



Taking IITs to Excellence and Greater Relevance

Report of Dr Anil Kakodkar Committee

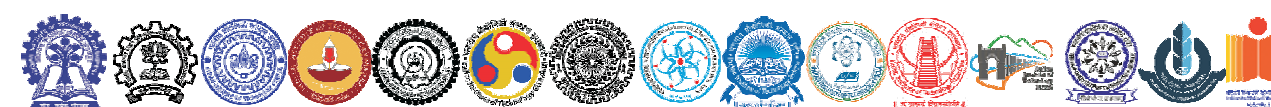
April, 2011

Taking IITs to Excellence and Greater Relevance

**Report of Dr Anil Kakodkar Committee
Appointed By MHRD
to Recommend Autonomy Measures to
Facilitate IITs Scaling Greater Heights**

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April, 2011



On letter head

Subject: Report of the Committee appointed by MHRD
to recommend autonomy measures
to facilitate IITs scaling greater heights.

Dear Shri Sibal,

MHRD vide F.NO.19-3/2009-TS1 dated 3rd February, 2010 had constituted a committee for suggesting a roadmap for autonomy and future of IITs as world class institutions for research and higher learning.

The Committee has looked into various issues in the context of the terms of reference given to the committee, consulted a broad range of stake holders specially the Directors of IITs and representative faculty and had the benefit of a discussion in the IIT Council. The committee is convinced that, given the demographic advantage that we have, the need to create conditions that can bridge the aspiration gap for our youth and the importance of knowledge and innovation in our inclusive economic growth; there is a pressing need to create and expand our education-research-technology-innovation-entrepreneurship eco-system in the country. IITs are presently at the right stage to create and nurture such an environment on a significant scale. IITs can also facilitate extension of such environment to other domains in the country at an appropriate stage. This requires a strategy to take IITs to greater level of excellence and relevance. The Committee has approached its mandate from this perspective.

Managing such a transition would naturally require complete autonomy so that IITs can adopt innovative and flexible management approaches to quickly move forward on a promising new idea in a selective manner. It is also clear that the IITs as research institutions would need to scale up with a comprehensive research infrastructure to address various dimensions of research and technology needs of the country. While expansion needs would naturally have to be met by the Government, it is important that eventually IITs become largely self sustaining as far as their operational needs are concerned. It is expected that once the autonomous management structure is in place, ability of IITs to bring in resources from non- Governmental sources will be considerably enhanced.

The Committee has been conscious about the need to ensure access to all deserving bright young people to this nation building process. The Committee has therefore proposed that only those who have parental income beyond a threshold determined by Govt. of India (4.5 lakhs at present) would need to pay the operational cost of under graduate education. For the rest it is proposed that their expenses at IIT be covered by the Government on a per student basis. It is also proposed that a hassle free bank loan

facility not involving any collateral should be made a part of admission process for all those who may be in the need.

Details are given in the report enclosed herewith. The Committee would like to suggest that the recommendations of the Committee may be treated as a whole. In case of their acceptance, we also suggest that an empowered group be set up for oversight and smooth management of transition to new paradigm including actions at several levels in the Ministry, IIT Council as well as at individual IITs.

We thank you for the opportunity given to us in this important task.

With warm regards,

Yours sincerely,

Anil Kakodkar 

T V Mohandas Pai 

Hari Bhartia 

Ashok Jhunjhunwala 

K Mohandas 

Ashok Thakur 

Shri Kapil Sibal
Hon. Minister,
Ministry of Human Resource development,
Government of India.

Executive Summary

A committee was constituted by the Ministry of Human Resource Development (MHRD) vide its order F.NO.19-3/2009-TS 1 of 3 February 2010 to suggest a roadmap for the autonomy and future of the Indian Institutes of Technology (IITs) as world-class institutions for research and higher learning. The terms of reference of the Committee are given in the order, a copy of which is included in the report at Appendix I. The committee held several meetings, including discussions with the directors of IITs and with a section of the faculty members of IITs at Kharagpur, Mumbai, Chennai, Kanpur and Delhi. A stakeholder survey was organized which provided valuable inputs. The committee also visited China on a study tour to five Universities there.

A country of India's size, on a rapid economic growth path, would require in today's context a significant emphasis on large-scale research at the highest levels of excellence. This is necessary to push the frontiers of knowledge and create new cutting edge technologies and thereby sustain India's progress as a leading country in today's competitive global environment. Development of such technologies should be linked to our industry to make them global leaders and to address the needs of markets both in India and the rest of the world. We should be in the forefront to meet the growing human needs with minimum use of earth resources in a manner that keeps the environment around us protected. We need to nurture a large science and technology (S&T) based innovation ecosystem that creates solutions for India's inclusive development and economic growth. The creation of a large pool of researchers (with PhD) commensurate with the size of our population and economy as well as our aspirations, is a key necessity for the realization of these objectives.

The IITs are known to be among the best teaching institutions in the field of engineering, which have made a global mark with their high quality undergraduate (UG) education. B. Tech graduates from the IITs have made a very significant impact in various domains. M. Tech degree holders from IITs play a leadership role in Indian industry and R&D organizations. They have also provided some PhDs to educational Institutions (in addition to industry). IITs have created all the relevant ingredients and the best platforms to lead the Innovation and Technology Development movement in the nation.

The IITs are now on a growth path to cope with the expansion mandate recommended by the Oversight Committee (OSC). This rather rapid rate of expansion has caused considerable strain on the system. At the same time, it is true that till recently, the IITs had not grown at a pace commensurate with the expansion of engineering education in the country. Currently, around 500,000 engineering graduates come out of our engineering colleges. This number would cross one million in three to four years from now. There is however a serious question about their quality. Industry finds a large number of these graduates unemployable needing further training. In the 1970s and early 1980s, close to 10% of engineering graduates came from the IITs; this has dropped to below 0.5% today. The decreasing fraction of IIT graduates and with a significant fraction amongst them moving away from engineering and technology, has led to decreasing benefit of IIT graduates to national development in proportionate terms.

In terms of research, the IITs are continuously enhancing their research activities as evidenced by the increasing number of PhDs coming out of the IIT system. In fact, most PhDs in engineering in the country are now coming from the IITs. Even so, the number of PhDs that come out annually from the IITs is very small (about 1000 per year) in comparison to the size of our country, size of our economy and number of youth in the country. Further, only about 1% of IIT B.Techs do PhD at the IITs. Recognizing that we are fast moving into an era dominated by a knowledge-driven economy and would have to face higher levels of competition as the Indian

economy becomes one of the largest in the world, emphasis on technology and innovation linked to advanced research is becoming increasingly important. The IITs, being the largest system for high-level engineering R&D and human resource development in an ambience of high-level research, have thus to take on the challenge of creating an advanced research-based innovation ecosystem that, on a national scale, is large enough to make a significant positive difference. For this purpose, while the scale of high-level research at the IITs needs to be considerably enhanced and broad based with the involvement of industry and national technology related programmes, the IITs should also contribute in a significant way to the research and development capability and culture in the country at large (by creating a large pool of PhD graduates). If one looks around the world, most of the best technology institutions in the world have 15,000+ students as opposed to 6000+ currently at each of the established IITs. USA and China produce around 8000–9000 PhDs in engineering and technology annually while in India the corresponding number presently is around 1000. With this background, and considering the large gap that we have to bridge in realizing our development aspirations, we need a large-scale increase in the number of PhDs coming out from the IITs. The Committee has therefore suggested that each IIT should progressively grow to have around 1200 faculty (from around 500 today) and closer to 12,000 students with maximum growth coming from an enhanced number of PhD students. While the established IITs could aim at reaching this scale up in about 10 years from now, the newer IITs could take longer. Further, the Committee has suggested setting up of 5 more IITs over this period of time. Thus, the Committee has recommended the number of IIT PhD graduates per year to be scaled up to 10,000, while continuously enhancing quality.

The Committee has suggested the retention of time-tested parameters like a certain faculty : student ratio (1:10) and PG : UG ratio (1:1 or higher). A comparison with the annual PhD output per faculty in the IITs vis-à-vis the situation in some of the high-ranking universities would suggest a scope for improvement here. The Committee has suggested a minimum of 0.6 PhDs per faculty annually, eventually reaching 1 PhD per faculty. On this basis, the Committee

has suggested that we should aim at scaling the IIT system to 16,000 faculty and 160,000 total student strength (with 40,000 at the PhD level, 40,000 at the Masters level and 80,000 UG students) by around the year 2020. Each year, then, the IIT system will admit 10,000 PhDs.

The Committee has also recommended an Executive M.Tech programme for about 10,000 working professionals from industry through live video classes to enhance the knowledge base in our industries.

Finding faculty in adequate numbers to meet the needs of OSC expansion as well as new IITs has in itself been a major challenge. Coping with faculty needs for scaling up the PhD programme to the above-mentioned level would thus have to primarily depend on the PhD programme at the IITs itself.

Feeders to such a large PhD programme in the form of bright engineering graduates have to be of a size commensurate with the requirements. While students with a Masters degree and, to some extent B.Tech students, of IITs would constitute an important channel (all efforts must be made to attract them into the IIT PG stream), one would need to tap other channels to get quality students in adequate numbers. The Committee has therefore suggested engagement of IITs with other good quality engineering and science education institutions, particularly those of the Central government like NITs, IIITs and IISERs, with a view to enlarge the pool for selection of quality students and also attract their faculty into the PhD programme. The Committee has also suggested special efforts be made to identify and pick up bright 3rd year students of IITs, NITs and such other such public or private institutions and to initiate them into the PhD programme. Further, the Committee has suggested an augmented intake of PhD students from industry and the engineering education system in the country. IITs being at the top of engineering education in the country should act as an inspiration to raise the level of engineering education in other public and private institutions. This would result in enrichment of these

institutions, which is long overdue. Of course, for all this to happen, the IITs would have to aggressively pursue candidates from these different streams to join their PhD programme.

To support such a large number of PhD students (40,000 at a time) with challenging and meaningful research problems would require comprehensive augmentation of research facilities and infrastructure. The Committee has proposed significant augmentation/addition in the following four domains. This would be over and above the current mode of support through various research funding agencies for individual proposals submitted to them by the faculty.

1. Identify 3–4 areas of recognized strength involving a reasonable faculty strength at each IIT and support them massively to become the world’s best. Selection of such areas should be done on the basis of demonstrated high-level capability.
2. Take up large coordinated research projects involving a number of groups from different disciplines (from same or different IITs) to address important national challenges/other grand challenges with specific pre-defined deliverables.
3. Establish research parks with significant industry presence at each IIT on the lines of a research park established at IIT Madras, to enable industry–academia collaborations and build a Research and Innovation ecosystem.
4. Establish special laboratories of government ministries/their Public Sector Undertakings (PSUs) at IITs to strengthen indigenous capability in key areas of national importance. It is expected that such augmentation of research infrastructure in the IITs would create useful linkages between them and the external world, thus making research at IIT more meaningful. More importantly, this would lead to a broad-based innovation ecosystem of which IIT students and faculty will be an integral part.

World-class institutions are characterized by the existence of a large high quality talent pool (faculty, students and visiting researchers), vibrant academic and research linkages with

external better quality institutions, availability of liberal resources and a flexible and conducive governance system that can recognize and selectively support credible new ideas in a hassle-free manner. Funding and autonomy of the IITs are thus key areas that need serious attention.

Towards enhancing autonomy that would provide the IITs the necessary flexibility to support and deal with a new idea or take a new initiative and lead them towards world-class excellence, it is proposed that each Institute be fully governed by its Board of Governors (BoG), including aspects like financial planning and expenditure rules, faculty remuneration, fees and number of faculty and staff, within the overall policy guidelines of the IIT Council in terms of expectations from IITs as world-class institutions, affirmative actions, technology directions and human resource development. The composition of the Board would enable representation of all stakeholders. The Committee has suggested that the Board should have one representative each from MHRD and the state governments. Other members could be selected from panels (duly approved by the IIT Council) prepared by S&T academies and Industry associations; also the alumni and faculty would also be represented. The Board will select the Chairperson following a due process and appoint him/her after approval by the Council. A search committee appointed by the Board would select the Director for approval and appointment by the Board. Selection of the next set of members to replace those retiring, would be done by a nomination committee of the Board and approved by the Board. Each institute would subject itself to a comprehensive institution review by an internationally eminent group once every 5 years. Such reviews which will be overseen by the IIT Council, will have focus on quality, programmes, their direction and size, working of the institutions and suggestions for change, including new initiatives. These review reports shall be made public. Further, there will be an annual MoU between the Government and each IIT, with the Council's oversight and guidance. Such MoUs would include commitments, responsibilities and deliverables on both sides (Government and IIT). The Visitor would retain emergency powers as at present.

Sustaining a large talent pool that acts as a magnet to attract bright students and researchers is one of the key features of a world-class institution. Attracting the best faculty to the IITs is thus of crucial importance. This would require a strong academic, research and innovation culture and a conducive and transparent organization that nurtures excellence. It has to be driven by the Director and faculty and there should be additional attractions like significant start-up funds that would enable researchers get on with their research from day one. The BoG should have the flexibility to decide on faculty remuneration. It is proposed that there should be a system of faculty assessment in terms of several parameters like teaching, research, technology development and industrial consultancy, policy research and service with differentiated faculty remuneration based on performance-based assessment. At the same time, a tenure system for faculty needs to be examined. The Committee has also suggested the need to enable and encourage some mid-career faculty from the established IITs to shift to newer IITs and for overseas faculty to join IIT.

Institutions like IITs that are devoted to growth in the knowledge, technology and innovation domains and related human capital development, should be seen as asset builders for the nation in the modern knowledge-driven economy. The Committee has thus suggested that IITs be made independent of non-plan (operational) support from the Government for their operational expenditure while at the same time seeking greater plan (capital) support to enhance research in a comprehensive manner, as outlined above. The objective of realizing autonomy would be facilitated by de-linking IIT finances with non-plan support of the Government. The enhanced plan support to IITs would have three components: (i) Student support at postgraduate and research level on a per student basis through scholarships, (ii) research support aimed at pushing the frontiers of knowledge and innovation and (iii) massive augmentation of infrastructure to support larger numbers of students.

It is proposed that the fee charged by the IITs should cover the full operational cost of education, which works out to be roughly 30% of the total current cost of education. A hassle-free bank loan scheme specific to IIT students has been proposed. No collateral would be required. This would enable access to all eligible and deserving students. Further, it has been proposed that MHRD should fully provide for fees and living expenses as per currently prevalent norms at IITs for all research students (PG) as well as UG students from weaker sections. In addition, all students whose parental income is less than Rs 4.5 lakh per annum (to be revised from time to time), should be paid scholarships covering 100% fees, and a monthly stipend. Incentives in the form of deferment of loans for students entering postgraduate education and research and proportionate repayment of loan for students joining as faculty and researchers into programmes at IITs and other areas identified by the Government, have been proposed.

The Committee has also recommended that all government ministries should provide a minimum of 20% overheads without ceiling on the R&D projects sanctioned to IITs. This is necessary to avoid strain on institute resources as they undertake enlarged R&D activities. Most US universities charge overheads to the tune of 50%. Industrial consultancy and royalty, alumni and industrial grants/donations and continuing education programmes, including executive M.Tech programmes, would be some other modes for enhancing IIT finances. It is expected that IIT resources through non-governmental sources would further improve in a significant way once the IITs acquire financial autonomy.

With this background, the Committee has suggested that the tuition fees should be between Rs 2–2.5 lakh per year per student. This would be reasonable considering the high demand for IIT graduates and the salary that an IIT B.Tech is expected to get. There is a legacy commitment in the form of retirement benefits under the old pension scheme (to the tune of around Rs 221 crore for all IITs in 2010). This should be continued to be paid by the Government till the end of the scheme.

To support research at IITs, MHRD should provide plan funds at Rs 1.5 lakh per student annually. The newer IITs do not have any significant endowment funds at present. Hence, Rs 50 crore as seed endowment over the next 5 years has been proposed for each new IIT.

On the capital investment front, the Government should support an Expansion Budget at Rs 20 lakh per additional student. In addition, a sum of Rs 5 lakh per student would be required in the established IITs for regeneration of ageing infrastructure. It is also assessed that for OSC-related expansion costs, Rs 15 lakh per student should be provided as Rs 10 lakh per student provided presently has been found to be inadequate.

The IITs must nurture an ambience of Innovation and Entrepreneurship to make India a world leader in the present-day knowledge economy. In order to achieve this, we should have substantially enhanced Industrial collaboration with a focus on technology development in the Indian context. A strong industry–academia relationship is of key importance. Initially, there needs to be significant give and take on both sides. But this will make a significant difference to teaching and research at the IITs and will train IIT graduates to take India to a leadership position. One should also encourage industry R&D personnel to become adjunct faculty and enable large numbers of industry persons to do PhD. Research Parks create the right ecosystem to bring students, faculty and industry R&D personnel together. It is proposed that Rs 200 crore be provided for setting up a Research Park on the lines of the IIT Madras Research Park at each IIT. The IITs need to learn that success in entrepreneurship often comes only after multiple failures and substantial benefits accrue only if R&D is pursued over long periods. We need to create a value system that takes these factors into account. IITs have to make special efforts to learn to evaluate faculty focusing on product development.

Outsourcing of support activities to the maximum extent possible has been strongly recommended. IITs should strive to minimize the number of regular employees for non-technical support functions. All decisions with regard to staff, including numbers and

remuneration, should be decided by the BoG. Most scientific staff is proposed to be on project mode, with flexibility of salaries for temporary staff. The technical staff could be in-sourced wherever possible. Here, the use of PhD students as teaching assistants would be of help. On the administration side, maximum possible computerization of functions has been recommended to reduce the requirement of administrative staff. Hiring of some professional mid-career staff could be considered to make the administration more efficient. They should be observed for their performance for a few years before they are regularized.

Scaling up engineering education with quality would ensure availability of quality human resource for meeting India's needs. It will also be an excellent feeder pool to critical areas as well as into the PhD programmes. Seventy Centrally funded institutions (including IITs) should therefore graduate 100,000 high quality engineers every year. While the share of 20 IITs could be 20,000 B.Techs, the 50 other institutions should plan to graduate 80,000 graduates every year in about 10 years from now. Hopefully, state governments and private institutions could create additionally at least 200,000 quality seats. This will create a reasonable sized science and engineering pool for India's future.

As a part of IITs' engagement in this process, each of the 50 Centrally funded science and engineering institutions (like NITs, IIITs, IISER, NISER) could select 5 bright young (aged around 35 years) faculty members from the IIT system and invite them to be a member of their BoG and Senate. They could be tasked to build a relationship with the concerned IIT department and young faculty at the Institute to enable and enhance research collaboration (Rs 50 lakh to be identified for each faculty for this purpose) between the institute and the IITs. They would encourage B.Techs to join PhD programmes at the IITs and, if necessary, get faculty to do PhDs at the IITs. Similarly, they could get some IIT PhDs to join the institute as faculty. It is expected that each faculty spends at least 15 days a year at the institute. One of the consequences of this strategy would also be that young IIT faculty would be trained to be future leaders. In a similar

manner, 3 young persons from industry could be identified by each NIT. They could be similarly invited to the Board and be tasked with similar goals.

Amendments to the IIT Act would be necessary to give effect to the above-mentioned recommendations.

Details are given in the report. We strongly suggest that the recommendations of the Committee should be treated as a whole to realize the intended objective. It is also recommended that an empowered Implementation committee should be tasked for implementation of these recommendations and to facilitate transition to the new framework for IITs.

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PREAMBLE

PREAMBLE

Higher education, particularly technical education, is critical to India's aspirations of strengthening its reputation as a major competitive player in the global knowledge economy on the one hand and to fulfill the national expectations of social development on the other. Within the huge and complex higher education system, the Indian Institutes of Technology (IITs) occupy a place of pride. Even so, the various reviews of the existing IITs have led to a consensus that there is scope for further improvement to make them world-class institutions.

The next 20 years of economic growth demand a much higher level of innovation, technological discoveries, deeper technical competence and greater intellectual property, which can only be created by an educational system focused on R&D, discovery and creativity. This demands a reorientation of the higher education system in India. The IITs being at the pinnacle of higher education have to lead the way, creating the scale, depth and innovation needed by the nation. The IITs have a much smaller part of India's technical ecosystem as compared to the role they played even 25 years ago. Today, with only 7500 undergraduate (UG) and less than 1000 PhD students graduating every year, the output of the IITs is inadequate for the future. Clearly the world has passed us by. If India has to be among the three largest economies of the world, the IIT system has to grow several folds in terms of research output, the number of PhDs and student graduation.

Issues of fair and affordable access to IITs are critical to provide a larger number of talented Indians with capabilities to contribute to national economic and social development, opportunities for employment and abilities to compete in the international arena.

