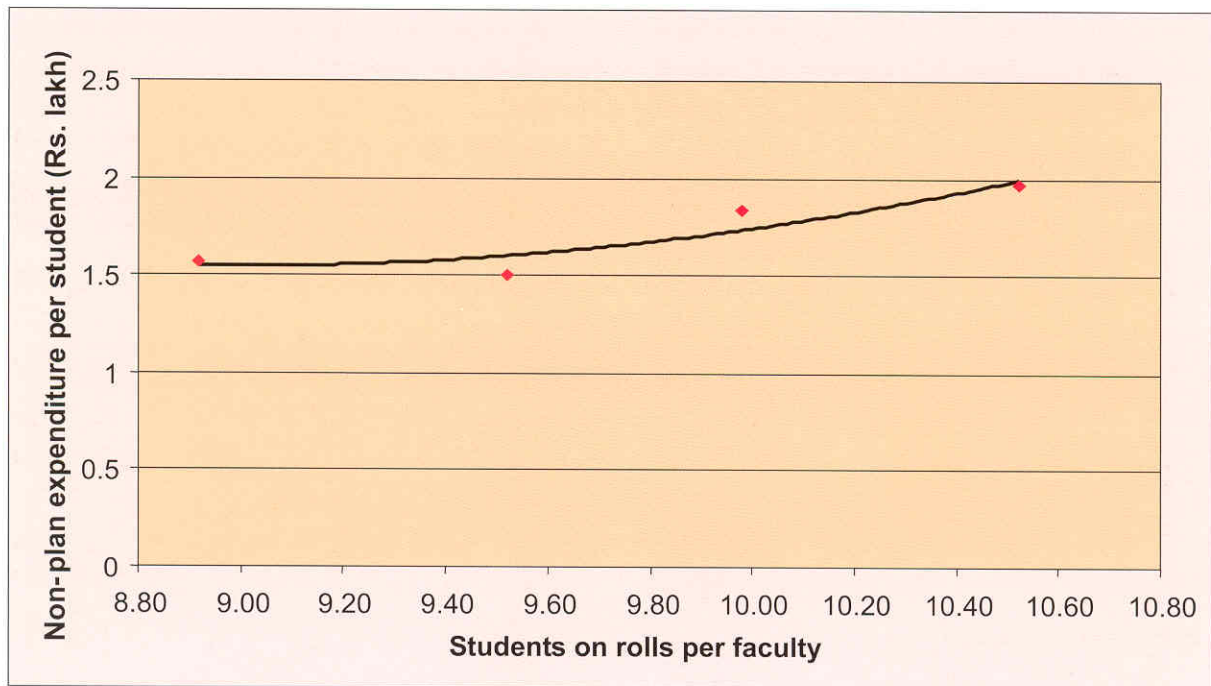


Figure 15.4.: Cost implication of increasing the intake

the existing departments/centers; lecture halls and teaching aids; faculty housing etc. IITK and IITKGP, among the older IITs, do have reasonably adequate space for some expansion within the present campus. However, in the case of IIT Bombay and IIT Delhi, the allowable space for buildings on the present campus has mostly been used up. IIT Madras faces restrictions because part of their campus is declared as a Reserve Forest. This IIT, in its present campus, also faces acute water shortage. Therefore, satellite campuses, with necessary amenities and easy access from the existing campuses, need to be developed in these three cases. Substantial investments would be inevitable if satellite campuses are to be developed.

b) Up-gradation of laboratory-equipments and laboratory space

In order to maintain the present high standard of education in IITs, it will be essential to augment the core laboratories, namely the undergraduate student laboratories, and the post-graduate student laboratories. The barest minimum cost for upgradation of laboratory equipment for increasing the student intake will be of the order of Rs.1 lakh per year per student for UG. The corresponding figures for M.Tech and Ph.D are roughly Rs.1.5 lakh and Rs.2.5 lakh, respectively. The minimum requirement of additional laboratory space for increase in the students' intake based on a recent study is about 8.0 sq.m.per UG student and about 4.0 sq.m. per PG student.

c) Additional hostel seats

One of the special features of IIT system has been its residential character. The data pertaining to student hostels and faculty housing as well as transit accommodation available currently are presented respectively in Figures 15.5 and 15.6.