The IITs should have standards benchmarked against the best universities around the world. One of the essential ingredients for this is a good governance system with an independent and fully empowered Board with representation from key constituents such as scientific establishment, industry, alumni, faculty and Government.

A good governance system helps to create a stimulating ecosystem to attract talented students and faculty and motivate the latter through a performance-based incentives structure. An enlightened governance system encourages faculty to engage in advanced research, technology development and consulting to stay abreast of new developments and to bring essential knowledge into the classroom. It provides the scope for quantum leap in the output of

postgraduates and undergraduates of exceptional quality. It stimulates a culture of innovation, encourages large-scale faculty development programmes and improves productivity. It creates a system of checks and balances, focusing on excellence and innovation. It motivates alumni to contribute generously and willingly fund facilities for the development of the institution. Good governance ensures that stakeholders, including students, faculty, institutional management, as well as those from the wider society, have full confidence and trust in our IITs, and that the IITs meet the objectives for which they have been set up.

Established by the Parliament of India as institutions of national importance, the IITs presently enjoy a considerable degree of academic autonomy and a reasonable degree of administrative autonomy but much lower levels of financial autonomy. They have the potential to demonstrate their capability as world-class institutions provided they are entrusted with a higher degree of administrative and financial autonomy than presently available, with assurances of impeccable accountability. This would require incorporation of drastically new models of relationships among the IITs and the Government, as also new forms of consultation and coordination with the IIT Council and other policy-making bodies. Fresh approaches to the fee structure and financial support are required to be evolved, along with several major changes to the present IIT Act.

Chapter 1

Introduction

1.1 Current State of Higher Education in India

India has one of the largest “Higher Education Systems” in the world. From 20 universities and 500 colleges at the time of Independence, it now has more than 500 universities and 25,000 colleges. ^[1]

The Government of India (GoI) has looked upon higher education as an instrument to invest in to achieve the national priorities of economic and social development, including improved quality of life for all and building technological leadership, as well as global priorities such as sustainable and equitable management of earth resources. Today, higher education is an enabler of economic growth as well as an indicator of the prosperity of a nation. Realizing this potential, GoI is formulating major policies related to higher education to meet the changing needs within the country and to be an effective player in the globalized knowledge economy. For example, in FY 2011, GoI has projected an outlay of about Rs 85,000 crore for higher education during the XIth Five-Year Plan period which marks more than a 9-fold increase over the Xth Plan outlay for the same sector.^[2] About 38% of this outlay is allotted for higher technical education.^[3]

In the last decade, the system of higher education has been reviewed by both government commissioned committees as well as others, for reforms from different perspectives. The focus of these studies broadly has been on the lines of: (i) growth of institutions, (ii) access to higher education, and (iii) enhancing the quality of education.

The growth rate of institutions in the last 10 years has been of the order of 13% per annum. While this has addressed the challenge of quantity, this steep increase has had implications in terms of quality. Similarly, the proportion of population in the age group of 18–24 years that has access to higher education, or Gross Enrollment Ratio (GER), is of the order of 13% (which is low as compared to 54.6% in developed countries and 22% for Asian countries) and only 25% of this GER receive postgraduate education.^[4] The GER is proposed to be raised to 30% by 2020. Similarly, the globalization of higher education has added newer dimensions in terms of quality assurance systems, equivalence of degrees and transparency in the regulatory structures of national systems. Over 450,000 students write the Joint Entrance Examination (JEE) for admission to close to 7500 seats in the IITs, showing the great demand for quality education; a much larger number do not even take the examination as they see no possibility of clearing them. At the same time, India today has over 250,000 of its young students studying abroad, demonstrating the great demand for quality education. India has not been able to meet the needs of our young for quality higher education.

Here is a brief snapshot of contemporary work. The Scientific Advisory Council to the Prime Minister of India ^[5] has talked about why India's presence in the world of Science (including engineering) cannot be ignored. The National Knowledge Commission ^[6] has focused on 5 key areas: Access, Concepts, Creation, Applications and Services. The PAN IIT ^[7] had arrived at 5 action (Pancha Ratnas) areas: (i) Implement comprehensive reforms in policies and governance, (ii) Mandate quality and increase capacity, (iii) Enable quantum improvement in faculty service conditions, (iv) Deploy technology for teaching and collaborative research, and (v) Establish an active Industry-academia

interface. The Yashpal Committee ^[8] has made recommendations on the renovation and rejuvenation of higher education. In another study on “The Higher Education in India: The Need for Change”, ^[9] Pavan Agrawal has recommended strategies to make higher education affordable and accessible to all by achieving policy coherence. The Rama Rao Committee ^[10] has comprehensively addressed the 11 points in its Terms of Reference for the IIT Review Committee including Vision/Mission, Admissions, Governance mechanism, Partnerships and Infrastructure.

1.2 Universities System and Technical Education

Universities play a critical role in making our higher education system vibrant – through creating knowledge, disseminating knowledge and managing the knowledge assets. The linkage between learning, research and innovation within higher education is the key to the building of sustainable knowledge societies.

Based on the provisions for academic, administrative and financial flexibility, there are different types of universities and institutions in the higher education system in the country. Some universities were established by an Act of Parliament while others were established by the state legislatures. Those established by Acts of Parliament are central universities and those set up by the state legislatures are state universities. In addition, some higher education institutions are granted the “deemed to be university” status by GoI. Furthermore, a few institutions are established as institutions of national importance by Parliament. Finally, there are the open universities which offer distance education programmes. The universities could be of unitary type with single or even multiple campuses, or an affiliating type. Universities that are deemed to be

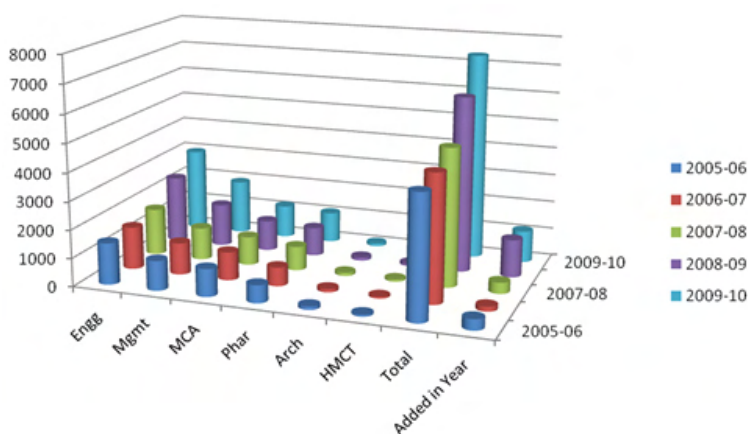
universities and institutions of national importance are degree granting institutions.

The last 5 years has seen a tremendous increase in engineering education in terms of the number of affiliated institutions, especially in the private funding space. ^[11] Here is a snapshot of the growth of AICTE-approved institutions:

Growth of AICTE-approved technical institutions in last five years

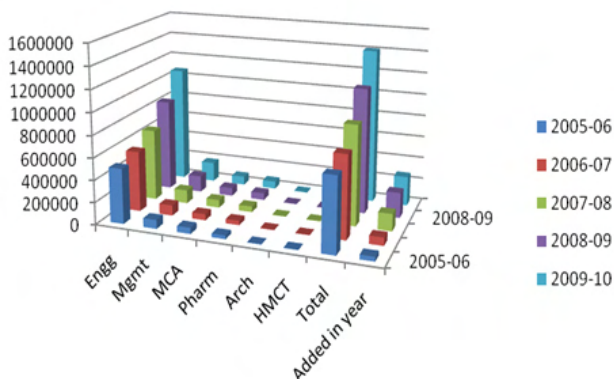
Year	Engg	MCA	Mgmt	Phar	Arch	HMCT	Total	Added in Year
2005-06	1,475	976	1,052	629	118	70	4,320	383
2006-07	1,511	1,003	1,132	665	116	64	4,491	171
2007-08	1,668	1,017	1,149	854	116	81	4,885	394
2008-09	2,388	1,095	1,523	1,021	116	87	6,230	1,345
2009-10	2,972	1,169	1,940	1,081	106	93	7,361	1,131

Source: AICTE Website, Last accessed in Nov 2010



Growth of intake in AICTE-approved institutions in last five years

Year	Engg	Mgmt	MCA	Pharm	Arch	HMCT	Total	Added in year
2005-06	499,697	80,464	55,548	32,708	4,379	4,435	677,231	40,691
2006-07	550,986	94,704	56,805	39,517	4,543	4,242	750,797	73,566
2007-08	653,290	121,867	70,513	52,334	4,543	5,275	907,822	157,025
2008-09	841,018	149,555	73,995	64,211	4,543	5,794	1,139,116	231,294
2009-10	1,071,896	179,561	78,293	68,537	4,133	6,387	1,408,807	269,691



Source: AICTE Website, Last accessed in Nov 2010

Legend: 1. Engg: Engineering, 2. Mgmt: Management, 3. MCA: Master of Computer Applications, 4. Phar: Pharmacy, 5. Arch: Architecture, 6. HMCT: Hotel Management, Catering and Tourism

Figure 1.1 : AICTE Approved Institutions and Their Intake

The above data does not include universities established under the UGC Act. In addition, there are institutions like the IITs, NITs, IIITs, IISER and NISER which had an annual intake of about 25,000 students in the year 2010, which is less than 1-2% of the capacity of the total system.

This large capacity expansion has created opportunities for young people to graduate in engineering and technical streams. While some of these institutions have done well in terms of the quality of education, overall, the graduates coming out have not been able to find appropriate employment while industries have been struggling to hire adequately equipped fresh engineers. While some of these institutions have postgraduate programmes, very little research work is done in these institutions. IITs and NITs, along with a few others, lead the quest for quality. While it is true that the IITs have to raise the bar of excellence further, they have to take leadership for driving the quality journey for other technical institutions too.

1.3 Centrally Funded Institutions

There are 88 Centrally funded institutions of technical and science education for students coming out of schools (10+2). Of these, there are 15 IITs, 20 NITs (another 10 NITs are proposed), 10 IIITs, 5 IISERs and 1 NISER. With the recent initiative of the Government, these institutions are receiving greater attention and financial support. We can expect a systematic upgrading of these institutions over a period of time. The NITs, along with some of the better engineering education institutions, should become important feeders of quality graduates into postgraduate and research programmes, including at the IITs. Some other institutions are relatively young and are likely to soon flourish into schools of excellence. The availability of high quality young scientists and technologists coming out from these institutions should enable science-based technological research pursuits in a much greater measure than what is possible at present.

1.4 50 + Years of Indian Institutes of Technology (IITs)

The Indian Institutes of Technology are now under The Institutes of Technology Act, 1961 and were set up to impart world-class, high quality education in engineering and technology at the undergraduate, postgraduate and PhD levels to students selected through national-level selection processes. Over the years, the IITs have distinguished themselves through excellence in academics and research.

1.5 The Beginnings

The origin of the IITs can be traced back to the interim report of the Sarkar Committee that envisaged setting up of institutions to meet the anticipated requirements of post-War (1939–45) industrial development. These institutions were to prepare high quality engineering graduates to meet the needs of developing India soon after Independence. Five IITs were established in quick succession in the 1950s. These IITs have now completed 50 years of existence.

The first IIT was established at Kharagpur in 1951. IIT Bombay came into existence in 1958 and IIT Madras, IIT Kanpur and IIT Delhi followed in 1959, 1960 and 1961, respectively. The first batch of 169 IIT graduates passed out of IIT Kharagpur in 1955. IIT Delhi had its first batch of 111 students pass out in 1966. All 5 IITs put together graduated 1201 students in 1967. These 5 IITs have grown in size over the years and in 2010–11, IIT Kharagpur alone admitted 1500 UG students into its various programmes.

After a gap of 34 years, a new IIT was set up at Guwahati in 1995. University of Roorkee was accorded the status of an IIT in 2001. Six new IITs came up in 2008 at Patna, Rajasthan, Hyderabad, Ropar, Bhubaneswar and Gandhinagar. Another 2 IITs came up in 2009 at Mandi and Indore. By 2009, the total number

of IITs rose to 15. In 2010–11, all 15 IITs together admitted 7678 UG, 7152 Masters and 1799 PhD students. The same year, 959 PhD degrees were awarded by the 7 established IITs.

1.6 Review of IITs

Over the years, the IITs have been reviewed thrice. The first review happened separately for each IIT. In 1971, IIT Madras was reviewed by a committee chaired by Professor P.L. Bhatnagar. This was followed by IIT Bombay in 1972 by Dr H.N. Sethna and IIT Kharagpur, Kanpur and Delhi in 1973 by Shri G. Pande, Dr S. Bhagavantham and Shri M.R. Chopra, respectively.

A joint review of all the IITs took place under the Chairmanship of Dr Y. Nayudamma in 1986. ^[12] The committee applauded the IITs for producing B.Tech graduates of excellent quality and comparable to the best in the world. It also commended the IITs for their role in upgrading of engineering education in the country but questioned their impact on national, industrial, economic and social development. The IITs were prodded to make a conscious and concerted attempt to excel in research and to be in the forefront in at least a few areas with research groups of international standards. The IITs were also asked to improve their interaction with industry through a variety of mechanisms. On the scaling up of quality technical education, the Committee felt that institutions like the Regional Engineering Colleges (later renamed as NITs) must receive infusion of funds and should be upgraded but did not suggest new IITs. Interestingly, they also suggested a cap on an optimum campus size of 2500 students for each IIT.

Since then the IITs have steadily grown in size and in 2002–03, all 7 IITs together graduated 2274 UG, 3675 PG and 444 PhD students with a faculty strength of 2375.

A second joint review of all the IITs took place under the chairmanship of Dr Rama Rao in 2004. The Committee report succinctly captures “Why IITs are Important to the Nation”.^[13] Among the many recommendations made by the Committee, the following are notable:

- Faculty matters: Provision to induct foreign nationals as faculty and joint appointments with industry.
- Research enhancement: Incentivizing research performance, strengthening PhD programme, bright B.Tech students to be taken into the PhD programme, identifying grand challenge, research problems, etc.
- Educational system: Science and HSS content in B.Tech must be enhanced; apart from basic research, projects that are design or business centric must be encouraged.
- Brand IIT through IPR: IITs must promote new thinking about innovation; dedicated IP management centres a must.
- IIT-Industry Linkage: Joint research projects with industry funds that will attract tax incentives, encourage and reward entrepreneurship of their graduates.
- Expansion: Increase in B.Tech intake is an absolute need; upgrading of existing institutions like the NITs.

The Rama Rao committee felt that there was no need for any change to the IITs Act for implementation of any of its recommendations.

1.7 IITs – Their Achievements, Aspirations, Concerns

In the recent past, IITs have undergone expansion at the UG and PG levels both in terms of new academic programmes and even a 54% increase in student intake. The IITs have initiated ambitious research efforts, entered the arena of

business incubation, learnt to engage with world-class universities through MoUs, etc. Five IITs have celebrated their golden jubilees and during that period paused to take stock of their achievements, articulate their aspirations and voice their concerns. The Committee's understanding of this is given below:

Achievements: As pointed out by 2 review committees, the IITs have met the challenge of creating a world-class undergraduate programme and attracted the intellectual cream of India into its campuses and produced graduates who have gone out to occupy positions of importance in all spheres of activities. Over 50 years, IIT has become a brand.

- Having established its educational programme, the IITs turned their attention to research and over a short period of 2 decades have risen in global stature consistent with the infusion of funds they have received.
- Academic programmes at the IITs underwent change continuously to keep pace with changing times. New programmes in upcoming areas have continuously been added. PG programmes have gained strength and PhD programmes have seen increased output.
- Funded research has gained momentum with tremendous increase in R&D funding. The total R&D funding of all the IITs put together in 2010 was about Rs. 573 crore.
- The IITs have turned their focus on patenting and technology transfer and have pioneered business incubation and are slowly growing in these fronts.

Aspirations: Having reached levels of achievement that have been noticed globally, the IITs now aspire for higher things.

- *Sustain the high quality education.* The IITs have put in place a world-renowned education system on their campuses. These academic programmes have a distinct character of rigour, flexibility, being futuristic,

integrally linked to research, strong in design component and being connected to local challenges.

- *Research that makes a difference.* Impact-making research that addresses major challenges faced by the nation and the world and important fundamental issues of the area are dreams that IITs wish to turn into reality.
- *World-class infrastructure.* Basic campus infrastructure, infrastructure for education, modern classrooms and laboratories, infrastructure for research, infrastructure that nurtures innovation and entrepreneurship, linkages with industry and society, and major investment in facilities to enable cutting edge research.
- *Outstanding faculty.* The need to attract top-class students of the nation into the teaching profession in large numbers is a challenging proposition. Attractive salaries, start-up grants, excellent research facilities and good campus life are factors that can influence this.
- *Performance evaluation and tenure systems.* These are possible ways of nurturing world-class faculty. Becoming a faculty at an IIT should become the most coveted position and must attract top UG students to PhD programmes, and the best among them to faculty positions.
- *Support systems:* Strong administrative and technical support will enable faculty to be productive, and achieve their potential.

Concerns: The IITs have concerns related to funds and human resource.

- Government funding of institutes of national importance has steadily grown over the years. The cost of research infrastructure to support cutting edge research in upcoming areas has far outpaced this increase in funding.

Further increase in public support is thus essential for improvement of the IITs.

- Availability of quality faculty is a major concern. Lesser numbers of top-class students are opting for postgraduate studies.
- Ageing physical infrastructure. Many of the buildings are 40–50 years old and need significant rehabilitation.
- World ranking of IITs by popular ranking systems have always disappointed the IITs themselves and all stakeholders who wish to see the IITs ranked within the top 100. Rising to meet this expectation is challenging and needs expansion of research activity, which is intimately linked to funding.
- The sudden increase in intake and the effort of mentoring the new IITs have strained the established IITs. All the IITs are suffering from infrastructure deficit and inadequate administrative systems and staff. Faculty is under strain due to the overload of academic as well as non-academic functions.
- Inadequate autonomy to chart out their own future.

1.8 HRD Minister’s Brainstorming Session with Chairmen, BoG and Directors of IITs

Shri Kapil Sibal, Minister, HRD, convened a Retreat of the Chairmen and Directors of all IITs and some members of the IIT Council on 4 February 2010. The main purpose of the Retreat was to draw an outline of the future vision of the IITs and how to bring them amongst the top 50 or 100 institutions in the world by 2020. The brainstorming session that followed discussed the following important issues:

1. Faculty induction and development
2. Academics: Rationalization of admissions and diversity in syllabi
3. Research: Infrastructure and outcomes
4. Governance issues: Finance, infrastructure and administration
5. Developing external linkages: Industry, Alumni, School system, Technical Universities

The sessions envisaged setting up of 6 committees to look into various aspects.

These are as under:

1. Committee under the Chairmanship of Prof. Anandakrishnan, Chairman, IIT Kanpur, to give a roadmap on how IITs can be among the top 50/100 institutions in the world in the next 5 years.
2. Committee under the Chairmanship of Prof. D. Acharya, Director, IIT Kharagpur, to consider issues of School Boards and Admissions into postgraduate courses such as M.Tech, M.Sc and MBA. The Committee should study the feasibility of designing an aptitude based SAT-like exam for admission into IIT courses.
3. Committee under the Chairmanship of Mr. Ajai Choudhary, Chairman, BoG, IIT Hyderabad, to suggest ways of diversification of syllabi to make it more industry friendly and relevant to the needs of a developing economy.
4. Committee under the Chairmanship of Prof Sanjay Dhande, Director, IIT Kanpur, for reporting the requirement of infrastructure for research.
5. Committee under the Chairmanship of Prof Gautam Barua, Director, IIT Guwahati, to give a blueprint of the new governance structure within IITs.
6. Committee under the Chairmanship of Prof T. Gonsalves, Director, IIT Mandi, to give a report on developing external linkages.

1.9 Dr Anil Kakodkar Committee – Formation and Terms of Reference

The Ministry of Human Resource Development (MHRD) vide its order dated 3 February 2010, constituted a Committee under the Chairmanship of Dr Anil Kakodkar, Chairman, BoG, IIT Bombay, to suggest a roadmap for strengthening the financial, administrative and academic autonomy of the IITs. The Committee includes eminent members like Shri T.V. Mohandas Pai, Member of the Board and Director, Human Resources, Infosys; Shri Hari Bhartia, Co-Chairman and MD of Jubilant Organosys; Prof. Ashok Jhunjhunwala, IIT Madras, Chennai; Dr. K. Mohandas, Vice-Chancellor, Kerala University of Health Sciences; Shri Ashok Thakur, Additional Secretary, MHRD.

The Terms of Reference for the Committee also included suggesting how to attract top students of the country into postgraduate studies in India, growth of the established IITs, establishment of new IITs and improving interaction among IITs, IIMs, IIIT, etc. The constitution of the Committee and detailed Terms of Reference are at Appendix I. Prof. Anandkrishnan Chairman, BoG, IIT Kanpur; Prof. Gautam Barua, Director, IIT Guwahati, and Prof. T. Gonsalves, Director, IIT Mandi, were subsequently co-opted with the Committee as the aspects to be looked at by their committees as identified during the Retreat overlapped with the terms of reference of the Kakodkar Committee.

1.10 Stakeholders' Voice

The Committee conducted an online survey to seek inputs from the various stakeholders of the IIT system. The survey was in the form of 58 questions grouped into 12 themes, and it was run for nearly a month (28 days) in July 2010. All the questions had a text box where respondents could express their detailed

opinion. In addition, 46 of the questions had radio-buttons for respondents to quickly indicate their reaction by choosing one of 3 options – Agree /Disagree/No Comments. Radio-button responses readily lent themselves to interpretation (as to what percentage agreed, disagreed, etc.). Textual responses, on the other hand, had to go through a detailed content analysis to extract the gist of the sentiments expressed. The survey registered 5170 visits and received 3755 responses. Each respondent identified him/herself to belong to one or more of the following 13 categories:

- 1 Alumni of IIT
- 2 Industry that hires IIT students
- 3 Industry that sponsors funded research at any IIT
- 4 Industry that hires consultants from IIT faculty
- 5 Industry at large
- 6 Educationist
- 7 Government official
- 8 Faculty of IIT
- 9 Current UG student of IIT
- 10 Current PG student of IIT
- 11 Current PhD student of IIT
- 12 Public at large
- 13 Staff of IIT

The survey reflected the expectations, hopes and aspirations of the various stakeholders. Many of them, as part of their constructive criticism, offered insightful, practical and “out-of-the-box” suggestions on how to take the IITs forward. They were also not sparing in their criticism on what ails the IITs and how to treat the “maladies”. A summary of these inputs is at Appendix II and all details are available at the online survey website. ^[14]

Brand IIT: A large majority agreed that “Brand IIT”, created mostly by the success of the alumni, is a “good thing”. But the IITs need to do much more to promote, sustain and leverage the Brand, and to make it truly world class. Their suggestions in this regard included more emphasis on publications and IPR generation, more industry collaboration and techno-entrepreneurial ventures, holding international technology/student festivals and marketing achievements and current initiatives using, if necessary, professional agencies. Periodic review of the structure and pattern of JEE to ensure true quality and caution against expansion at the expense of quality (including reservations) also figured in the responses.

As an Academic Institution: While the IITs do respond to new challenges, they will need to do much more, such as (i) attract UGs to PG programmes, (ii) attract and retain good faculty, (iii) attract experienced industry personnel in teaching and research, (iv) undertake innovative and industry oriented research and (v) achieve “world-class status”. This is necessary if the IITs are to remain centres of academic excellence. Several useful and diverse suggestions have been made for this. Most were against “diversification” to include non-technical disciplines (arts, law, medicine, etc.) for fear of brand dilution; instead they suggested partnering with reputed institutions in those fields.

Research: The quantum and quality of research, the respondents felt, must increase by focusing on industry oriented, India-centric, societal and environmental issues, as well as by encouraging interdisciplinary (other scientific disciplines, humanities and social sciences) and inter-institutional collaboration. Discouraging repetitive research, focusing on innovations and commercial viability and the use of indigenous knowledge are suggestions to increase the depth, diversity and relevance of the research efforts at the IITs. Every IIT can

concentrate on certain specific areas and become “top of the heap” in the world in those fields. The creation of a post of research director and permanent non-teaching positions, increasing UG and PG programmes, encouraging UG research while decreasing the overemphasis on B.Tech and setting up industrial parks (e.g. as done by IIT-M) are among the several suggestions received for improvement of research in the Institutes. There are many recommendations for improving laboratory management and for enhancing funding, including upward revision of tuition fees.

Improving Technical Education in India: While the IITs have excelled in producing high quality B.Techs, they need to do much more towards improving technical education in India and raising the level of general technical skills in the country. Suggestions in this regard include (i) training of teachers, (ii) organizing distance learning programmes and web-based classes/lectures for other engineering/technical institutes, and (iii) conducting workshops for schools and engineering colleges. Producing top-class PhDs, generating leadership in key areas to address problems/issues relevant to the country and focusing on select areas like water resource management, urban planning, etc., were suggested by the respondents. They also stressed the need for more industrial exposure for both UG and PG students.

As a Technology Provider: The IITs have not played a significant role as a provider of viable technologies for a variety of reasons (many have been cited). Chief among the suggestions for improvement on this score are (i) setting up industrial parks, (ii) government departments establishing R&D centres in or near IIT campuses, (iii) encouraging industries in their sectors to do the same, (iv) effective, accessible and transparent technology transfer/commercialization

mechanisms, and (v) better marketing of IITs' strengths and achievements. The IITs should, together or individually, set up mechanisms that will help translate the ideas and technologies emerging from the Institutes into viable industrial ventures. Such mechanisms/entities should focus on the selection of potentially viable technologies, identifying industrial partners/venture capitalists, initial hand-holding for technology proving, seed marketing and follow-up assistance until the industry can go forward with confidence. The large majority, including students, do not think that an R&D and innovation fostering programme will hinder academic activities. However, 33% of the faculty feels that it might!

IPR Generation: IITs must focus on IPR generation and protection. Among the suggestions in this regard are (i) easily accessible IPR offices with knowledgeable and interested faculty heading them, (ii) law courses with IPR focus ("legal-engineering bridge"- alumni's suggestion), (iii) courses in research ethics, (iv) programmes on the logistics of patenting that will help to understand the whole process and make it easier and faster. Over emphasis on publication is to be avoided. They must also devise ways and means to encourage/enhance creative thinking among students and faculty, and facilitate their becoming leaders in nation building, though there was no agreement on how this could be achieved.

As a Workplace/Employer: While most agreed that an IIT is a good place to work/good employer, reforms/ "change" in organizational structure and ethos are essential to make them much more efficient, agile and even-handed. More autonomy, liberation of the faculty from administrative yoke and recruitment of overseas faculty are the major suggestions in this regard. However staff and government officials did not offer any comments.

IITs and Society: The IITs must engage much more with the society through, among other things, local governments and NGOs, in local and regional issues such as sanitation, water management, road safety and environmental issues like pollution control technologies - green technologies - and adopt initiatives similar to the “corporate social responsibility” of companies (teaching in the villages, helping other colleges and universities, compulsory NSS, helping SMEs, etc.).

As Catalysts of Economic Development: The Institutes should become catalysts for economic development by working with industry to solve their complex problems, incubating knowledge enterprises, creating an engineering talent base and encouraging small industries. Focus must also be on fostering innovative ideas for futuristic technologies, student participation in industry related activities and on incubating enterprises catering to solving burning societal problems, even if they are not expected to yield immediate results. A majority however felt that the IITs are not easily accessible/responsive (except to “big” industries), with some even doubting IIT faculty’s ability/expertise in solving industry problems.

Mission, Vision and Mega National Projects: A majority of the respondents opined that the IITs have not formulated a clear vision and mission, or even if they have, not implemented it. IITs should join hands with IISERs, NITs, IISc and IIMs to take up large national projects, and should also cooperate with and complement each other. Most felt that teaching must be the main focus for UGs, and research for PGs; however, 32% felt that consultancy, with lower weightage, may also form part of the Institutes’ responsibilities. Setting up of overseas campuses was favoured by 36% (mainly for raising funds).

Financial Autonomy: While financial independence from Government was strongly favoured, most felt that the IITs should do a lot more to raise funds. They

have suggested several strategies for it, including generation of income from IPR, effective and persistent fund-raising efforts, industrial consultancy, joint ventures and even “radical privatization”. 32% suggested that IITs should become self financing by increasing the tuition fees. 71% favoured performance-based differential pay for the faculty.

Performance Evaluation of IITs: Most of the respondents are not aware if mechanisms and/or metrics are in place for performance evaluation of IITs, but felt strongly that such mechanisms must be put in place. Only 4 out of the 8 faculty who responded to the question, were aware of previous evaluation committees; they felt that no follow-up action was taken on the recommendations. Some felt that competition among the IITs may serve as an automatic evaluation mechanism.

1.11 China Visit

The Committee took up a study to understand best practices in world-class universities. While people are familiar with US universities of good standing, the same is not true with respect to Chinese universities. Several universities in China have world-class ranking. The team visited China during 3–6 November 2010 and met with key decision makers and stakeholders of select world-class universities in the Shanghai and Beijing clusters. While a detailed report on their observations, analysis and viewpoints is available ^[15] a brief summary is given below.

The higher education system in China has undergone a major transformation in the last decade. In some universities, the scale up has been to the tune of 6 times or more over a 10-year time span. Chinese university campuses are very large, some typically with 30,000–40,000 students studying and living on

campuses of around 1000 acres. Accommodation for students on the campus is compulsory according to the law. Around 1000 universities in China offer a 4-year programme. Of these, around 500 offer Masters programmes and 300 offer doctoral programmes. China will soon start producing around 50,000 PhDs annually. Some of the large universities already graduate around 1600 PhDs annually.

The budget in larger universities could well be above RMB 1.5 billion with a significant portion coming from industry. Universities have undergone considerable augmentation of infrastructure with several new campuses that have been recently established. Infrastructure upkeep is outsourced and was seen to be in an excellent state.

Universities enjoy institutional autonomy under Central government guidance. There is a system of comprehensive performance assessment of the faculty, which is done annually. Faculty compensation may vary by as much as a factor of 10 depending on the performance measured on the basis of teaching, research output, technology, resources brought in, IPR generated, linkage with industry/local government, etc. In very special cases, faculty compensation may even touch RMB 1 million.

Most of the universities that were visited had a large science park, some as large as 4000 acres, in close proximity. Such parks house a wide variety of industrial research, including technology incubators, start-ups, research parks and standalone industry R&D facility, all making up a large innovation ecosystem.

While the higher education system in China has gone through a major scale up, now there seems to be a greater attention towards enhancing quality. A graded system of support towards this objective is in place. To promote excellence, 100

better performing universities are supported under National Programme 211. Forty among them are specially treated under National Programme 985, with 9 best universities forming a part of the prestigious C-9 Programme.

1.12 Structure of the Report

This report is presented in 9 chapters. **Chapter 1** provides an introduction for the whole report and briefly outlines the formation of the IITs and goes on to summarize the growth of the IITs during the past 6 decades, summarizes observations of the committees that reviewed these institutes in the past and explains the circumstances leading to formation of this Committee. This chapter also summarizes what the stakeholders have to say about the IITs. **Chapter 2** takes stock of the IITs. **Chapter 3** looks at the IITs as research institutions and addresses how to get these to become world class through setting goals. **Chapter 4** dwells on issues of governance and autonomy essential to help IITs achieve excellence. **Chapter 5** takes a look at expectations from faculty and their roles and responsibilities. **Chapter 6** is on role of the staff at the IITs. **Chapter 7** looks at innovation and entrepreneurship at the IITs. **Chapter 8** is on the scaling of quality engineering education in India starting with the IITs. **Chapter 9** sums up the contents of Chapters 1 to 8.

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Chapter 2

Current State of IITs

Our country needs high quality scientists and engineers in large numbers commensurate with our national development needs and the size of our young population. Unfortunately, more than 500,000 graduates who come out of our engineering colleges annually (in the next 3 years, the number is likely to cross a million) have not met the expectations in terms of quality. This has resulted in a large number of the graduates coming out of these colleges being found unemployable needing training even while there is an acute shortage of capable engineers and technologists to meet the requirements of industry and other segments.

2.1 National Needs in Engineering Education

Engineers and technologists are required for practically every aspect of the nation-building activity, and management of infrastructure and new products that improve the quality of life. They are involved in activities that generate technologies and wealth and make the nation more competitive and powerful. In this new era of knowledge economy, there is a need to emphasize on creating an ecosystem that promotes innovation in our higher engineering and technological institutions. While the shortage of employable engineers and large disparity in quality among engineering graduates is in itself a serious issue and needs a resolution, a more serious issue is with regard to finding quality input to postgraduate education, training and research in engineering and technology. With India marching ahead, it must be able to develop technologies for itself as well as for global markets on a large scale. This necessitates a strong R&D and

innovation culture and pursuits in all our higher technical education and research institutions. For high-end activities that involve new technology and development, one needs to have high quality engineers and technologists at the postgraduate and PhD levels in large numbers. Since new technology often evolves out of new scientific knowledge, the disciplines of science and engineering have to co-exist. Most of our engineering institutions lack depth in science. Emerging India requires emphasis on high quality human resource with higher end capabilities in engineering and technology. Stated simply, we need considerable scale up in the number of PhDs in engineering with an attendant scale up at the graduate and postgraduate levels to provide quality inputs into research and technology endeavours, apart from other areas where also there are shortages.

2.2 IITs and National Scene in Engineering Education

While this challenge is very large and needs involvement of all our institutions and many more, the IITs, being on top of the technical education pyramid, have to lead the way and also significantly influence the quest for quality among others.

One of the distinguishing features of the IITs is their strong emphasis on research. The established IITs have a significant proportion of students (more than 50%) in their postgraduate programmes (Masters and PhD) in engineering, sciences and humanities. The IITs are thus perhaps the only institutions where engineering undergraduates study in an environment of research being done by a large number of postgraduate students. Some data on current student intake at all the IITs is given in Table 2.1.

Table 2.1 : Intake into 15 IITs

<i>Intake of Students into Various Programmes at IITs</i>									
S. No.	Name of the Institute	2009-2010				2010-2011			
		UG	Masters	PhD	Total	UG	Maste rs	PhD	Total
1	IIT Bombay	746	1,038	219	2,003	880	1,275	291	2,446
2	IIT Delhi	712	1,019	356	2,087	857	1,128	204	2,189
3	IIT Kanpur	785	464	196	1,445	987	618	173	1,778
4	IIT Kharagpur	1,289	1,354	352	2,995	1,512	1,582	380	3,474
5	IIT Madras	684	851	233	1,768	849	937	153	1,939
6	IIT Roorkee	905	885	313	2,103	1,008	997	160	2,165
7	IIT Guwahati	498	454	246	1,198	588	545	299	1,432
8	IIT Bhubaneswar	109	0	9	118	124	0	14	138
9	IIT Gandhinagar	109	0	14	123	128	0	8	136
10	IIT Hyderabad	112	32	29	173	125	70	50	245
11	IIT Indore	107	0	3	110	123	0	16	139
12	IIT Mandi	98	0	0	98	125	0	20	145
13	IIT Patna	120	0	29	149	120	0	17	137
14	IIT Rajasthan	106	0	0	106	134	0	1	135
15	IIT Ropar	104	0	10	114	118	0	13	131
	Total	6,484	6,097	2,009	14,590	7,678	7,152	1,799	16,629

Data on Masters and PhD degrees awarded, journal publications and R&D funding received by all IITs is given in Table 2.2. The 8 new IITs are too young to contribute to this effort.

Table 2.2 : 15 IITs - Degrees awarded, Publications and Funding

S. No.	Name of the Institute	Year of starting	Data for 2009-10 (Publications data is for 2009)						
			M.Tech Degrees Awarded	PhD Degrees Awarded	Faculty Strength	No. of Papers in Journals in 2009 www.scopus.com [#]	R&D Funding (Rs crore)	Consultancy (Rs crore)	Technology Transfer (Rs Crore)
1	IIT Kharagpur	1951	745	155	537	1209	142	10	0.353
2	IIT Bombay	1958	706	179	487	711	86	16	0.340
3	IIT Madras	1959	464	173	427	836	68	23	0.600
4	IIT Kanpur	1960	503	131	345	756	70	8	0.670
5	IIT Delhi	1961	625	138	417	887	57	19	0.085
6	IIT Guwahati	1995	205	48	251	389	18	4	0.090
7	IIT Roorkee	2001 [†]	682	135	379	590	56	30	-
8	IIT Patna [§]	2008	-	-	41	8	3	-	-
9	IIT Rajasthan [§]	2008	-	-	21	0	43	0	0
10	IIT Hyderabad [§]	2008	-	-	80	1	27	0.02	0
11	IIT Gandhinagar [§]	2008	-	-	43	6	0.4	0.17	-
12	IIT Ropar [§]	2009	-	-	14	0	-	-	-
13	IIT Bhubaneswar [§]	2009	-	-	46	7	1.7	1	-
14	IIT Mandi [§]	2009	-	-	14	0	0	0	0
15	IIT Indore [§]	2009	-	-	36	1	1.5	-	-
	Total		3,930	959	3,138	5,401	573.6	111.2	2.1

Notes:

- # Data on Journal publications is got from www.scopus.com. Typical query used is : (affil ("Indian Institute of Technology Indore") or affil (IIT Indore) or affil (I.I.T. Indore)) and pubyear is 2009 and srctype (J)
- * Established in 1847 as Roorkee College and in 1947 named as University of Roorkee. Year of conversion into IIT is 2001.
- \$ These IITs are 2 to 3 years old and too early for PhD/Masters students to graduate

The pursuit of education and research together benefits both the students as well as the faculty. Further, PhD programmes are excellent vehicles for training in research and problem solving. Enhancing research in IITs both in terms of quality as well as number of researchers is thus a national necessity. The IITs should become centres of learning through their frontline research, technology power houses through comprehensive R&D, globally recognized knowledge centres through the quality of their human resources and output at the doctorate and masters levels and, finally, credible solution providers to support society and industry. Indigenous technology and innovation at the cutting edge are crucial for India to succeed in global competition and frontline research is crucial for doing so ahead of others. This requires pursuit of research, technology and education in a strongly interlinked manner to maximize the synergy. This also requires several disciplines in science, engineering, management and humanities to work together to address the problems needing resolution. We thus need several major centres where there is an ambience of scholarship that sustains strengths in individual disciplines, of research that takes each discipline forward, of technology development that leads to better quality of life for our people, generates wealth and provides solutions and advice on different aspects of national development. Such an ambience provides an excellent holistic learning opportunity to students and prepares them as competent professionals who can take India forward. We

must remember that as India moves up the ladder in global competition, we would need professional capabilities in research, technology and deployment that are much more demanding than they are at present. Clearly the IITs, with their achievements so far, provide an excellent launching pad for reaching new heights.

2.3 IITs and Global Scene in Engineering Education

There is thus a strong need to take the IITs even further as world-class institutions with global ranking nearing the top. QS World University Rankings is one of the popular rankings. Appendix III gives the QS World Rankings for the top 10 ranks, followed by some of the more well-known institutions, and also the first entry for each country ending with the first entry for India. India figures at Rank 187 with IIT Bombay. Eleven Institutions from India which figure in the QS Rankings for 2010 are given in Table 2.3. It must be noted here that QS ranks only those institutions that have a UG programme.

Table 2.3 : QS Ranking of Some Indian Institutions of Engineering Education

<i>Sl. No</i>	<i>QS Rank 2010</i>	<i>Institution</i>
1	187	Indian Institute of Technology Bombay
2	202	Indian Institute of Technology Delhi
3	249	Indian Institute of Technology Kanpur
4	262	Indian Institute of Technology Madras
5	311	Indian Institute of Technology Kharagpur
6	371	University of Delhi
7	401–450	Indian Institute of Technology Roorkee
8	451–500	University of Mumbai
9	501–550	Indian Institute of Technology Guwahati
10	501–550	University of Calcutta
11	551–600	University of Pune

University ranking and the methodologies that are adopted have attracted much criticism as well as acclaim. Even so, they do serve a purpose in qualitative comparison of different institutions. But they need to be used wisely in order to derive benefits. The following simple scenarios bring out certain interesting observations. Many of the top-ranking institutions have a Medical School. QS has classified all IITs to be without a medical school, which is accurate. The ranking of IITs in comparison with institutions without a medical school is shown in Table 2.4.

Table 2.4 : Influence of Medical School on QS Ranking

<i>QS Rank within Institutions w/o Medical School</i>	<i>QS Rank 2010</i>	<i>Institution</i>
1	5	Massachusetts Institute of Technology
21	187	Indian Institute of Technology Bombay
24	202	Indian Institute of Technology Delhi
37	249	Indian Institute of Technology Kanpur
39	262	Indian Institute of Technology Madras
124	501–550	Indian Institute of Technology Guwahati
125	501–550	University of Calcutta
146	551–600	University of Pune
<p>Note:</p> <p>The above list looks at institutions that are classified by QS to be focusing on all 5 areas but do not have a medical school. QS has wrongly classified IIT Kharagpur to be focusing only on 2 areas and without a medical school. For this reason, IIT Kharagpur is missing from the list.</p>		

QS Rankings consider the 5 areas listed below for measuring diversity of disciplines on campus:

1. Arts and Humanities
2. Life Sciences and Medicine
3. Natural Sciences
4. Social Sciences

5. Engineering and Technology

QS considers all IITs, except IIT Kharagpur, to be focusing on all these 5 areas though in reality most IITs are not. (IIT Kharagpur is considered to be focusing only on 2 areas.) This fact also adversely affects the ranking of IITs.