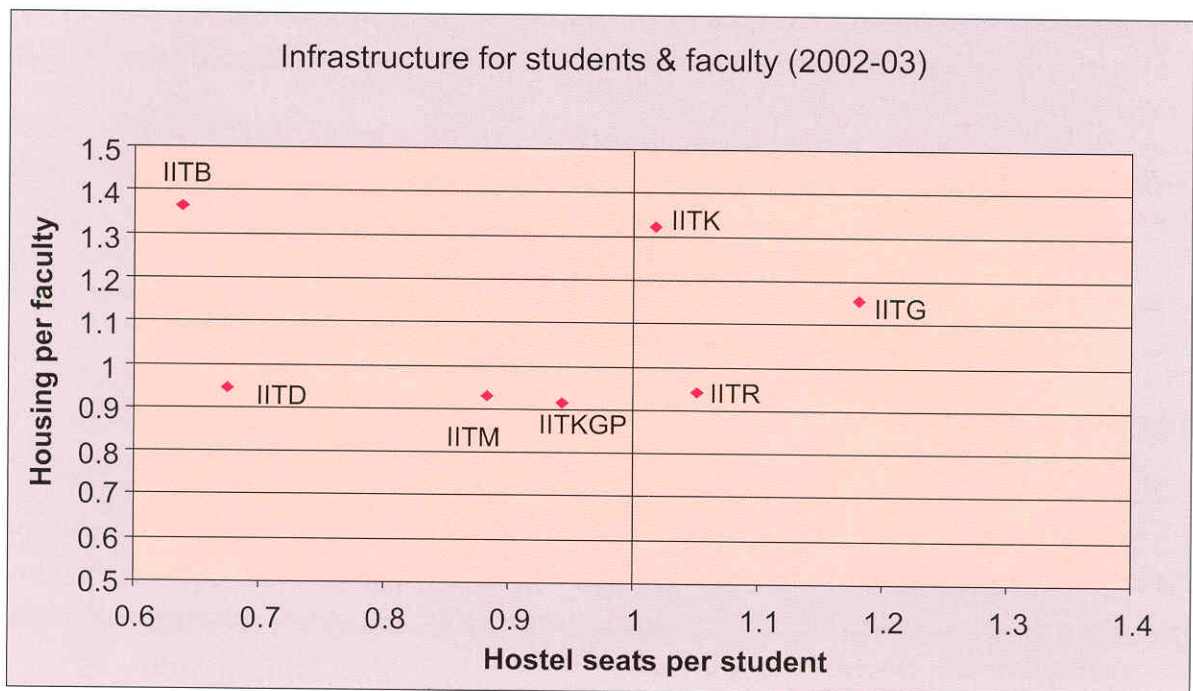


Figure 15.5: Infrastructure for students & faculty (2002-03)