A significant factor in ranking is the quality and quantity of research and perception of peers, which again is heavily influenced by the quality of research. Thus, research output significantly influences these rankings. Hence, a scale up of PhD programmes in the IITs, which is in fact a national necessity, can be highly beneficial. Rather than doing so as a one-step process, we should target a planned scale up over a reasonable period of time. We must ensure that quality is also enhanced as we increase the number of PhDs. This would necessitate, in addition to academic rigour, considerable augmentation of research infrastructure that includes top-class laboratories for the pursuit of world-class research, laboratories for focused technology development needed by industry and national missions and an environment that nurtures innovation and entrepreneurship. Students should be able to participate and have firsthand experience of practicing what they learn in the classroom for problem-solving endeavours that make a significant impact. They should learn to participate in multidisciplinary efforts for such problem-solving activities that involve research, technology development, innovation and entrepreneurship, and management and societal deployment skills. Even as they do so, their grounding in a core discipline of their choice must remain very sound.

As it is, the IITs are currently facing an acute shortage of faculty when it comes to coping with the increased admissions and needs of the new IITs. Even after the most aggressive faculty recruitment drive by tapping all possible sources, there would be shortages. A significantly enlarged PhD programme would thus

find strong justification on this account alone. The number of PhDs that the country would need is of course much larger. There is a large requirement of faculty in higher technical academic institutions. Further, there is need for PhD-level induction in the R&D activities of national laboratories and industries. We should thus encourage PhD programmes at several academic and research centres in the country. However, looking at the abysmally small number of PhDs (refer Table 2.5) we produce in engineering and the state of research in different institutions, it is clear that most of this load would have to be borne by the IITs. Comparative data on population, GDP and number of PhDs in Engineering and Technology in USA, China and India are shown in Table 2.5.

Table 2.5 : India, China and USA: A Comparison

<i>Country</i>	<i>Population (billions in 2009) Source : World Bank</i>	<i>GDP \$ T (2010)</i>	<i>No. of PhDs in Eng & Technology</i>
USA	0.31	14.1	7634 in 2009 ^[1]
CHINA	1.33	5.0	12000 in 2006 ^[2]
INDIA	1.15	1.5	1000 in 2006 ^[3]

To achieve such major transformational changes and sustain them at a level of excellence that is world class would need an autonomous governance model that is driven by a sound and enlightened philosophy, has strategic vision and flexibility to nurture talent and adjust to specific needs, commitment to objectives and adherence to the principle of accountability at the level of expected deliverables. Such a governance system has to be based on decision-making capability entirely within the institution which is duly guided by an enlightened

peer group both from within the institution and outside. Such institutions need to be liberally funded so that they can be host to a large talent pool and a magnet to attract even greater talent. The World Bank report *Challenges of establishing world class universities* [4] provides a good insight into what constitutes a world-class university. The features of such an institution are depicted in Figure 2.1, which is based on Jamil's report.

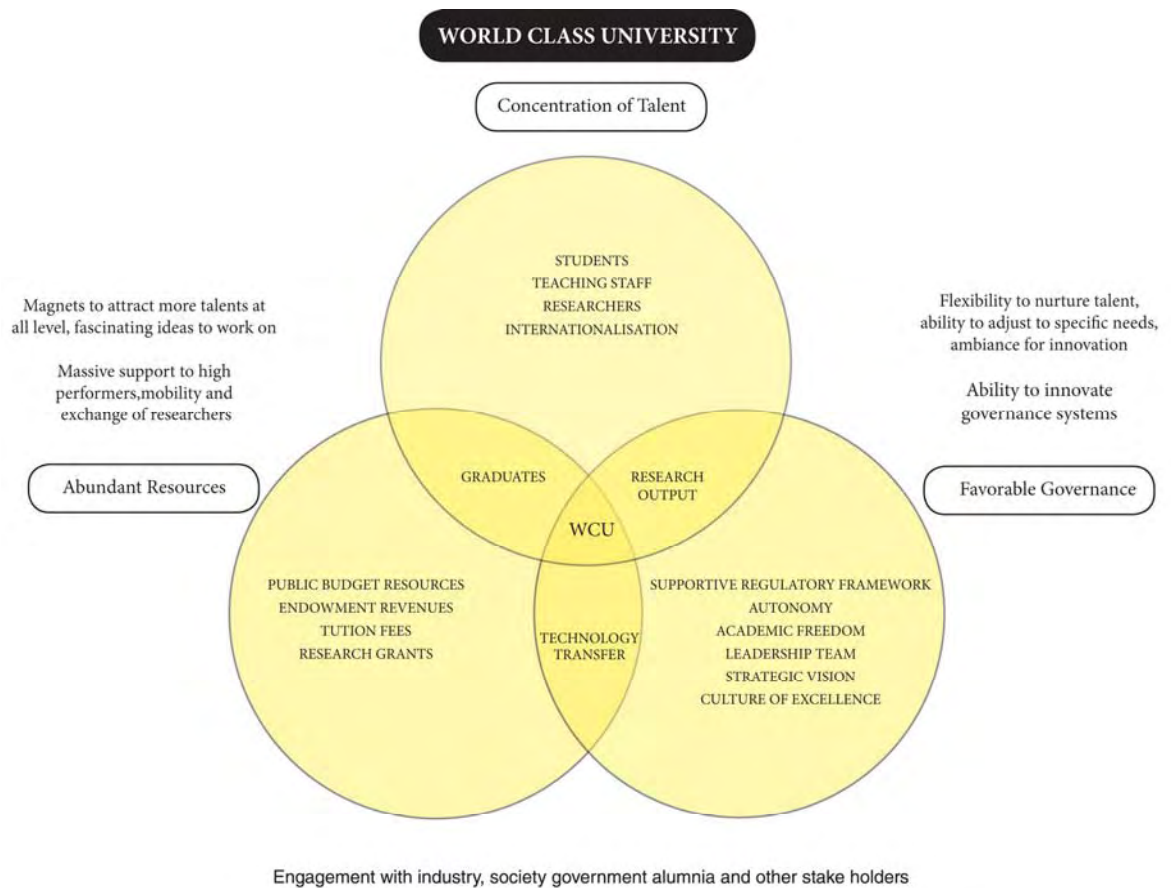


Figure 2.1 : Challenges in Establishing World-Class Universities

Source: Adapted from Salmi Jamil, *Challenges of Establishing World-Class Universities*, World Bank, Washington DC, 2009.

We must also recognize that the IITs have proven their credibility and should be enabled to move to higher levels of excellence and realize their full potential. As long as they demonstrate their performance following some predetermined benchmark on human resource development, research excellence and technology leading to value, we need not hesitate in treating them differently from the rest of the public-funded systems in the Government. Since we are looking at IITs as the engines of India's technological and economic growth in a competitive world, this approach is justifiable. A world-class institution needs a world-class governance model.

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Chapter 3

IITs as Research Institutions

We live in a rapidly transforming knowledge era. Therefore we need high-level knowledge workers, with the capability to design and innovate, in large numbers commensurate with our large population and our growing economy. Further, we need to be able to produce leaders with the vision and ability to transform and to sustain ourselves in the interdependent and competitive world. Technological capability of the country and more importantly in today's context, creating an innovation ecosystem is the key to India's rapid progress towards the highest levels of economic and social development. The IITs thus have an important role in leading India's emergence as a producer of high technology in the country and the world and its translation to the marketplace.

While it is welcome and necessary for IIT education to become wider and holistic and have programmes in humanities, management, law and medicine, it is however necessary that all such programmes have focus and orientation towards technology.

While doing so, the IITs have to also make a difference to the model of inclusive development through delivery of appropriate technologies. This requires research at the IITs to be scaled up and moulded to the above-mentioned objectives. Presently, the IITs and IISc are the only institutions that produce PhD scholars in engineering in some significant numbers. This, however, is far too insignificant considering the requirement of higher technical education and research alone. In the not too distant future, we should expect industries to need PhDs in large numbers to support their own research needs. The reputation of the IITs is built largely by their B.Tech and M.Tech alumni (most Indian industries

and government institutions have a large number of IIT M.Techs). Their reputation as research institutes is not as high. Neither have they made as significant a contribution to the development of technology. Their role in identifying and defining the technologies that would be of special interest to India has so far been limited (though in some specific areas some IITs have made a small mark). It is necessary to change this focus and make the IITs into world-class institutions engaged in education, research, technology, innovation and society–industry engagement in the specific Indian context. We need to realize this goal by building on the achievements and gains realized so far.

It is also to be noted that most reputed engineering institutions in the world have acquired a certain size. The faculty strength in those institutions is close to 1200 or more and the number of students is more than 12,000. The IITs, in comparison, are small. The established IITs have about 500 or less faculty members and the number of students is around 6000. Even though infrastructure may limit the growth of certain IITs, the Committee feels that each IIT should strive to have 1200+ faculty members and student strength should be closer to 12,000. The growth, however, in accordance with the focus on research, should come mainly from PhD students.

3.1 Scaling at IITs

3.1.1 Research Scholars

A large number of highly talented research scholars working with eminent faculty in a very supportive environment is an important feature of a world-class research institute. The IITs graduate about 1000 PhD scholars per year now, though the numbers admitted have increased significantly in the last couple of years. Research scholars doing MS are also not significant. The number of M.Tech

students has slowly increased over the years and to a limited extent they contribute to research. It is here that the IITs have to change. They have to significantly increase the number of its PhD scholars up to a scale that matters. The number of PhD students graduating in India in engineering and technology is around a factor of 10 less as compared to China and USA. Considering the population and likely scale of India's economy in the near future, the number of PhD scholars graduating should be comparable.

Till recently there were 7 IITs. Eight new IITs have been set up in the last few years. These are just beginning to recruit their faculty. At the same time, the established IITs still have significantly less number of faculty members than they require. Although adding a large number of IITs in a short time has been a major challenge and perhaps should have been a more gradual process, there is an urgent need to scale up the IIT system looking at their needs. It is likely that about 5 new IIT would be set up in the coming decade (making at least one IIT in each major state). These would all require faculty. PhD graduates of IITs would form a major feeder for IIT faculty. Other educational institutes would also require PhD graduates to strengthen their faculty. At the same time, as industry becomes stronger in India, they would need large numbers of PhDs for their R&D activities.

We recommend that the IITs should strive to increase the number of PhD graduates from the currently less than 1000 PhD students graduating each year, to 10,000 research scholars graduating every year by 2024–25. As a PhD student would normally take 4 years to complete the programme, 10,000 PhD scholars need to be admitted to the PhD programme at IITs by 2020–21. This is the minimum number that would be required to meet the country's requirements. For 20 IITs, it would mean an average of 500 PhDs. The established IITs have to strive

to reach a number of 800 to 900 PhDs graduating each year, so as to provide leeway and time to the newer IITs to gear up.

The first reaction of most would be that such a scale up is not possible. While it would not be an easy task, we would suggest the means to ensure that such numbers are indeed achieved. There is little doubt that such numbers are required by India. That it would be a big challenge for the IITs is also obvious. But this becomes an opportunity not only to contribute to the nation, but also to transform the IITs.

3.1.2 Faculty

Scaling of PhD scholars is not possible without scaling faculty numbers.^[1] In fact, while significant faculty strength is required to produce a significant number of PhD scholars every year, the PhDs produced in the IITs would become a potential input and allow the number of faculty members to grow. Some top-level research institutes in the world produce about one PhD graduate for each faculty member (who is not on leave). This ratio for the IITs is much lower.

The Committee recommends that the IITs quickly get 0.6 PhD students to graduate for each faculty member every year and then strive to get to 1 PhD student to graduate per faculty each year in the years to come, with an assumption that the IITs would not let quality decline as they scale up. These ratios will establish IITs as premier research institutions. With an average of 0.6 PhD graduates for each faculty member and a target of 10,000 PhD students graduating from the IIT system every year, faculty strength at the IITs needs to grow to 16,000 by 2020–25. This is indeed a tall task, given that the number is less than 4000

¹ Even though hiring new faculty has been difficult, the IITs have been hiring many more faculty in recent years.

today. But if we are aggressive and continue to produce over 0.6 PhD graduates for each faculty, it is possible to reach these numbers, as shown in Table 3.1 (the numbers below are just an example of what can be done):

Table 3.1 : Aggressive Growth of Faculty at IITs

<i>Faculty at IIT: Aggressive Growth by Rapidly Expanding PhD Programme</i>						
<i>Year</i>	<i>No. of PhD students admitted</i>	<i>No. of PhD students graduating</i>	<i>No. of IIT PhDs joining as faculty</i>	<i>No. of faculty joining from outside</i>	<i>Retiring IIT faculty</i>	<i>Total IIT faculty</i>
2010						4,000
2011	2,600	1,200	420	280	240	4,460
2012	3,122	1,600	560	373	223	5,170
2013	3,619	2,000	700	377	207	6,040
2014	4,530	2,400	780	420	181	7,059
2015	5,294	2,470	803	344	176	8,030
2016	6,424	2,966	890	381	201	9,100
2017	7,280	3,438	1,031	344	182	10,293
2018	8,234	4,304	1,184	395	206	11,666
2019	9,333	5,029	1,257	419	233	13,109
2020	10,487	6,103	1,221	407	262	14,475
2021	11,580	6,916	1,037	346	362	15,496
2022	12,397	7,822	978	245	387	16,332
2023	13,066	8,866	887	222	408	17,033

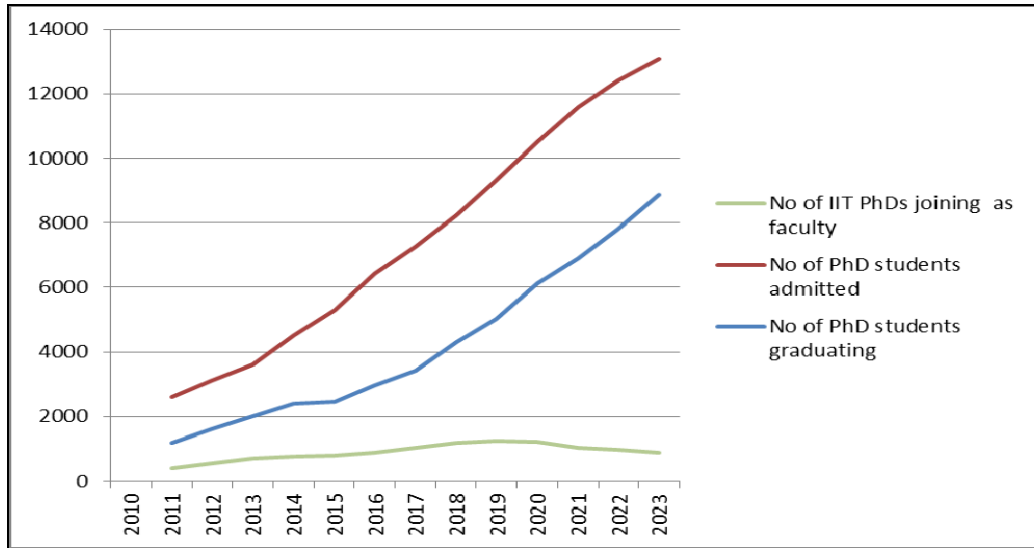


Figure 3.1 : Growth in PhD Programme

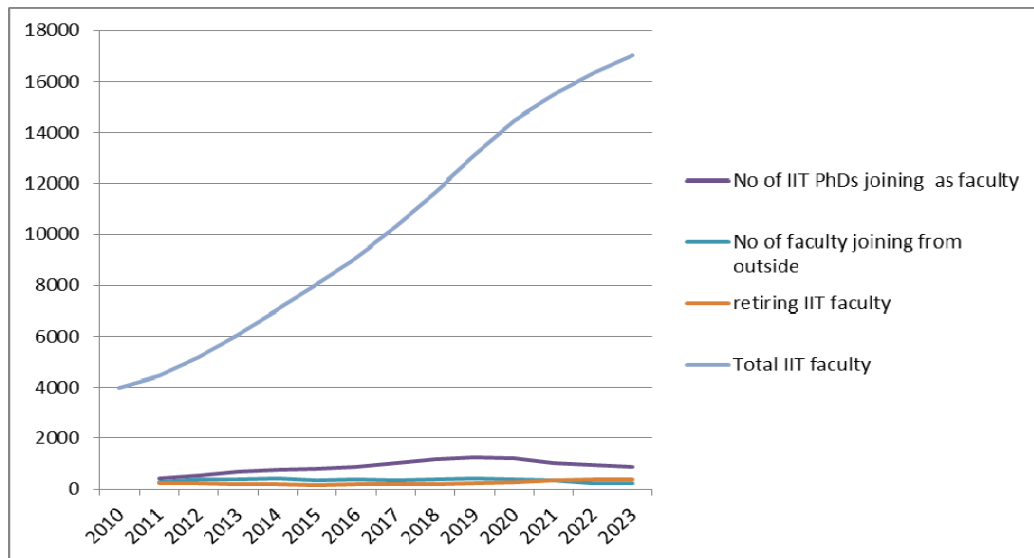


Figure 3.2 : Growth of Faculty at IITs

This assessment makes certain assumptions. These are:

- (i) The number of faculty today is about 4000.

- (ii) On an average, a PhD student takes 4 years to complete his/her programme. 95% of those admitted would get their degree (5% drop out).
- (iii) PhD graduation in the next 4 years is assumed to be 1200, 1600, 2000 and 2400; after that, 95% of those admitted 4 years ago, will graduate.
- (iv) The IITs today are aggressive in admitting PhD students. It has been assumed that the IITs will admit 0.65 PhD students for each faculty member in 2012, which will grow to 0.8 PhD students per faculty by 2016. Individual IITs may admit more.
- (v) It is expected that larger numbers would join industry as they will start paying higher salaries once they recognize the importance of in-house R&D. Thus, the percentage of graduating PhDs joining the IITs as faculty will initially be high (35%), as the newer IITs have to build their faculty strength. But it will drop to 25% in a few years (30% by 2016 and 25% by 2019); that is, by the time PhD students from industry and other institutes start graduating. The number will fall further to 20% and even 10% as the IITs reach closer to 16,000 faculty numbers.
- (vi) The percentage of faculty who come from outside the IIT system is initially high (40% faculty intake will initially come from this category) as the number of IIT PhD graduates are now low. But it will go down to 20% in about 10 years' time.
- (vii) With these assumptions, one can reach close to 16,000 faculty by 2022 and 10,000 PhD students admitted by 2020. Even with marginal changes in these assumptions, it is indeed possible to come up with a plan to achieve the target numbers.
- (viii) Retiring faculty is high in the beginning (as high as 6%); it will drop to 1.5% in about 5 years' time. This is because a number of senior faculties at the

IITs are likely to retire in the coming years. But with young faculty joining thereby forming a large base, the number of those retiring is going to go down in some years. It will again rise to 2.5% by 2025.

3.2 Where will the PhD students come from?

The next obvious question is, where would this large number of PhD intakes come from? Today, the IITs struggle to get quality intakes for their PhD programme and the number of joiners is rather inadequate. To enable a much larger number of PhD intakes (10,000 per year), the Committee suggests that the IITs consider three largely untapped streams for intake, besides the current one. These would include:

- a) Admitting bright undergraduate (UG) students for PhD at the end of their 3rd year undergraduate engineering programme from any institute in India. The IITs would have to take up a programme to identify such students purely on the basis of their academic performance of the past 3 years, recommendations from their teachers and evaluation of their research potential as identified through an interview (conducted by the IITs). Once identified, these students would be admitted immediately in an IIT and would complete their B.Tech programme as well as their PhD in about 5 years' time. The UG degree could be awarded by the institute they came from and the PhD in due course by IIT. The IITs should aim to take 2500 such youngsters for PhD programmes from this stream every year.
- b) Teachers from other institutes in India joining an IIT for PhD. The programme is to be somewhat similar to the Quality Improvement Programme (QIP) of yesteryears. Appropriately rechristened, the programme should be supported by MHRD by partially paying their salary in addition to tuition fee for the 3

years that they would spend at an IIT. With over 3000 engineering institutions in the country, it should be possible for the IITs to admit 2500 such teachers every year for PhD.

- c) Attracting youngsters working in industry to join part-time PhD programmes. While the provision for such admissions exists, it has to be further liberalized; for example, these youngsters could take up their course-work on video, even while they are at the industry. Their one-semester mandatory stay at IIT could follow while they take up their research work. The IITs have to strive to get 2500 youngsters from industry every year for their PhD programme.

Each of these three streams would require some action by the IITs; they would not get the numbers by simply waiting for students to come. The IITs have to take upon themselves to attract students. If each of these three streams ensures 2500 intakes each year and another 2500 come through the existing channels, it should be possible for the IITs to attract 10,000 PhD students every year. Incentives to attract students to do PhD and later join the IIT system as faculty, as discussed later, should help the process.

3.2.1 Undergraduate Students and Student–Teacher Ratio

To sustain such a large PhD programme, we need a large UG programme of high quality as a feeder. Later in the report we will discuss the strategies the IITs need to adopt to facilitate this in institutions other than IITs. The IITs have always aimed to maintain a student: teacher ratio of 10:1, considering that it would be a research institution. They have also always strived to have a PG : UG ratio slightly exceeding 1:1. The Committee feels that these are the correct numbers to pursue. Undergraduate education in an environment of high-level research and search for

solutions of importance to industry and national development is an important feature. The IITs are the only institutions that have done this on a large scale so far. Thus, continuing with UG programmes at the IITs is important. With 16,000 faculties across 20 IITs, the total number of students would work out to 160,000. With the PhD programme outlined above, the number of PhD students would be roughly two-and-a-half times the number of faculty, or 40,000. Other PG students (Masters level) could account for another 40,000 and UG students could be 80,000. This would give a PG: UG ratio of 1:1. It is recognized that some IITs may have more PG than UG students but, overall, the IITs could strive to have 80,000 UG students thereby ensuring an intake of 20,000 per year. The numbers will stack up as follows:

- (i) Faculty: 16,000
- (ii) PhD students: 40,000 (10,000 admitted each year)
- (iii) Masters level students: 40,000
- (iv) UG students: 80,000 (20,000 admitted each year)

Such numbers at the IITs would not only make them into research institutions, but also contribute significantly towards enhancing the national strength of India in terms of academic pool, engineering research as well as technological capability. This would also lead to major improvement in the quality of other engineering institutions in the country.

3.3 Diversity on Campus

Several measures taken in the past have made education at the IITs fairly inclusive for socially underprivileged classes and today they constitute 49.5% of the student population in an IIT. This inclusiveness has however not extended to women. In 2010, only 12% of those who qualified in the Joint Entrance examination (JEE) were women. This was a mere 6% just 5 years ago in 2005. JEE data reveals that the percentage of women appearing for the examination is itself low. In 2010, only 25% of those who appeared for JEE were women (this was 15% in 2005). While the success rate in JEE is 3% for men, it is only 1% for women. National data shows that among those who earned degrees in engineering/technology in 2005, women constituted 21% ^[2] and this percentage must have increased over the past 6 years. The low percentage of women in the UG community in IITs has perhaps to do with coaching that underlines success in JEE. Intensive coaching that often demands long hours away from home (or even days away from one's home town) at an early age, can often be a deterrent for women aspirants.

Measures that will encourage women to seek entry into IITs are hence considered essential and the following recommendations are made towards achieving this.

- When there is a tie in total marks in JEE, the rank is decided by marks in individual subjects. It is recommended that whenever there is a tie in total

² 'Educational Statistics at a Glance 2005–2006', MHRD, Department of Higher Education, 2008.

marks, women may be ranked higher than men. Individual subject marks may then be used to rank within men and women as before. This will help women get better choices of branch. Also, some more women at the bottom of the merit list may benefit from such a system.

- Women, who get admitted and are required to pay a fee, may be reimbursed 50% of the fee amount by the Government.

3.4 Research Infrastructure

To support such a large research programme, we need considerable augmentation of research infrastructure at the IITs. Further, such a research environment should be broad based, covering several aspects such as research to push the frontiers of knowledge, research to address the challenges in science, and development as well as research to meet the needs of national technology development and industry. The IITs are already in the mode of taking up large programmes involving several disciplines and research groups drawn across all institutions (IITs, NITs, IISERs, IISc, etc.) to address certain key national challenges. The Committee recommends further augmentation of this trend over and above the expanded research activity through research projects brought in by the expanded faculty. Other aspects of augmentation of the research infrastructure at IITs are discussed in the following sections.

3.5 Technology Leadership

- (i) Each IIT should aim to acquire technology leadership in at least 3 or 4 areas. To be world-class universities, the IITs should strive to be among the best institutes in some discipline(s). No university can be uniformly good in all areas. At least to begin with, it has to excel in any one area. The IITs should

put in place a system which allows, enables, encourages and supports it to start excelling in areas that it can. The aim should be that within 7 to 10 years, each IIT should be among the best universities in at least 3 or 4 areas.

- (ii) There has to be a conscious effort to attain leadership as this does not happen automatically. World-class excellence is not acquired by simply choosing some areas and allocating funds. The IIT system has to consciously allow areas it excels in, to forge ahead. It has to be done at the department levels as well as at the institute level. The simple representative system in committees would not encourage select areas to get ahead, but will act as a leveller.
- (iii) As the IITs attempt to recruit the best faculty in each area,
 - i. They have to watch in what areas *faculty members are excelling*
 - ii. Where *natural groups are being formed* (one cannot become the best in technology today without a sizeable group of faculty members and research scholars from multiple disciplines working together)
 - iii. Where they are *able to attract national and/or international attention* and acquire funds, attract *fresh talent* from India and abroad and where they are able to *collaborate with industry and make a difference* there. As such, areas and groups are identified; institutes need to pay special attention to the area and the group. They need to provide more internal funding and space and make special efforts to hire more faculty members and research scholars in the area. Only at this stage do the IITs need to declare these as special or core areas. These areas need to emerge in a competitive manner (high peer interest in emerging frontline areas, attracting external research funding, strong interest among young talent, recommendations of institution/department review, stakeholder interest in frontline research, etc.) and not identified by some internal committee/director. Such groups

should be funded to their maximum absorptive capacity. The IITs have to then protect these groups from committees and departments that may discourage them and sometimes resent the special attention paid to such specific areas and groups.

- iv. At the national level, such groups need to be identified, promoted and challenged to do more. The Department of Science and Technology and other ministries need to provide higher funding and use such groups to do more. Industrial collaborations in such areas need to be taken to new heights.

3.6 Industry Interaction

Encouraging industry to set up their research labs at IITs Indian industry has been changing rapidly in the last 10 to 15 years. Today they want to become the world's best. Unlike in yesteryears when they depended entirely on import of technology, today Indian industry recognizes the necessity to carry out and participate in R&D to master their technology. Unfortunately, they have little understanding or experience in conducting research, though they may have acquired the ability to indigenize and productize technologies.

The IITs, on the other hand, have shown over the last 50 years to be islands of excellence in India. They have built an academic and research culture par excellence, untouched by many ills of the society around. They however have had limited experience in working with industry.

The IITs and industry form a perfect complement to each other in such a situation. They however do not understand each other. Living in their own world, they do not communicate and hold on to the opinion that the other is of little good. IIT faculty would often say that if only Indian industry was like that in the

West, they would have had no difficulty. Industry, on the other hand, believes that the academia in the West would deliver and are more willing for tie-ups with industry and fund them generously. It is imperative that both of them break this logjam.

IIT Madras recently created an IITM Research Park (IITMRP) to overcome this problem. They helped create an infrastructure just outside IITM for industry to set up their R&D facilities. In many ways, it is just like any other infrastructure which would house R&D centres of companies. But situated at the boundary of IIT (with a proposed flyover providing a connected campus), this has one difference. One of the conditions for setting up their research laboratory in this Park is that they must collaborate with IITM. In fact, IITM has evolved a measure of this proposed collaboration in the form of credits earned by industry for every interaction and require that industry acquire a minimum number of credits for each square feet of area that they occupy at the Research Park. Having placed industrial R&D and faculty (and students) on a connected campus and creating an obligation for industry to collaborate with IIT, would soon begin breaking the logjam discussed above.

In other words, it is highly desirable that industries set up their R&D labs on campus (or adjacent to campuses). Industry will benefit immensely from such an arrangement. This will help them get acquainted with the faculty and research scholars and understand their expertise and abilities. Using them for their R&D activities would then be only a matter of time. They would be able to train their research personnel with short-term courses, and part-time MS and PhD programmes offered by the IITs. They would also be able to identify bright youngsters to hire and involve students on a part-time basis in their research. They would be in position to create an industry–academia consortium to

influence policies where required, make contributions and influence the standards and bid for larger projects. At the same time, they would be in a position to quickly learn the basics of research and tap the IITs to learn about the latest research going on anywhere in the world. As the IITs have multiple departments, industrial research could leverage their cross-disciplinary expertise.

For IITs and faculty, such labs would enable them to transform themselves. To begin with, the faculty could learn the commercial aspects of the products and services in the areas that they work on. They would be able to understand the technical challenges faced by industry, and also analyse what it takes to make research commercially usable and enriching, and expand their R&D. They would also learn how to productize research. They would be able to tap experienced personnel as part-time MS and research scholars. Besides, together with industry, it could set up on campus (or adjacent to campus) research facilities they would not have dreamt of setting up alone. They would jointly be able to attract larger government funds in addition to getting funding from industry. It would help to know that China has around 300 research parks, and, in Sweden 56 science parks and incubators host around 4500 companies.

3.7 Interaction With Government Agencies

Encouraging and enabling various government departments and ministries to set up R&D labs at IITs Most government departments and ministries (for example Power, Railways, Airlines, Surface Transport, Mines and Minerals, Communications, Alternative Energy, Coal, Oil and Gas, Industries and others) do not spend much on R&D. They need to spend a minimum of 2% of their total budget on R&D and help create and develop technologies which could transform their respective sectors. As India continues to grow, it is important that

government departments use R&D to push industry to higher technological capabilities in their respective sectors.

The problem is that most ministries know little about R&D and would not know where to begin. The R&D culture in many ways is an anti-thesis of the bureaucratic culture. While the latter may be useful for governance, control and management, R&D in such a framework will be a non-starter. The IITs, on the other hand, have created an R&D culture at their institutes and know what it takes to pursue excellence. It will be highly desirable if each ministry sets up its R&D labs at one or more IITs. Procedures would have to be evolved so that while a board chosen by a government ministry (which includes IIT and laboratory representation) defines the broad objectives and budget and approves specific projects proposed by the lab, the governance issues, research leadership and detailed programme development comes from within the lab and IIT. It would be also advisable that the ministries then encourage industries in their sectors to set up their R&D labs around such government R&D labs.

One of the purposes of these labs set up by various ministries would be to stay on top of the state of art in its sector. It would identify how India could acquire strategic advantage and define the technologies it needs to develop and acquire in the years to come. Working with industries in its sector, it would learn to take technology from lab prototypes to products and make them commercially viable. It would identify the role that technology could play in taking its industries to a commercially advantageous situation.

For the IITs, these labs would be a great boon. Besides bringing in funds, equipment and industrial contacts, it would enable their research to become more industry focused. Their research scholars and students would gain a lot by working in such labs, complementing their theoretical knowledge with practice. In

this context, the development of Chinese capability in High Temperature Reactor offers a good example. The programme was visualized and developed in Tsinghua University as a technology need of the future. Today, the entire national technological capability in this area of high future potential is with the University, including a small operating nuclear power reactor based on this technology. Internationally, it is now recognized that this would be one of the key technologies to support sustainable carbon dioxide-free fluid fuel supply in the future.

3.8 Executive M.Tech Programme for Industry

Industry in India employs a large proportion of the half a million engineers graduating every year in India. As many of them are not adequately trained, industry spends significant time and effort to train them. But as industry becomes increasingly stronger, it feels the need for their employees to acquire a higher academic degree while still working. The opportunity to acquire higher qualification is a strong motivation for employees and helps in reducing turnover with professionals focusing on specific areas of specialization. One critical constraint is that the employees cannot spend any significant residency period at the IITs or other institutes. The entire programme has to be based on online interaction, and supervision of projects, etc. by qualified mentors at their workplaces. The pace at which an employee goes through the programme has to be variable, depending on the employee's abilities and workload at different times. As such, the constraints imposed by the course structure/schedule must be as few as possible. Despite these constraints, the programme must be innovative and create degrees with high intrinsic and brand value.

It is suggested that a new degree, called Executive M.Tech degree, be created to distinguish it from the existing residency based M.Tech programme. An

Executive M.Tech degree from an IIT would however be considered equivalent to its regular M.Tech programme for admission to IIT's PhD programme, if necessary with some specifications on additional preparation. Many leading universities adopt such an approach.

The Executive M.Tech (EMT) programme will consist entirely of online (live video lectures and web-based assignment/examination) courses offered in the evenings or on weekends, and a project supervised entirely by a qualified mentor at the workplace. The courses will be taught by IIT faculty and the evaluations will also be done by them. There will be no evaluation of the assignments that may be given. The course may have some discussion sessions for assignments. Solutions may be uploaded by the teacher. The student will not be required to visit any IIT for either attending courses or taking exams. There will be no lab courses (except where off-site labs can be accessed using virtual labs). The project will also be evaluated by IIT faculty. First, the proposal will be evaluated and approved, and then the thesis and student will be evaluated. The student will be physically present for the viva. It is also possible to include at this time a breadth-oriented comprehensive viva based on the courses taken. This viva evaluation could be done only for the purpose of feedback to the employer on the degree of transformation that has occurred in him/her. It could also be given credits if desired.

The project is a very important component of postgraduate education in the IIT system. While online courses and absence of labs enable the programme to scale, it is equally important to make the projects locally supervised without IIT faculty co-supervisors for scaling to happen. In order to ensure that the potential supervisor, employer and student clearly understand what is expected, a detailed document will be provided that will explain (i) the types of projects (analytical,

simulation, modelling, experimental, prototype development, research oriented), (ii) the amount of work expected, (iii) the quality of literature, survey and reporting on the thesis, and (iv) sanity checks on the experimental and simulation results expected. IPR issues will be also be dealt with. Sample theses representing the different types and quantum of work that is acceptable, will also be provided.

Project evaluation will be done by an independent faculty committee. If desired, an interim evaluation can also be obtained by a committee member based on a video-conference presentation in order to ensure the project is on the right track. This evaluation will be informal and not count for the final grade.

Two operational modes are possible for the programme with each IIT having its own or a common programme jointly operated by the IITs. The latter may have difficulties associated with Senate jurisdiction and awarding of a degree. The former may work quite well for the established IITs and may even lead to healthy competition, but the newer IITs may be required to partner with their erstwhile mentors for some time. Further, to give the students the maximum possible latitude in taking courses at times when their workload is less, we may need to allow a student to register for a course offered by a sister IIT, maybe up to a maximum of 50% of the total credits. At the end of the course, the course grade will be transferred to the IIT with which the student is registered.

It is possible to scale up to 10,000 Executive M.Tech graduates every year. The programme could be initially started in 4 or 5 areas and more specializations may be added over time. The programme could also contribute significantly to the finances of the IITs as each M.Tech programme could be charged Rs 5–7 lakh.

More details and rationale of the suggested programme is given in Appendix IV.

3.9 International/Foreign Students and Faculty

For research and innovation to flourish, we need to nurture an environment where plenty of new ideas can emerge and where there is competition even for the best performers. It is also important that the research culture is maintained at its best. Continuous exposure and exchange with external high-level research environs is thus important to maintain research at the frontiers of knowledge. We should thus welcome high-quality international presence in our academic and research institutions. There is however some difference between conditions prevailing here and those in the West. While we need to create wider access for our own people to higher education, in the West there is a serious shortage of local people to meet their national programme needs and they need to get bright minds to come from outside. Even so, a selective presence of external high-level intellect in our institutions must be encouraged. A recent decision of the IIT Council to facilitate limited presence of foreign faculty and students in the IITs is thus a welcome move.

Ten percent faculty and 20% graduate students could be overseas students. The IITs have to evolve into global education institutions and become a larger part of the global knowledge network by welcoming a sizable number of overseas faculty and students. This has strategic advantages for India as it enhances India's soft power globally.

Chapter 4

Governance, Autonomy and Finances

4.1 Context

The Indian Institutes of Technology (IITs) are premier technical education institutions in India. They have been set up at various times as Societies with their own Boards. By The Institutes of Technology Act, 1961, the existing Societies have been legally converted into a body corporate, having perpetual succession and a common seal. The Act lays down their powers and obligations and is reasonably well constructed, giving the IITs a high degree of autonomy in their own governance. The Act also set up the Council of IITs to coordinate the activities of all the Institutes so that there is commonality in many matters and to act as an interface between the Government and the IITs. The Council has the right to advise on general policy matters as well as lay down policy regarding employment terms and also examine and recommend to the Central government the allocation of funds for them.

However, the Act is contextual and written in the social context of the 1960s. Today there is a need to re-examine the governance and funding model to give the IITs a much greater degree of freedom in their own management to enable them to be flexible, respond to the economic environment faster, develop their own compensation and incentive plans and invest in identified areas. Being largely funded by the Government, the IITs are subjected to government spending regulations and government audit. The IITs' ability to invest is also constrained by the spending curbs of the Government. This has put the IITs at a disadvantage when compared to many reputed universities around the world which have full financial autonomy.

Largely funded by the Government out of public funds, the IITs' own sources of funds are limited to about 18% of their operating revenues. In addition, the fee component today amounts to a small percentage of the total expenses. Their infrastructure requirements are met wholly by the Government. The IITs enjoy a very great degree of academic autonomy but not the required level of administrative or financial autonomy as they are dependent on funds from the Government.

The Board of Governors of an IIT has substantial powers of governance and is responsible for the general superintendence, direction and control of the affairs of the Institute and exercises all the powers of the Institute not otherwise provided in the Act. It also has the power to review the actions of the Senate. The Board has the power to take decisions on questions of policy, make statutes, institute courses of study and make appointments to academic as well as other posts and the authority to realize the objectives of the Act, which are indeed very broad. The Chairman is nominated by the President of India, who is the Visitor, and the Board consists of persons nominated by the Government and the Council. As the Council is dominated by the Government, once again there is control on the composition of the Board by the Government. Once appointed, the Board has substantial powers excepting on financial matters, but it does not have the power to appoint independent members. The term of the members of the Board is normally 3 years. The Director of the Institute is appointed directly by the Government and not by the Board. There is a need to have a more transparent method of appointing the Chairman and Members of the Board as it is possible that the composition of the Board can reflect the preferences of the Government of the day and not necessarily the objectives of the Act.

The Government has expressed a desire to make the IITs more autonomous so that they evolve into Institutions of global excellence. The IIT management also feels they require more autonomy, especially in matters of finance and governance, to help realize their potential. Very often, generic instructions to curb non-productive expenditure in the Government, Government norms for spending and restrictive procedures that prevent innovations in management and governance, determine the limitations on the directions that IITs can take. Also, being funded almost primarily by the Government, they are considered as the “State” for legal purposes, which impose further responsibilities on them. Autonomy can only be ensured when the IITs can meet their financial needs substantially.

4.2 Financial Autonomy

The root of the autonomy challenge lies in the inability of the IITs to be financially independent. Below is the snapshot of sources of revenues of 7 established IITs. These are IIT Bombay, IIT Delhi, IIT Madras, IIT Kanpur, IIT Kharagpur, IIT Guwahati and IIT Roorkee.

The total operating revenues of the 7 established IITs was Rs. 942 crore in 2009 and Rs. 1283 crore for 2010. These figures have been extracted from the financial statements submitted by the IITs for these years.

Table 4.1 : Operating Revenues of Seven Established IITs

	2009	2010
Income	Actuals (in Rs. crore)	Actuals (in Rs. crore)
Student Fee	68	97
Government Receipts*	775	1,050
Investments receipt	29	34
Others	70	102
Grand Total	942	1,283
<i>*Note:</i> Government receipts are adjusted with surplus/deficit of previous years.		

Funding for an IIT comes from the following sources:

- a. **Plan grants** from the Government: The **Plan grant** or Capital Grant covers the cost of buildings, laboratories, libraries and other infrastructure. These funds are used for non-recurring or capital expenditure. These are not accounted for in the operating revenues but are separately accounted.
- b. **Non-Plan grants** from the Government: The **Non-Plan grant** or Operations Grant covers operational expenses such as salaries, retirement benefits, estate maintenance, etc. Operational grants make up for about 82% of operating revenues for the IITs. These are disclosed as government receipts.
- c. **Tuition fee:** **Tuition fee** is earnings from the Undergraduate, Masters and PhD programmes. Tuition fee contributes, on an average, about 7% of the operating revenues for established IITs.

- d. **Investments and endowment income:** The return on endowments and investments, and donations from alumni is about 3% of the operating revenues for established IITs as against 10–40% for top US universities.
- e. **Others/revenue from auxiliary enterprises and sales/services of educational activities:** This source of revenue includes income from royalty, publications, seminars, workshops, sponsorships, examination fees, consultancy, and so on.