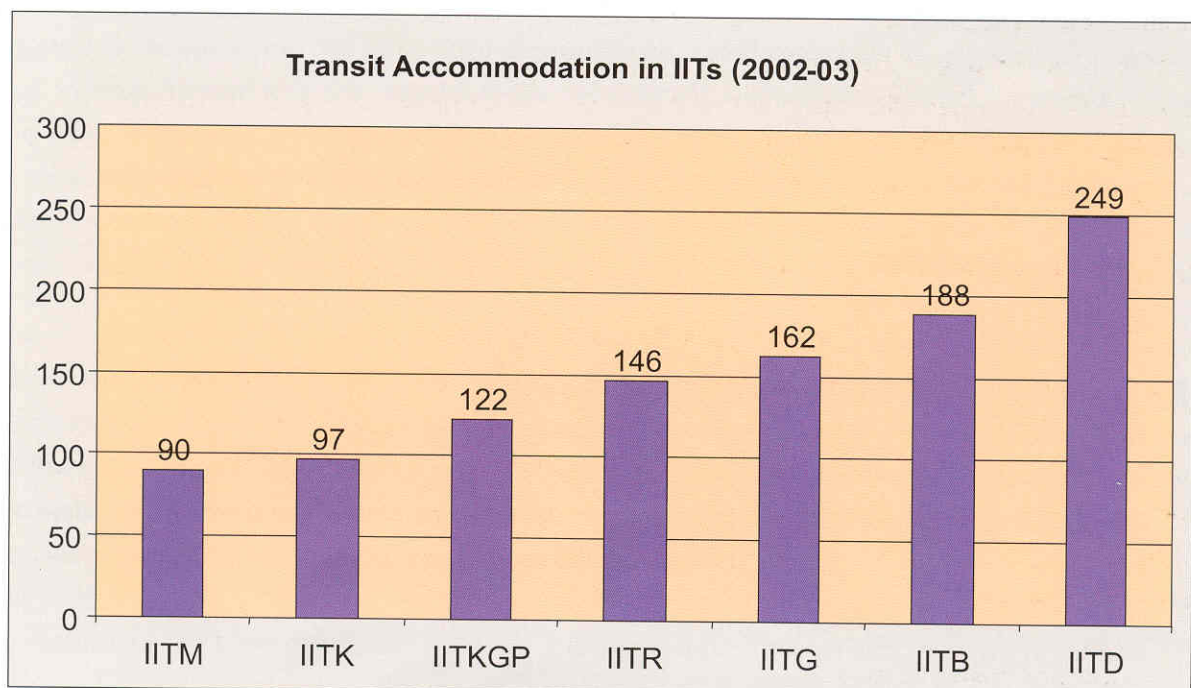


Figure 15.6: Transit accommodation in IITs (2002-03)

The cost of adding a seat on the present campus land is about Rs. 2.00 lakh per student. This calculation is based on the requirement of about 10 sq. meters per student plus 15 sq.m (in a six-storey building with lifts) to account for toilets, verandas and common rooms in the hostel at the present cost (about Rs. 10,000 per sq.m).

d) Additional space for faculty

The cost of an average office space of 12 sq.m. and an average housing space of 150 sq.m. is estimated to be Rs. 11.00 lakh per each additional faculty. It may not be possible to add all of this on some of the campuses and additional land may have to be acquired.

e) Academic infrastructure

At the present level of intake, the classroom and the library facilities have become over-loaded. The IITs have been experimenting with lecture classes at UG level as large as with 100 to 200 students. It is now important that, for better communication between students and the teacher, electronic classroom aids are provided. In order to increase capacity of the present classroom, additional furniture requirements have to be kept in mind.

f) Electronic classrooms

Because of the increased intake, classes are likely to have as many as 400 students. Students in such large classes tend to have diverse backgrounds and levels of preparation. Tutorials and assignments are an integral part of course-based education in IITs. Effective tutorials for such large classes require a combination of classroom/laboratory atmosphere. One of the best solutions is through use of virtual (electronic) classrooms. In such an environment, the conduct of quizzes and examinations can be automated. Such a classroom is a cluster of two or more classrooms, each with a capacity of, say, 100 students. Establishment of a Virtual Class Room is an interesting exercise in technology. Each such classroom is expected to be about 250 sq. meters costing about Rs.25 lakh including furniture. The cost of each cluster together with the equipment cost will be about Rs.1.5 crore.

15.5 SUMMARY OF RECOMMENDATIONS

- (i) Increase in intake at the B.Tech level is an absolute need of the hour. While the growth in intake in PG and Ph.D (in the last ten years) has been impressive, new measures, as discussed in Chapters 7 and 8, have to be thought of and implemented. There are additional recurring and non-recurring costs to be incurred. While some more expansion is feasible within the existing IIT system, the extent of this expansion cannot be large and need not be uniformly undertaken by all the IITs. Each BOG can discuss the local constraints and possibilities and recommend possible additional intake for the IIT Council finally to decide.

- (ii) In the light of the above discussion, large-scale quantitative improvement has to come from additional IITs. Focus on quality education should be zealously guarded while deciding on additional IITs. The necessary investments have, therefore, to be ensured.

There is also an exercise underway for upgradation of existing institutions. The seventeen NITs are a case in point. Progress in this respect will be slow but every effort has to be made to enhance the stature of the NITs. IITs have in one sense shown the way and this example is to be emulated in all its facets, and even improved upon.

15.6 CAMPUSES IN FOREIGN LANDS: OBSERVATIONS

In view of the international visibility acquired by the IITs, there is an express interest in the IITs setting up campuses abroad. On the face of it, it appears that export of the IIT model in this manner will greatly contribute to globalizing the IIT brand name. The other merits of the proposal are the following:

- This move will help students in foreign countries in gaining quality education like what the IITs impart in India.
- Over a period of time, foreign students graduating from the IIT system will build up into a formidable pool of goodwill for India and the IITs.
- The best of such graduates from foreign land may wish to pursue PG & Ph.D programmes in the IITs in India.
- This will be an effective way of nurturing a strong and emotional bond among the future generations of professional leaders in India and abroad who will always be inclined nostalgically to recall their life as students in similar academic environments.