It is evident from the above that about 82% of all operational expenses and all capital expenditure comes from the Government. Without attaining financial independence, true autonomy will not be a reality. For this purpose, a financial strategy is essential to ensure that the IITs are eventually able to fund their operations fully and also part of their infrastructure needs. Till such time, Government grants to new and established IITs would be necessary.

It would take some time for the IITs to reach this stage. However, this is possible if conditions conducive to reaching such a goal are created. In fact, making them autonomous should facilitate greater non-governmental financial inputs into the IITs. Towards the objective of taking IITs to the level of world-class institutions, it is recommended that the IITs become independent of any non-plan (operational) budgetary support of the Government except the legacy of pension commitments.³ Instead, a substantially enhanced support through plan

³ Faculty and Staff hired after 1 January 2004 are under the new pension scheme which is funded from monthly contributions from the staff and the Institute which the Government or Institute would not have to support when the staff retires. Provision for pension is made in the yearly expenses and money transferred. However, staff hired before 1 January 2004 are under the old pension scheme, where the Institute/ Government would provide pension money each year after the staff has retired. It is proposed that since this is a legacy expense, the Government should continue to support it, till it expires.

(capital) funds is recommended to augment research and institutional infrastructure and support to research students in tune with the proposed scaling up. The key recommendations are discussed in the following sections.

4.3 Key Recommendations on Fee and Scholarship

1. We recommend that the IITs become financially independent of non-plan (operational) budgetary support to meet their operating expenditure, while the capital, student scholarships and support and infrastructure expenditure continue to be met fully under plan (capital) budget support by the Government.
2. To achieve the above, we recommend that the IITs recover the recurring part of the cost of education through fees levied on undergraduate (B.Tech) and postgraduate (Dual degree/M.Tech/MS/PhD) education. This will not recover the full cost of education as the capital cost will be borne fully by the Government. The fees will cover a substantial part of the annual recurring costs.
3. For the established IITs, assuming the faculty : student ratio to be 1:11, for modeling purpose, the break-even point is between Rs. 2-2.5 lakh/student/annum levied across UG, Masters and PhD programmes based on the current expenditure and student intake pattern. Our recommended fee for UG, Masters and PhD is therefore of the order of Rs. 2-2.5 lakh per annum. This excludes the cost of hostels and living costs for the students. Given that different IITs have different programmes and different cost structures, the fees may vary across the IITs. These cost estimates are based on the financial statements submitted by the IITs and may need to change

based on the timing of the decision on fees being taken by the Government and other factors.

For the UG programme, students would pay the recommended fee of Rs. 2–2.5 lakh per annum. This will take care of the recurring cost of education but will not take care of the total cost of education as the capital costs are funded fully by the Government and act as an implicit subsidy. The capital investment per student is estimated at Rs. 20 lakh, as discussed in the section “Key recommendations on grants for Infrastructure”. At 12% interest and amortization in 10 years, the per capita costs will amount to nearly Rs. 3.50 lakh per year. In addition, we recommend, a yearly capital grant of Rs. 1.5 lakh per student for normal capital expenditure. Along with yearly inflation, all this will take the total cost of education to Rs. 7.5–8 lakh per student per year. It may be noted that the average salary of an IIT graduate is more than Rs 6 lakh per annum, as evidenced by the salary offered during placement across the IITs. Therefore, charging Rs. 2–2.5 lakh per annum as fees is justifiable on grounds of the earning potential of an IIT graduate who is today highly prized by industry. It may be noted that the recommended fee is not covering the total cost of education, but only about 30% of the current cost of education at IIT, excluding the land cost.

A special loan programme for students is recommended later which should be easily available on admission without collateral and without the guarantee of the guardian so that no student is deprived of education because of want of means.

4. Each IIT Board should have the power to determine the fee structure based upon the Institute’s needs across the years.

5. We recommend that a National IIT Scholarship programme be instituted to fund student fees, as shown in Table 4.2. This will ensure that Government spending is according to the number of students enrolling and the actual seats utilized for reserved and socially disadvantaged groups in the UG programme. This would also enable the IITs to scale the Masters and PhD programmes without constraints.

Table 4.2 : Proposed Scholarship Scheme

#	Category	Government Funding for Tuition Fee
1	Reserved category candidates	100% tuition fee
2	UG (parental income < Rs. 4.5 lakh / annum)	25% of total seats to be scholarship seats with 100% of tuition fee
3	Masters	100% tuition fee for all Masters students
4	PhD	100% of tuition fee for all PhD students

In addition, the National Scholarship scheme should include a stipend to cover cost of living for the scholarship holders.

For the reserved category (i.e. SC or ST only) or any socio-economically disadvantaged group as identified by the Government (for example, students from families with income level below Rs. 4.5 lakh per annum), the students should receive scholarship from the Government for 100% of the fees as well as living expenses.

For students of the UG programme who belong to the general category, or from rural areas and the OBC category, the Government should continue the merit-cum-means scholarship programme, which would now also include the fees that they pay to the institute. All students in the above programmes, whose annual parental income is less than Rs. 4.5 lakh (to be revised from time to time), should be paid scholarships for 100% of the fees and a monthly stipend. This will address the issue of social equity and also the criticism that charging full fees by an IIT would deprive a meritorious yet poor student of high quality education.

Thus it may be noted that at most only 52.5% students in the UG programme will be asked to pay the full fees. This percentage could change from year to year based on the admission of students from the socially and economically disadvantaged sections.

We therefore recommend that only students from families with incomes over Rs. 4.5 lakh per year and who do not belong to socially or economically disadvantaged sections or from rural areas, be asked to pay the full fee. All others should be able to get a full scholarship from the Government so that no student, having passed the entry criteria, is denied an education in an IIT for want of means.

All Masters and PhD students should receive a scholarship from the Government for 100% of the fees as well as their stipend, determined from time to time. This is because the PG programme is essentially a research programme and builds intellectual capital and technological capabilities for the country. Being strategic assets, they need to be funded by the Government. This will go a long way to improve the quality of student intake, incentivize students to

continue research and get their PhD degrees and meet India's need for more PhDs in various areas.

We recommend that the stipend payout for Masters and PhD students be continued by the Government, as is currently being done, and can be revised suitably from time to time.

Table 4.3 : Masters and PhD Assistantship Payout

#	Program me	Scholarship (Rs./month)	Scholarship (Rs./year)	Contingency (Rs./year)	Overhead (Rs./year)	Total (Rs./year)
1	Masters	8,000	96,000	0	0	96,000
2	PhD	18,000	2,16,000	25,000	20,000	2,61,000

Source: MHRD, 2010

6. The IITs could use their own resources and alumni funds to establish some more scholarships for meritorious students.
7. We specifically recommend that the student intake be determined by the Board of each Institute annually so that they can enroll a right proportion of students for both UG and PG programmes commensurate with available infrastructure. The Government should provide an adequate number of scholarships every year based on such intake without any reduction and also the capital investment needed to fully fund growth in infrastructure needs.

4.4 Key recommendation on Pension Liabilities

As the IITs have to pay for legacy liabilities like pensions for their staff which is a recurring liability, the Government should continue to pay for legacy pensions (currently Rs. 221 crore/annum) for all employees (including faculty and staff) till the old pension programmes for retired and existing staff run their

term. Today, all new appointments are made by the IITs on the basis of a fully funded pension plan and hence there would be no future unfunded liabilities for such appointments. The current pension payments are as shown in Table 4.4.

Table 4.4 : Government Pension for Seven Established IITs

#	IIT (FY 10)	Retirement Benefits (Rs. Cr)
1	Kharagpur	51.5
2	Bombay	47.3
3	Madras	53.8
4	Kanpur	33.1
5	Delhi	22.5
6	Roorkee	12.0
7	Guwahati	0.8
	Total	221.1

The retirement benefit figures are taken from the financial statements and may vary depending on the DA and other increases from time to time.

4.5 Key Recommendations on Research and Consultancy

1. To create a world-class Research and Development capability, it is suggested that research activities be funded from public/private sources by:
 - a. National Science and Engineering Research Board, DST, DBT, DRDO, ARDB and other such funding agencies who should have adequate budgets and make research grants for universities based upon competing proposals.
 - b. MHRD should increase its budget for R&D for IITs to be granted against competing proposals. By this, education at the PG level will be research based.

- c. Compete for research assignments from the private sector.
2. Today, many government funding institutions do not provide sufficient overheads for R&D projects as part of a research grant. It is recommended that a minimum of 20% (without cap) be provided as overheads in each grant by all government agencies including MHRD, DST, DBT, DIT and DRDO. It is to be noted that in Europe and USA, the overheads are as high as 50–60%.
3. For each of the new IITs, a special annual grant of Rs. 10 crore per year is recommended for research for a period of 5 years.
4. Consultancy engagements should be encouraged to generate industry–academic interactions and resources.

4.6 Key Recommendations on Grants for Infrastructure

1. We recommend the infrastructure and expansion costs continue to be funded fully by MHRD in the form of Capital Grants.
2. For the 7 established IITs, the following need to be funded:
 - a. The current capital grant of Rs. 60–70 crore for each established IIT, used for normal capital expenditure like expansion of labs and purchase of equipment, needs to be increased. As the institute expands and improves research, this would have to be increased. It is proposed that yearly capital grants to IITs be Rs. 1.5 lakh per student. This will ensure that laboratory expansion needs are taken care of commensurate with increase in students.
 - b. The current state of infrastructure at the established IITs is not in tune with what is expected of a world-class institute. Hence, it is proposed that these institutes be given a one-time rejuvenation budget for existing students of Rs. 5

lakh/student, based on the strength as of March 2011, spread over 4 years. This will ensure that the IITs modernize their infrastructure and buy adequate equipment for cutting edge research that is commensurate with the growth.

- c. For the Oversight Committee (OSC)-related expansion programme, MHRD had earmarked funding of Rs. 10 lakh per student. This is considered inadequate and needs to be increased to at least Rs. 15 lakh per student.
- d. As the IITs increase their number of students (as recommended in this report), it is recommended that a sum of Rs. 20 lakh per additional student needs to be provided towards infrastructure.

3. For the new IITs, we recommend the following (also see Appendix VII):

The autonomy argued for by this Committee requires the IITs to raise substantial funds. The new IITs are at a serious disadvantage here. They do not have alumni who could be a major source of donations, as in the case of established IITs. They do not have the track record that brings in funds from industry. Neither do they have large amounts of sponsored R&D, the overheads of which are an important source of funds. Lacking such “unfettered” funds, they will not be able to implement the above-mentioned measures. Hence, if the new IITs are to realize their disruptive potential, they need the creation of an initial endowment fund. This fund could be spent as per the norms set by the Board of Governors, and not as per MHRD norms. It is strongly recommended that each of the new IITs be provided with an annual grant to the tune of Rs. 10 crore per year for the first 5 years to create such an endowment. In addition,

- a. The existing project mode of funding is to continue
- b. For additional students beyond the project plan, a sum of Rs. 20 lakh per student is to be provided

- c. Further, over time, they should reach the same yearly capital grant provision as the existing IITs
4. The capital grant for infrastructure expansion should be given at least 30 months in advance so that the infrastructure is ready when the students arrive.
5. We recommend that all the IITs should maintain their accounts based on common accounting principles. A common accounting manual should be prepared so that there is commonality of accounting across the IIT system, making accounting and audit easier and comparable and more transparent. A full set of financial statements should be reviewed by the Board every quarter and submitted to the Council not later than 45 days from the end of the quarter. It is suggested that each IIT has an online computerized accounting system on a scalable platform.
6. We recommend that the IITs create the necessary human resources to manage their own finances. Each IIT should appoint a Chief Financial Officer (CFO) who is a qualified Chartered Accountant (CA) or a Finance Management Graduate (CA/MBA) along with a team to manage the financial affairs of the IIT. Each IIT should evolve its own financial policy for spending and authorization, as approved by the Board, to ensure proper processes. The IITs should not be required to follow Government Financial Rules for their finances except for capital grants received from the Government. Each IIT should appoint a firm of CAs to act as internal auditors so that proper reporting and controls are ensured and reported to the Board for governance. The current structure of the IITs is not geared to manage the financial setup. The CFO is to be part of the administrative structure of the IIT and separate from the academic setup. S/he should report to the Audit Committee to be set up by the Board and also to the Director to ensure independence and proper

accountability. Being statutory corporations established under law, the existing Comptroller and Auditor General (CAG) audit of the IITs would continue and accountability ensured to Parliament.

7. The IITs should start an aggressive drive to get endowments, scholarship grants and funds from their alumni and other donors to meet at least 10–15% of their needs on an annual basis over time. This will ensure that the IITs benefit from their alumni and also allow the alumni to give back substantially to the IITs. There are over 90,000 alumni of the IITs who are leaders in society. Therefore, it is recommended that each IIT sets up an Office of Endowment (with appropriate staff) to gather large endowments from alumni and evolve project plans for endowments. Most alumni would prefer to fund specific projects or schemes because they would want to see the output of their grants. Therefore, a basket of projects needs to be prepared to market this to the alumni. This office shall also manage the endowment funds to ensure reasonable financial returns and govern the entire endowment process as per the financial policy approved by the Board and as per government norms. Over a period of time, the IITs should get a substantial part of its revenue from returns on endowment funds which can cover a fair part of their capital expenditure. The Office of Endowment should report to the Director of the institute.
8. Large-scale capital investments should result in proper maintenance of campus, infrastructure and hostels. The current maintenance methods are inadequate. This is an aspect that needs improvement. It is recommended that well-known facilities management companies be invited to bid for management of the campuses and infrastructure of the IITs. This would include tasks like cleaning, utilities management, garbage disposal, painting, minor repairs and gardening, so as to maintain the infrastructure in very good condition. However, existing

staff on the payroll need to be protected with all the benefits intact, to ensure that there is no dislocation. We recommend no further addition to permanent IIT maintenance staff other than a management layer, which is required for proper management of maintenance systems.

9. Students will have to pay for the full maintenance cost of hostels, including utilities, on a “no profit no loss” basis in the form of monthly payments. This is over and above the tuition fee. The cost of maintenance of the rest of the campus would be borne by each IIT out of their revenues.

4.7 Income/Expenditure Statement of Established IITs for Fiscal 2009 and 2010

The income and expenditure statement of the 7 established IITs for fiscal 2009 and 2010 has been analysed on the basis of the financial statements submitted by them. We have created a financial model based on the existing expenditure pattern with the new fee structure to enable assessment of the financial impact of the new fee structure. This is only indicative and based on the information given to the Committee by the IITs and MHRD. The actual may vary from the above. It is suggested that decisions about the finances are taken based on the specific condition of each IIT at the point when the decisions are taken.

Table 4.5 : Income/Expenditure of Established IITs for FY 2009 and FY 2010

	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2011</u>	<u>Notes</u>
	<i>Actuals</i>	<i>Actuals</i>	<i>Estimate</i>	<i>Model with New fee</i>	
Student/faculty Ratio	11.4	11.0	11.0	11.0	<i>FY09, FY10-- actual data</i>
Student Fee (Rs. lakh/annum)				2.00	<i>Break-even is between Rs. 2 & 2.5 lakh /annum.</i>
<u>Income (in Rs. crore)</u>					
Student Fee	68	97	103	878	<i>Course fee collected (Fee x no. of students for UG, Masters and PhD.</i>
Government Receipts	775	1,050	1,112	333	<i>Government operational expenditure (pension and assistantships)</i>
Investments	29	34	35	35	<i>Endowment income, interest income, return on investments, etc.</i>
Others	70	102	86	86	<i>Entrance exam fee, library fee, hostel fee collections, admin receipts, sponsorships etc. included.</i>
<u>Grand Total</u>	943	1,284	1,337	1,333	
<u>Expenditure</u>					
Salary	404	646	640	640	<i>Sharp increase in FY 10 due to provision for Sixth Pay Commission</i>
Admin Expenses	218	298	339	339	<i>Estate maintenance, water, electricity, housekeeping, etc.</i>
Retirement Benefits	137	221	223	223	<i>Sharp increase in FY 10 due to provision for Sixth Pay Commission</i>
Scholarships	99	90	110	110	<i>Assistantships</i>
Student Amenities	40	38	39	39	<i>Gym, health facilities, library, transport, subsidy, etc.</i>
<u>Grand Total</u>	897	1,294	1,351	1,351	
Surplus/(Deficit)	46	(10)	(15)	(19)	

4.7.1 Projection of PhD Students

The numbers for PhD students are taken from Chapter 3 (Table 3.1). The net addition of PhDs, that is, number of PhD students admitted minus number of PhD students graduating, can be derived from this table. For example, the net addition of PhDs in FY11 is 1400; in FY12 it is 1522; in FY13 it is 1619, and so on. Using this, the total PhDs in the system is modelled. For example, the total PhDs in the system in FY12 is 8922, and in FY13 it is 10,541 and so on.

By 2020, the target is to achieve an admission per year of 10,000+ PhD students with the given Faculty-to-PhD student ratio.

4.7.2 Projection of UG and Masters Students Intake

Based on PhD data, UG and Masters intake is modelled as follows:

- ✓ The in-campus strength of close to 50%:50% for UG:PG is maintained.
- ✓ Growth of student intake is assumed to be slow for the first 3 years and is expected to accelerate later and then stabilize to allow time for faculty recruitment and infrastructure needs to come up.
- ✓ The in-campus students strength is modelled keeping the above factors to reach approx UG=80,000, Masters=40,000 and PhD=40,000, leading to a total of 160,000 by 2023 (or 140,000 by 2020).
- ✓ The current in-campus student strength, all including, is 45,000. This is scaled to 140,000 in 2020.

- ✓ The in-campus student intake is derived from from the student strength by taking into account the graduating students. For example, UG students graduate every 4 years and Masters students graduate every 2 years.

The table on student intake below (Table 4.6) is first modelled with total student strength numbers for all the IITs.

Table 4.6 : Student Intake Modelling for the IIT System

<i>Total</i>	<i>UG</i>			<i>Masters</i>			<i>PhD</i>			<i>Total</i>
	<i>Intake</i>	<i>Graduating</i>	<i>In Campus</i>	<i>Intake</i>	<i>Graduating</i>	<i>In Campus</i>	<i>Intake</i>	<i>Graduating</i>	<i>In Campus</i>	
FY 10	5,619	5,000	25,000	6,015	4,500	10,000		1,200	6,000	41,000
FY 11	5,900	5,000	25,900	6,316	4,500	11,816	2,600	1,200	7,400	45,116
FY 12	6,490	5,000	27,390	6,947	6,015	14,263	3,122	1,600	9,322	50,975
FY 13	7,463	5,000	29,853	7,642	6,316	15,890	3,619	2,000	11,341	57,084
FY 14	8,583	5,619	33,436	8,406	6,947	17,981	4,530	2,400	13,871	65,288
FY 15	9,870	5,900	37,688	8,827	7,642	19,860	5,294	2,470	16,765	74,313
FY 16	11,351	6,490	43,139	9,268	8,406	21,486	6,424	2,966	20,719	85,343
FY 17	13,054	7,463	49,702	9,731	8,827	22,811	7,280	3,438	25,033	97,546
FY 18	15,012	8,583	57,251	10,218	9,268	24,202	8,234	4,304	29,829	111,282
FY 19	16,513	9,870	65,180	10,729	9,731	25,663	9,333	5,029	34,858	125,701
FY 20	18,164	11,351	71,994	11,265	10,218	26,710	10,487	6,103	40,316	139,020

Table 4.7 below is then modelled for student strength in the 7 established IITs with 60% of the overall student strength.

Table 4.7 : Student Intake Modelling for the Seven Established IITs

<i>Estab. IITs</i>	<i>UG</i>	<i>UG</i>	<i>UG</i>	<i>Masters</i>	<i>Masters</i>	<i>Masters</i>	<i>PhD</i>	<i>PhD</i>	<i>PhD</i>				
	<i>In-take</i>	<i>Graduat-ing</i>	<i>In Campus</i>	<i>Intake</i>	<i>Graduat-ing</i>	<i>In Campus</i>	<i>Intake</i>	<i>Graduat-ing</i>	<i>In Campus</i>	<i>Total</i>	<i>UG %</i>	<i>Masters %</i>	<i>PhD %</i>
FY 10	4,754	5,000	25,000	5,921	4,500	10,000		1,200	6,000	41,000			
FY 11	4,903	5,000	24,903	6,246	4,500	11,746	2,461	1,200	7,261	43,910	57	27	17
FY 12	5,094	5,000	24,997	6,825	5,921	14,071	2,914	1,600	8,975	48,042	52	29	19
FY 13	5,509	5,000	25,506	7,428	6,246	15,577	3,306	2,000	10,681	51,764	49	30	21
FY 14	5,847	4,754	26,354	8,042	6,825	17,373	4,061	2,400	12,742	56,469	47	31	23
FY 15	6,587	4,903	28,187	8,189	7,428	18,737	4,590	2,331	14,932	61,856	46	30	24
FY 16	7,411	5,094	30,696	8,152	8,042	19,461	5,368	2,758	17,969	68,126	45	29	26
FY 17	8,326	5,509	33,928	7,778	8,189	19,198	5,739	3,125	20,951	74,076	46	26	28
FY 18	9,339	5,847	37,757	7,190	8,152	18,199	5,984	3,835	23,810	79,766	47	23	30

Table 4.8 gives a snapshot of the financial aspects related to the future growth of established IITs, based on the recommended numbers given in Table 4.7. However, we need to recognize that the actual situation would depend on the growth of existing IITs, new IITs, and IITs to be set up. This is just to assess the viability based on the new financial model and the actuals may vary from the estimate.