However, there are a number of difficulties in going ahead with such a proposal, no matter how laudable it may be in the light of the points made above. The principal problem is the availability of faculty. The Indian IITs themselves are grappling with this issue at home. The difficulties get exacerbated if good faculty members have to be found to man institutions abroad as well. The demand is building up on the IITs to expand their student strength as well as on their authorities to add to the existing family of the seven IITs by creating more IITs. With such pressures, those who are manning the IIT system cannot be expected to pay the required attention to another need.

Finally, it has to be remembered that India has more than 10 million candidates coming out of the 10 + 2 stage which makes them eligible to aim at getting into the IITs. Out of this huge population, nearly 2 lakh students strive to take the Joint Entrance Examination. In view of the high selectivity in the admission process, the quality of the intake has been consistently high. It is not clear that similar numbers of aspirants would be available in the countries in question and, therefore, the

apprehension that the same selectivity and high quality as in India may not be achievable. Further, India can only have limited influence in certain matters concerning other nations and students in other countries may have alternative options operated by developed countries.

The best course of action seems to be that of a model somewhat akin to the one from which this country itself benefited when institutions in countries abroad spared their time and trouble and were willing to use their experience for nurturing the IITs during their fledgling days. In other words, the IIT system as a whole in India can act as a leading consortium when agencies abroad express an interest in adopting the IIT model. It may be recalled that, at the time when IIT Kanpur came into existence, MIT, a leading institution in USA, formed a consortium comprising quite a few American academic institutions. It is this consortium which took the trouble to design several aspects and features of IIT Kanpur. Indian IIT system today can play a similar role in contributing to the establishment of new institutions abroad for quality teaching and research in engineering and technology. IIT faculty and others experienced in the IIT system can be involved in this process. This will eliminate all burdens, such as financial, personnel and administrative, in taking up such an onerous task. It is also possible to conceive of participation by Indian IITs where it concerns some of the PG courses and research programmes abroad. These responsibilities will add to the IIT faculty load only to a marginal extent.

15.7 A MOST RECENT INDICATION

A most recent indication is that eminent universities such as Stanford University, Yale University and Georgia Institute of Technology are considering proposals to set up their off-shore campuses in India. However, no details are as yet known, but there is a distinct possibility that the off-shore endeavours of the universities named above could very well encompass education and research programmes in engineering and technology disciplines. It is entirely conceivable that this trend will build up in the coming years and more and more leading universities not only in USA but also in Europe, in the UK and in Australia could seriously get involved in India with their off-shore activities. IITs cannot be oblivious of such possibilities becoming a reality. This likely development has to be reckoned with in any policy related to expanding the IIT system in India.

In the face of this new challenge that is likely to be at their doorstep, IITs have to think and act ever more competitively. IITs should be seriously aiming at having their own presence in the advanced countries. Thanks to the sterling achievements of their alumni, IIT brand is well recognised abroad. With such indications as have been mentioned, it is time for the IITs to aggressively export and establish their own brand as an educational system in foreign lands. These institutions have to excel in every academic sphere so that their status as the most sought-after destination by students and faculty alike is not diminished.

In this context, the following measures may be considered by the IIT Council:

1. The IIT system acts as a consortium for helping other countries in establishing quality institutions for teaching and research in engineering and technology, as described above.

2. IITs develop a strategy in which their ventures abroad are undertaken in partnership with eminent universities in the respective host countries.
3. The Government is persuaded to set up more IITs in our own country. This has to be done at a steady pace, as quality institutions like the IITs demand substantial capital, financial and human. To the family of five IITs that were established during 1950-1961, one new IIT and another by conversion of an existing University were added in the last 10 years. It is time to consider adding at least two more IITs at this juncture.
4. IITs to be equipped and supported in setting up their own full fledged off-shore campuses. (The constraints in this regard discussed earlier in this chapter have to be overcome). IITs to be assisted in every possible way to excel in an environment of severe competition.
5. IITs reach well thought-out MOUs with such of those universities who are likely to position themselves in India. Such MOUs need to be focussed on joint research in the immediate future. This report has throughout emphasized research enhancement in the IITs. Partnership in research should, therefore, be an undiluted goal while welcoming leading universities coming into India.

The above are the immediate thoughts of the Committee which are placed here with the intention of assisting the IIT Council. IIT Council may please deliberate on how best they might enable and empower the IITs in meeting the challenges looming large in the way their overseas counterparts are contemplating on India as their promising destination.