We have attempted a detailed financial model for FY 12 to FY 14 as per our recommended structure, which is depicted below in Table 4.8. In order to understand the impact of our recommendations and the new fee structure, a detailed model is presented as well in the annexures.

Table 4.8 : Income/Expenditure of Established IITs for FY 2012 Onwards

<i>FY</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	
<u>Assumptions</u>					
<u>Student Intake</u>					<u>Notes</u>
UG	5,094	5,509	5,847	6,587	Student intake till 2011 from MHRD, rest projected
Masters	6,825	7,428	8,042	8,189	Projection of student intake in line with expected scaling up of IITs
PhD	2,914	3,306	4,061	4,590	UG:Masters:PhD In campus ratio of 50:25:25 maintained
<u>In-Campus Strength</u>					
UG	24,997	25,506	26,354	28,187	Student intake X 4 Years = In-campus Strength
Masters	14,071	15,577	17,373	18,737	Student intake X 2 Years = In-campus Strength
PhD	8,975	10,681	12,742	14,932	Student intake X 5 Years = In-campus Strength
Total	48,042	51,764	56,469	61,856	
Student/Faculty Ratio	11.0	11.0	11.0	11.0	
Student Fee (Rs. lakh/annum)	2.00	2.00	2.00	2.00	Break-even is between Rs. 2 and 2.5 lakh/annum
Addl Faculty Cost (Rs. lakh/annum)	12	12	12	12	Cost structure assumed for additional faculty
<u>Income</u>					
Total Fee Collection*	961	1,035	1,129	1,237	Partially funded by Government and rest from students, break-up given below
Government Receipts: Pension	246	270	297	327	Pension liability assumed to increase 10%YoY
Assistantships	135	150	167	180	As per student numbers
Investments	36	37	38	39	
Others	110	121	133	146	Other Income assumed to increase 10%YoY
<u>Grand Total</u>	1,488	1,613	1,764	1,929	
<u>Expenditure</u>					
Salary	748	864	1,001	1,160	Salary increase at 10%. Projected based on addl fac. required to maintain stud: fac. ratio.
Administrative Expenses	373	411	452	497	Assumed to increase 10% YoY
Retirement Benefits	246	270	297	327	Assumed to increase 10% YoY
Assistantship	135	150	167	180	As per student numbers for 7 IITs
Student Amenities	42	47	51	56	Assumed to increase 10% YoY
<u>Grand Total</u>	1,545	1,741	1,968	2,220	
Deficit/Surplus	(57)	(128)	(204)	(291)	

Deficit/Surplus (Rs. 2.25 lakh / student / annum)	63	2	(63)	(136)	
Deficit/Surplus (Rs. 2.5 lakh / student / annum)	183	131	79	18	

As per the above-mentioned financial model, government funding would be through scholarships on a per student basis rather than on an operational grant to IIT. This would need to progressively increase to account for increase in student intake and inflation.

Table 4.9 shows fee collection from students and government scholarships estimated for modelling purposes for the 7 established IITs.

Table 4.9: Estimated Fee Collection from Students and Government Grants

<i>Fee at R.s 2 lakh/ All amount in Rs. Cr</i>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>
Government Pension	246	270	297	327
Assistantships	135	150	167	180
<i>(i) Students share of the fees</i>	385	393	406	434
<i>(ii) Scholarships as fees</i>	576	642	724	803
Total Fees	961	1,035	1,129	1,237
Total Government grant (Pension+ Scholarship + Assistantship)	957	1,062	1,187	1,310

We expect the Government to also cover the cost of living of some students as done today.

4.8 Introduction of Special Loan Schemes

There is a need for the Government to work with the banking system to create a special loan scheme to enable students to pay their fees, as is the system in many countries.

1. As the increase in fees would increase funding requirements for students, a special loan programme for students is recommended, which should be easily available without collateral. We had approached the State Bank of India (SBI) to evolve this loan programme for IIT students. The suggested draft terms are detailed in Appendix V. This shall ensure that no student is deprived of education for want of money. Students will have access to scholarships and easy availability of loans from Public Sector Banks (PSBs) as a part of the admission process itself.
2. It may be noted that the Government has evolved a special Educational Loan Scheme with the Indian Banks' Association (Appendix VI) to pursue Technical/Professional courses in India. Under this Central Scheme, the interest payable by students belonging to Economically Weaker Sections (EWS - gross parental income of less than Rs 4.5 lakh/annum) for availing the Educational Loan for Technical/Professional Courses in India for the period of moratorium (i.e., Course Period plus one year or 6 months after getting a job, whichever is earlier), as prescribed.
3. Under the Educational Loan Scheme by the Indian Banks' Association, the interest shall be borne by the Government of India. After the period of

moratorium is over, the interest on the outstanding loan amount shall be paid by the student along with the principal.

4. In order to incentivize students of an IIT pursuing postgraduate programmes in the IIT system, the period of moratorium should be extended for the duration of such PG programmes being pursued by them at an IIT. Also, under the scheme, the interest during such moratorium should be paid by the Government. This will incentivize UGs to pursue PG education in the IIT system. We recommend that this should be a part of the scholarship scheme and should extend to the entire course of study after the UG stage.
5. For those who join an IIT or a NIT as a faculty or join some key areas as identified by the Government after completion of their studies in an IIT, the respective institutions/PSUs/government departments should repay the loan on their behalf on a proportionate basis for the number of years they continue serving with them. This will incentivize the PhDs to join PSUs or government institutions.

4.9 Administrative Autonomy

Along with financial autonomy, there is a need for greater accountability of the IITs to the Government and the taxpayers who have funded the establishment of the IITs. Today, accountability is ensured by the fact that the Government appoints the entire Board of the IITs as well as IITs' Directors and dominates the Council and that the Government funds over 80% of the financial needs of the IITs and their entire capital costs. Autonomy and Accountability are two sides of the same coin. Accountability is also ensured today by governmental audit and the

fact that the accounts of every IIT is to be audited by the CAG and laid before each House of Parliament.

The IITs enjoy academic autonomy. Hence, the challenge to a greater degree of autonomy is financial and administrative, and not academic. Financial autonomy can be achieved by the means explained above and for administrative autonomy the following is suggested.

1. Each IIT enters into a Memorandum of Understanding (MOU) with MHRD on an annual basis with due approval of the IIT Council. The MOU will include: (i) the academic accomplishments of the Institute, including the research and technological outputs, (ii) the number of students to be admitted in various categories, (iii) the quantum and number of scholarships and assistantships to be provided by the Central government for UG, Masters and PhD students, (iv) support to students from scheduled categories and those with weaker economic background, (v) incentives to students to get into research and teaching, and (vi) the quantum of support from the Central government for pension payments, capital expenditure, research and such other matters as mutually decided.
2. The MOU will state the obligations of the Government to the IITs in providing funds for research, scholarships for their students, infrastructure and funds for legacy obligations such as pensions for retired staff and the commitment of the IITs for outcome.
3. The Board will have full freedom under the MOU to decide the structure and quantum of fees, the compensation policy for its employees, the service conditions for its employees, etc. based on the general guidelines given by the IIT Council to ensure some uniformity. The Board will have full authority over its own budget and not be bound by the Government's

financial rules for expenditure but be bound by its own published norms. The Board will be the final authority on its expenditure pattern. However, the Board will abide by Government norms for the capital grants given by the Government.

4. The Board will also have the authority to appoint the Director of an IIT using an open, transparent search and selection mechanism. Currently, under Section 25 (a) of the IIT Act, 1961, the power of appointing the Director rests with the Government. The contractual obligations of the Director will be decided by the Board. The Director will be responsible and accountable to the Board. The Director will have a term of 5 years at a time, subject to re-appointment and retirement. The Director shall not be removable from the post, except with 3/4th majority of the Board, unless he/she has committed an act of moral turpitude, or gross indiscipline, or been convicted under the law. The Director shall have full powers of management of the IIT subject to the Board's mandate and control. The Director shall exercise all powers save that specifically stated to be that of the Board. The Director shall be ordinarily eligible for a maximum of two terms.
5. The Director of an IIT should be an individual who commands respect among the faculty on the basis of his/her academic credibility. In addition, the Director should have a vision to take the IIT to be a world-class institution and possess leadership qualities to carry the entire institution with him/her in an evolving scenario. Further, the Director should be an excellent manager to run a large institution with very diverse set of activities, including management of external linkages. He/she should be able to nurture a conducive and effective governance framework that has significant

delegation of authority that enables the Director to play a strategic role without getting bogged down with routine activities.

For the purpose of appointment of the Director of each Institute, the Board shall appoint a Search Committee of at least 3 members who are eminent and accomplished citizens and well respected in the country. This Committee may have, at most, one member of the Board. The Committee shall propose a panel of 3 names to the Board and the Board may select one of the names. In case the Board is unable to select any name from the panel, the Board may ask the Committee to suggest another panel or the Board may form another Search Committee. This process should be completed before retirement of the existing Director.

6. The Board should have the authority to appoint the majority of its own members by an open, transparent policy through a Nomination Committee of the Board. The Board of an Institute shall consist of the following persons, namely:
 - a. The Chairman, who shall be a non-official person of eminence in education, science, engineering, technology or industry, to be recommended by the Board and approved by the IIT Council
 - b. The Director, *ex-officio*
 - c. One eminent person who is an academician or an industrialist or Principal Secretary in charge of higher technical education in the state, to be nominated by the government of the state in which the Institute is situated. However, in the case of any IIT which is situated in a location determined to be a region by the Government of India, the nominee will be recommended

by a Council or a representative body of that region. It is NEC in the case of IIT Guwahati.

- d. One person to be the nominee of the Ministry of Human Resource Development, Government of India, to be nominated by the Minister
- e. Three eminent representatives of industry to be selected by the Board from a panel of names proposed by a group consisting of the Chairmen of the Confederation of Indian Industries (CII), the Federation of Indian Chambers of Commerce and Industry (FICCI), the Associated Chambers of Commerce and Industry of India (ASSOCHAM) and the National Association of Software and Services Companies (NASSCOM), and such panel being approved by the IIT Council.
- f. Three eminent persons who are research scientists or technologists, to be selected by the Board from a panel of names proposed by a group consisting of the Presidents of INSA, IAS, NASI and INAE, and such panel being approved by the IIT Council
- g. Two eminent alumni of IIT who are not employees of any IIT, to be appointed by the Board.
- h. Two Professors of the Institute, to be nominated by the Senate
- i. One eminent citizen appointed by the Board.

The term of the Board members should be maximum of 2 terms of 3 years each, subject to recommendation of the Nomination Committee and approval by the Board. The Chairman of the Board will be recommended by the Nominations Committee of the Board based on a transparent and approved criteria and process, and approved by the Board, from among its members so that there is familiarity with the working of the Board and autonomy is respected. In the event that the

Nominations Committee is of the opinion that there is need to look outside the Board for a Chairman, it may do so. Appointment of the Chairman will be subject to approval of the Council. The Act needs to be amended for this purpose.

7. The tenure of the Chairman would be for 3 years and extended for one more term subject to the process stated above. The term of the Chairman will be independent of the term already served on the Board as a member.
8. Each IIT would publish an annual report stating its accomplishments and this would be widely disseminated, including being placed in the Houses of Parliament.
9. The Board should respect the social and national development commitment of the Government as per constitutional dictates, as the law of the land should prevail over all else.
10. The Board should have the authority to raise funds on the assets of the IITs in a prudent manner, after a full financial appraisal, to meet the infrastructure needs of the IITs subject to prior approval of MHRD. The Board should have full authority to raise funds from alumni or donors on its own as approved under a scheme of the Board, subject however to any conditions in the Act.
11. The Government should, through the IIT Council, exercise its prerogative over the IIT by invoking the power of the Visitor under Section 9 (2) every 5 years so that the achievements and governance of the IITs is reviewed by a committee set up for this purpose with eminent academicians of international eminence as members, to assess the Institute and publish a report thereon. This would ensure transparency and accountability to the Government and the public. The Government can take any corrective step based on this report without impinging on its autonomy. Section 9 gives the

Visitor emergency powers to inquire into the affairs of the IIT and issue such directions as he considers necessary and the IIT is bound to comply with such directions. This is to ensure that the principle of autonomy is balanced by full accountability as befits a public institution.

12. The composition of the Board should be a minimum of 10 members and maximum of 15 members, including the Chairman and Director.
13. The Nominations Committee will be required to consider candidates for membership. There will be an open transparent process. Recommendations of the Nominations Committee will be considered by the Board and the decision of the Board will be final and binding, subject to any subsequent approvals.
14. As future Boards envisaged in this report will be substantially different from existing Boards, it is recommended that the new start-up Boards of each IIT be reconstituted by a commission set up by the IIT Council, comprising of at least 5 members, being eminent scientists, academics, industrialists and technocrats who are widely respected and accomplished.

The recommendations suggested above require some changes in the IIT-Act, 1961. The original IIT-Act, 1961 along with the proposed changes in the Act have been given in Appendix VIII.

Some recommendations about Donors:

The IITs should aim to get funding from donors to build up their funds. There can be a larger number of donors so that support is broad based. The donors may fund Chairs, Programmes, Scholarships, Internships, sponsorship of faculty/students for attending conferences on a sustainable basis, fund

infrastructure, etc. IITs may accept the above from donors based on such conditions as it may agree at its discretion. The donor should be eligible for a full deduction of their contribution against their income under the Income Tax Act as is currently allowed for any grants made to Universities in India under Sec 35AC of the Income Tax Act, 1961. A notification or an amendment is essential in the law to include IITs in this list.

In essence, the governance model has to ensure the following:

1. Each IIT is governed by an independent Board with full authority to manage its finance and other matters with transparency and accountability subject to the MoU signed with the IIT Council.
2. The Government plays its role in the public interest respecting the full autonomy of the IIT as envisaged in the MOU with each IIT.
3. Each IIT becomes financially independent for its revenues and recurring (operation) expenditure over a period of time.
4. Public accountability is ensured by the MOU and reviews of its operations every 5 years by the Visitor through a special review committee for this purpose.
5. The Act needs to be amended to reflect the changes needed for this purpose. A detailed proposal is provided in Appendix VIII.

4.10 Impact of Committee Recommendations on Government

Funding Pattern for IITs

The impact of the Committee recommendations on the Government's funding of the IITs is explained hereafter, based on available information. The

figures may vary based on the condition of each IIT, decisions taken on the Committee recommendations and other information as may be available later. For modelling purposes, the following assumptions are made:

1. The new fee structure would be in place from the academic year 2011–12. All new student entrants would be eligible for scholarships towards the fee, or pay the fee, based on their background.
2. For students who are in campus from earlier years, the fee structure would remain the same and the difference between the full fee and that payable by the students would be paid by the Government to each IIT till the students graduate over the years.

The following calculations indicate that the government grant per student is comparable even when the growth is factored in and the new scheme of scholarships is taken into account.

The fee difference as per the new scheme and old scheme is given below:

<i>Fee Structure for Calculations</i>	<i>FY 12</i>	<i>FY 13</i>	<i>FY 14</i>	<i>FY 15</i>
New Fee	2.00	2.00	2.00	2.00
Existing Fee	0.50	0.50	0.50	0.50
Difference	1.50	1.50	1.50	1.50

The government grant for each of the previous 3 years is given below:

<i>Current Government Grants</i>			
<i>7 Established IITs</i>	<i>FY 09</i>	<i>FY 10</i>	<i>FY 11</i>
Plan	397	249	534
OSC	599	541	366

Operational*	658	988	1,114
Total	1,653	1,777	2,014
New IITS			
Capital+	60	249	250
Grand Total	1,713	2,026	2,264

Notes: *Income/expense of IITs are adjusted with the surplus/deficit of previous year

+OSC Grants are not applicable for new IITs

* Operational Grants are not applicable for new IITs

For fiscal 2012 onwards, the impact of the Committee recommendations, at a recommended fee as stated earlier, is shown in Table 4.10.

Table 4.10 : Government Grants under New Proposal

	<i>Amount in Rs. Cr</i>	<i>FY 12</i>	<i>FY 13</i>	<i>FY 14</i>	<i>FY 15</i>	<i>Remarks</i>
1	Total Operational: Pension	246	270	297	327	<i>10% increase YoY</i>
2	Capital					
3	<i>Assistantship</i>	137	153	173	191	<i>Rs. 96,000 per MTech student for all students in IIT system</i>
4	<i>Scholarship for fresh students</i>	263	585	799	1,087	<i>* 22.5% entrants at new fee for SC/ST exempt, * 25% of total UG scholarships at 100% fees. * 100% for Masters and PhD exempt</i>
5	<i>Supporting students of existing scheme</i>	516	307	202	3	<i>* For existing students the government pays the difference between the new and old fee * (UG:3 prev years, Masters:1 prev year, PhD:4 prev years)</i>
6	<i>Established 7 IITs: Rejuvenation budget (one-time for existing students)</i>	549	549	549	549	<i>* Rs. 5 lakh /student of estd IITs based on strength as of Mar 31, 2011. spread over 4 years</i>

7	Established 7 IITs: To support Research / Labs	765	856	979	1,115	* Rs. 1.5 lakh /student for Capital Grant for the opening balance of students in 7 estd IITs each year ,dependent on growth factor
8	Established 7 IITs: Future Infrastructure creation	412	997	1,197	1,232	* For 7 established IITs, Rs. 20 lakh/new student each grant spread over 2 years
9	New IITs: Future Infrastructure creation	375	563	844	1,266	* It was Rs. 250 crore for 8 new IITs (as per MHRD for FY 11). Assumed growth of 50% from FY12 onwards
10	New IITs : Research grant	80	80	80	80	Rs. 10 crore per new IIT for corpus for research
11	Research Parks	350	350	350	350	* Rs. 200 crore / IIT for 7 established IITs spread over 4 years, new ones to be part of their plan scheme separately
12	Total Capital Grant	3,446	4,440	5,173	5,871	
	Total Capital + Operational	3,692	4,710	5,470	6,198	
	For Established IITs	3,237	4,068	4,546	4,852	7 IITs plus Research Parks
	For New IITs	455	643	924	1,346	Includes new infra and research grants

Note: * The above does not include stipends (for e.g. PhD stipend Rs. 2.61 lakh/year/student), as these are given directly to students.

The calculation of government grants per student, with additional rejuvenation budget for established IITs, new IITs, research grants and for Research Parks is provided in Table 4.11.

Table 4.11 : Government Grants, with Rejuvenation Budget, New IITs' Research Grants and for Research Parks

	<i>FY 10*</i>	<i>FY 11*</i>	<i>FY 12</i>	<i>FY 13</i>	<i>FY 14</i>	<i>FY 15</i>
Total Government Grants (Rs. crore)	2,026	2,264	3,692	4,710	5,470	6,198
No. of Students in-campus	41,000	45,116	50,975	57,084	65,288	74,313
Grant/Student (Rs. lakh)	4.94	5.02	7.24	8.25	8.38	8.34

Note: * Till FY 11, actuals have been taken from MHRD. FY 12 onwards, Government spending on student scholarships, pension and infrastructure expenditure projected in the model is considered.

The calculation of government grants per student without additional rejuvenation budget for established IITs, new IITs, research grants and Research Parks is provided in Table 4.12.

Table 4.12 : Government Grants, without Rejuvenation Budget, New IIT's Research Grants and Research Parks

	<i>FY 10*</i>	<i>FY 11*</i>	<i>FY 12</i>	<i>FY 13</i>	<i>FY 14</i>	<i>FY 15</i>
Total Government Grants (Rs. crore)	2,026	2,264	2,713	3,731	4,491	5,219
No. of Students in-campus	41,000	45,116	50,975	57,084	65,288	74,313
Grant/Student (Rs. lakh)	4.94	5.02	5.32	6.54	6.88	7.02

Note: The increase in FY 12 onwards is because of the growth factor in students' intake and also due to enhanced capital expenditure for growth.

The additional rejuvenation budget for FY 12 onwards for established IITs, new IITs, research grants and Research Parks is as follows:

	<i>FY 12</i>	<i>FY 13</i>	<i>FY 14</i>	<i>FY 15</i>
Rejuvenation Budget	549	549	549	549
New IITs' Related Budget	80	80	80	80
Research Parks	350	350	350	350
Total (Rs. crore)	979	979	979	979

4.10.1 Financial Implications of Recommendations

The financial recommendations of this report are with respect to Capital (non-recurring) Expenditure, Operational (recurring) Expenses of IIT and scholarships. We will examine them separately:

1. *Capital (non-recurring) Expenditure:* Today, the Government meets almost 100% of the Capital Expenditure of the IITs. The Committee recommends that the Government continues to meet 100% of the Capital Expenditure of the IITs. The specifics are as follows:
 - a. One-time capital grants associated with OSC expansion at IITs: MHRD had earlier sanctioned Rs. 10 lakh per student for OSC expansion. The IITs have found this to be inadequate. The Committee recommends that this be increased to Rs. 15 lakh per additional student.

- a. Future expansion recommended by the Committee: The Committee has recommended substantial enhancement of the IITs, especially of its PhD programme. The Committee recommends that for such expansion, the Government provides Rs. 20 lakh per additional student.
- b. One-time capital grants for rejuvenation and refurbishment of existing infrastructure: The IITs were set up over 50 years back and much of its infrastructure is far below what it should be for a world-class institute. The Committee has recommended a one-time grant of Rs. 5 lakh per existing student for rejuvenation
- c. Rs. 200 crore for each established IIT for Research Parks.
- d. Yearly capital grants: The Government provides Rs. 60–70 crore per IIT as yearly capital grants for established IITs. The Committee recommends that in future, the IITs be provided Rs. 1.5 lakh per student as yearly capital grants.

These are essentially recommendations for enhancement of amounts being provided currently by MHRD considering the cost escalation over the years and also the need for better infrastructure and future expansion. These amounts would have to be further enhanced in future depending upon inflation. The only exception would be the amounts for rejuvenation and for Research Parks. The estimated amounts payable in 2012, 2013 and 2014 in this regard are given in the above table.

2. *Operational (recurring) Expenses:* Today, over 80% of the operational expenses of the IITs come as grants from MHRD. The Committee recommends that in future the IITs be financially totally independent of MHRD for their non-plan (operational) budget. However, the old pension-related expenses still need to be paid by MHRD. No other operational expenses would be paid to the IITs. Today, MHRD provides close to Rs. 2 lakh per student per year (including

scholarships) as operational grant to the IITs. This amount would become nil. For the current 45,000 students, this would be roughly equal to Rs. 900 crore.

3. *Scholarships*: Today, MHRD provides full tuition and scholarships for all UG students from reserved and economically weaker sections, and for M.Tech, MS and PhD students. Besides, it provides merit-cum-mean scholarships to about 25% of all UG students. The Committee recommendation is that MHRD should continue to provide the scholarship plus full tuition fee to the same set of students. This amount would go up substantially as
 - a. Tuition fees of IITs would now go up, pushing up the amount of tuition fee.
 - b. Increase in the number of students, especially of M.Tech and PhD students, will push up this amount.

If we combine expenditures detailed under points 2 and 3 today, even though the Government would now reimburse the enhanced tuition fees for all postgraduate students, reserved category students and for those who qualify for merit-cum-means, it would still save an amount equal to the enhanced fees paid by students who do not get scholarships. So there would be a net saving by the Government on this count.

Chapter 5

Faculty at IITs

World-class Institutions require world-class faculty members. This is especially true since the IITs have graduated from being the best undergraduate institutions to the best research-cum-teaching institutes. A reputed and highly qualified faculty will be needed to attract the best research scholars from India and abroad. Attracting and retaining high quality faculty is one of the most difficult tasks for any institute and this would have to be among the top priorities of the department chairs and director of an institute.

Before we look at specific steps that need to be taken up by the IITs, let us look at what young quality faculty members are looking for. They are different from their counterparts in a similar age bracket, who are similarly qualified and work elsewhere. While they consider themselves (and often are) intellectually superior, they are free spirited. They know that academia may not give them the comfort and wealth that many other disciplines could, but they seek a liberal academic environment which gives them great intellectual satisfaction. However, today's young faculty and their families will want a comfortable, urban upper-middle class life with minimum problems. They value, above all, their autonomy to choose what they would work on, pursue the research that they wish to and build relationships of their choice; they resent any form of bureaucracy and there must be a very good reason for anything that is refused to them. They would want a very transparent, participative and fair administration which keeps everything functioning for them. They aspire for peer recognition which they value and would not mind a fair peer evaluation process for themselves and for their group.

What matters to them most is the respect among peers and not necessarily the pursuit of wealth.

The academia has been highly influenced by scientists in the West. Thus, paper publications are considered of highest value. IPR and technology creation is new and while it is acceptable today, it is considered secondary to papers. The same is true when it comes to influencing policies; while some have taken it up, it is not considered to be the highest form of activity. In other words, the faculty is more inward looking, less to do with what can impact or influence the society. Of course, there are those who differ, but they are a small minority.

Today's young faculty in India is a very confident lot; they consider themselves to be second to none in the world. The only reason, they believe, they do not seem to perform as well as some others is because certain external conditions prevent them from doing so.

While one has to start with grooming the values, attitudes and desires of today's bright youngsters who wish to become faculty members at IITs, at the same time it is important to prepare them to build and lead world-class Indian institutions of tomorrow. As the nation moves towards overcoming many of its shortcomings and acquiring global-level leadership in many areas, it would require its best academic institutions to look inwards and do much more for the nation. Attitudes have to change if India's academic institutions have to become the best in the world and help the nation attain its goals and aspirations.

5.1 Scaling of Faculty at IITs

One of most complex tasks that the IITs will have to take up is the scaling up of quality faculty. There are around 4000 faculty members in the IIT system today. As discussed in Chapter 3, this number has to be scaled up to about 16,000 in the

next 10 to 12 years. This is not going to be an easy task. While Table 3.1 in Chapter 3 does indicate that this is potentially achievable, it will indeed be an uphill task for the institutes to make this happen.

The IITs must appear to a potential candidate as the right place to join and work in. While the established IITs do indeed have an attractive academic culture, the newer IITs would have to work hard to create a similar culture and innovate to do better. But even the established IITs do not have the ecosystem to dramatically scale up. For the young minds who aspire to join the IITs as faculty, there are many questions that would need to be answered. The recent protest by IIT faculty regarding pay has indeed created a doubt in many minds. Most youngsters believe that if the IITs are to become world-class institutes, then a lot has to be done fix all this. Here are some pointers:

- a. They have to see a strong, functioning and responsive administration. They would like to see that the institutes are financially secure and strong.
- b. They would like to see that the campus environment is modern, clean and an attractive place to live and work in. They would like to see facilities for good education for their children in campus schools or nearby. They would also like decent accommodation.
- c. They would like to see strong departments with good facilities. The presence of high quality and renowned faculty will be a great attraction.
- d. They would like to be assured of good start-up grants, follow-up research funding and facilities, and quality students and research scholars.

In achieving all this, a great deal of effort is required of the Directors of the IITs, department chairs and department faculty. It is the faculty of a department who are in the best position to attract other faculty. They have to be involved and they have to lead; the department chairs, directors and deans of the institutes have

to enable all this. The box below describes the efforts required in the form of Faculty Search Committees of a department; certain departments in some institutes have taken this up, producing some excellent results.

Departmental Faculty Search Committee

Young PhDs today have a significant number of options. To attract them to join IITs as faculty members, the IITs would have to do a significant amount of work; gone are the days when they would be expected to come knocking at an IIT's door; floating an advertisement and expecting them to apply would not go very far. One has to do something considerably different.

One of the ways that has proven to be successful in attracting young talent is the creation of a department-level faculty search committee consisting of young faculty members, with a mandate to attract and recruit the best faculty for the department. The committee members send feelers to top institutions around the world, short-list youngsters who are in the middle of their PhDs, especially those of Indian origin. One of the faculty members in the committee would get in touch with such youngsters and get them to come and participate in a seminar if and when they visit India. The departmental faculty would use this opportunity to carry out an evaluation; if they consider him/her to be of suitable as faculty, the committee would keep in touch and try to influence the youngster to join as a faculty immediately after graduation.

The committee also quickly scans the bio-data of any person who writes to the department/institute expressing interest in a faculty position. Carrying out the initial evaluation, the committee gets the departmental Chair to respond within a few days of receiving such an interest (a survey of the faculty who joins has shown that the quality of the first letter from a department influences to a reasonable extent the final decision of the youngster). The candidate is requested to give a seminar to the department faculty (in some cases even remotely on video), interact one-on-one with a

few faculty members and a quick decision is made. The speed of the decision-making and the professionalism in treating a candidate well is the key to attracting them to the institute

5.2 Part-time and Adjunct Faculty from Industry

Most IITs have the provision to hire people from industry as part-time or adjunct faculty. However, this provision is sparingly utilized. Also, the IITs have not found adequate means to leverage even those few who are hired. This needs to change. Today, Indian industry is increasingly involved in Research and Development and has highly qualified and experienced people. They could be leveraged by the IITs in the following ways:

- a. Certain courses at the IITs can be converted to 4–5 modules of 8 to 10 lectures. It will be beneficial if the adjunct faculty teaches one or more of these modules (including conducting tests and evaluation on these modules). The teaching would hopefully be different – reflecting and drawing on the industry experience of the faculty. It would help students to understand industry better and start an interaction between them and industry personnel. Further, it would reduce the teaching load of the regular faculty.
- b. The adjunct faculty could guide B.Tech/M.Tech students by helping to provide more industrial content in their projects. This will help IITs handle increasing number of UG/M.Tech students.
- c. Adjunct faculty could be co-guides for MS/PhD students, especially if they are from industry. It will help enrich their research content.

- d. Joint industry–academia projects could be taken up by adjunct faculty along with regular faculty.
- e. Adjunct faculty can join hands with regular faculty in taking up interventions on government policies and regulations.

It may be desirable that the IITs identify and bring in adjunct faculty with the same care and drive they display when recruiting regular faculty.

The IITs should also consider bringing in some reputed overseas faculty as adjunct faculty, especially if they are willing to spend some time at the IITs every year. This would add to the IITs' drive to become the best institutes in the world. IITs with more autonomy could have both the attraction as well as resources for getting such faculty members.

5.3 Faculty Pay-scales and Remuneration

It is recommended that the respective IIT Boards should have full powers to decide on hiring, remuneration and benefits, evaluation and promotion of all faculty members within the overall policy framework made by the IIT Council. The decisions on faculty remuneration will be one of the critical tasks of the Board. The IITs have so far functioned assuming that pay-scales are to be decided by the Ministry of Human Resource Development (MHRD) and that all the funds would also come from MHRD. But with the autonomy envisaged in this report, revenue generation and expenditure would become the responsibility of the institute's management. On the one hand, the remuneration has to be good to attract good faculty members, but on the other hand it has to be in line with the total revenue and expenditure of the institute. The IITs presently have uniform pay-scales and increments, in the sense that once hired at a certain level (on a fixed pay-scale), all faculty members get the same increments and remuneration

year after year. Further, the remuneration is equal for all disciplines. The Board would now be empowered to have different remunerations⁴ for different faculty members (based on appraisals) and could give different increments each year. IIT administration is not used to this system and may not be able to handle the dissatisfaction and murmurs this new system may generate. Also, the IITs currently do not have any serious faculty appraisal process in place and the only appraisal is carried out for promotion from Assistant Professor to Associate Professor and from Associate Professor to Professor. This has to change. Some suggestions to fix remuneration could be as follows:

- a. Have a base pay which is more in line with today's salaries and could be based on the Government Pay Commission's recommendations.
- b. The institute could then add a component, which could depend on the performance of the institute and the importance and market value of the discipline to which the faculty belongs.

⁴ The IITs, till recently, would decide on the pay-scale of a faculty only when he/she is taken as Assistant Professor, and subsequently for promotion to Associate Professor and then for promotion to Professor. Even here, the scales are fixed and only a few increments are decided based on experience and expertise. But this is now changing. Along with the latest pay revision, the IITs have introduced performance-based incentives (PRILL), where yearly evaluation and certain incentives are proposed. This is to be implemented soon. The second is that those who get the Bhatnagar Award are today given Rs 15,000 per month. Also, if one is a member of two of the four academies, it is proposed to give them Rs 15,000 per month. Besides, there are fellowships like the J.C. Bose Fellowship, which can give Rs 25,000 per month. Several institutes have introduced some chair/fellowships where a faculty can be given some extra allowance every month. But this is done sparingly in some IITs.

Besides, all the IITs allow consultancy assignments to be taken up and the faculty can retain up to 70% of what they bring from industry. Also, there is a provision for taking fellowship and work outside IITs for up to 2 months every year. There is also a provision for sabbatical, where a faculty gets his/her salary while they take up a fellowship. So, there is the scope for variable pay. The recommendations here are that the Boards can then decide on the appraisals, remunerations and variable components. Today, IIT salaries are fixed by a Committee and based on Pay Commissions. The pay includes basic pay and DA. The DA component gets revised based on inflation but the annual increase is miniscule. When the IITs de-link from the government, the DA component may no longer exist and, therefore, there has to be annual appraisals and hikes.

- c. There could be a third component which would depend on the performance of the faculty, the recognition in terms of academy fellowships and awards.
- d. The fourth component for an individual faculty would be the consultancy component in line with what they get today (except that unlike today, even a sponsored project could have a component contributing to it).
- e. An IIT faculty member can join the Board of a company after taking the necessary permission from the institute. The Board's sitting fee and remuneration would be taken directly by the faculty member.

The IITs could consider taking faculty on a tenure track system. In such a system, a young faculty is initially taken as a tenure track faculty on contract. The faculty needs to show significant ability, publish and/or work closely with industry producing high quality work over a period of 5 to 7 years. His/her work is then evaluated thoroughly and only an excellent performance would enable the faculty member to obtain what is a tenured position. Faculty who do not succeed in getting a tenured position even after several years, are asked to leave. Such a system is followed in universities in the United States and it helps prune out non-performing faculty. The best universities have a very tough tenure evaluation, where only a fraction of the faculty succeeds. The IITs are not used to such a process and it is likely that there will be some opposition to it. The Governing Boards of the IITs could consider faculty recruitment at the IITs under two tracks – one track being regular faculty as they are recruited today and the other being the tenure track. Faculty selected through the tenure track could have higher scales in order to attract brighter candidates.

5.4 Faculty Appraisal

The Board of each IIT should decide on the roles, responsibilities and appraisal of their faculty. Faculty roles may include teaching, research, technology development and industrial consultancy, as well as policy making and standards development. Besides, they may be involved in administrative functions. While each Board can decide on how they wish to carry out the appraisals, a possible appraisal process is suggested here.

The faculty sets an annual goal. Younger faculty members could possibly discuss their goals with the Department chair or senior faculty members before finalizing them. Senior faculty could set their goals and appraise them on their own. In the goal setting, for example, a faculty can decide what percentage of his/her time and focus in the next year will be spent on each of the following 5 parameters:

- 1 Teaching (and project guidance): say 25%
- 2 Research, MS/PhD guidance, Research-oriented projects: say 40%
- 3 Technology development, Industry interaction: say 15%
- 4 Policy/Standards: say 10%
- 5 Service: say 10%

There could be a minimum share expected of the faculty members in each of these parameters, depending on whether or not they are involved in administration. Besides, the goals could also be specified qualitatively in each of these 5 areas, depending upon what the faculty wishes to do.

At the end of the year, the faculty member conducts a self-appraisal (say on a scale of 0 to 10) on each of these 5 parameters and cites evidence for each score – both qualitative and quantitative. They would also be required to explain deviations from the original goal.

Review/evaluation of self-appraisal: A departmental committee would review the appraisals for Assistant Professors and an institute-level committee would review the appraisals for others. Once in 5 years, an external review of these appraisals could be carried out. The appraisals should not rely too much on the numbers (like number of papers published – sometimes referred to as bean counting) but on the quality and impact of the work done.

One possible lacuna of this system of having committees for evaluation and decision-making with respect to remuneration could be that the committee members will not reward excellence as such and could tend to equate everyone, thereby promoting mediocrity. Further, they may use compassion to evaluate low-performing fellow faculty. Keeping this possibility in mind, members of the appraisal committee, both at the departmental and institute levels, should be selected from among the high-performing faculty (top 5%). The performance would be measured by:

- a. Recognition and awards the faculty member has received at the national/international level
- b. Academy fellowships
- c. Excellent publication record
- d. Quantum of funds the faculty member has brought into the institute
- e. Excellence in technology development
- f. Excellence in interaction with industry

Appraisal of department chairs: Department chairs need to be selected on the basis of their ability to lead the department and drive excellence. The IITs use a rotation system for selecting department chairs. While using the rotation system,

driving of excellence should not be sacrificed. They should be appraised annually on the basis of the performance of the department with respect to:

- a. Recognition and awards the department faculty members receive at the national/international level
- b. Academy fellowships for department faculty
- c. Research publications of department faculty/research scholars
- d. Quantum of funds that department faculty brings in
- e. Technology developed by department faculty
- f. Quantum of department faculty's interaction with industry
- g. Number of MS/PhD students it graduates

Besides, the high-performing faculty (top 5%) of the department (referred above) should carry out an appraisal of the department chair. Based on these appraisals, the Director would conduct a department chair appraisal and place the record before a Board sub-committee.

Appraisal of deans: The deans need to be evaluated by a process similar to that of department chairs. Once again, the emphasis has to be on excellence in their performances, as measured by how the institute fares. It may be desirable that the appraisal and selection of deans is rigorously looked at by a committee of the Board of Governors.

Encouraging technology development: One of the weaknesses of the IITs today is their lack of experience and expertise in evaluating the “technological development and industrial consultancy roles” of its faculty members. Neither the departments nor their faculty members have expertise in this area. Most external experts are also weak in this respect. While they can evaluate the faculty on the basis of the quality and quantity of their publications, this is not so with respect to

technology development. In fact, some even argue that this is not academic research. Low-quality papers are sometimes rated higher than such development. Therefore, technology development and work with industry is under-emphasized and faculty/faculty candidates who are strong in this aspect are not promoted or even selected. It becomes self-perpetuating as the IITs do not get senior faculty who can conduct such evaluations. Young faculty members do not go out to develop relationships with industry and postpone this to a later stage of their career. At the same time, occasionally technological development of mediocre quality is romanticized. All this impacts the character of the IITs and they fail to achieve excellence in terms of industrial collaborations, technology development and commercialization.

The IITs would have to pay special attention to this aspect in order to change their current character. One way forward is to invite people who have excelled in technology development and commercialization to all appraisal and selection committees in significant numbers and explicitly look for such contribution from faculty.

Nurturing post-doctoral fellows

The world over, the best institutes have a considerable number of young post-doctoral fellows. Funding of these fellowships mostly come from the research grants of the faculty. The IITs need to pay special attention to get and nurture a significant number of post-doctoral fellows. First, their pay and remuneration could be on par with young faculty who would enter the IITs, especially as such fellowships are temporary in nature and do not have all the benefits associated with a faculty position. At the same time, the IITs have to recognize these fellows

(as well as other temporary staff hired for projects) as an important component of the institute and contributing to its growth.

Start-up Research Grants for Young Faculty

Most top institutions in the world have a programme to attract top-grade talented young PhDs as faculty in their institutions. The programme includes an attractive pay package, start-up research grants and space to set up labs. Sometimes a significant research grant and facilities are provided to accomplished faculty members to attract them to the institute.

As the IITs go about attracting talent, they have to work out such special schemes. While the IITs themselves would provide start-up grants (today it typically provides Rs. 10 lakh), this needs to be complemented by some national-level programme and schemes. It is recommended that young faculty should be able to quickly get start-up research grants of up to Rs. 1 crore on a competitive basis, but where the whole process—that is, from the time a grant proposal (format to be on web-site) is submitted to the money coming to their institute—should be no more than 3 months. MHRD could set up such schemes jointly with DST and similar other organizations. The grant should allow the young faculty and his/her students to attend conferences in India and abroad, buy equipment and consumables and hire project staff without restrictions. The grants should be available for up to the first 2 years of a faculty joining these institutes.

Academic leaders at new IITs

Through intensive efforts, the new IITs are able to attract a number of young faculties. They are mainly fresh PhDs, though some may have a few years of research or teaching experience. As such, most are enthusiastic to set up a new IIT and establish themselves as renowned academicians. Coming from diverse backgrounds, they have fresh ideas that could transform their chosen IITs. However, they lack the experience necessary to drive their ambitions in an IIT which has mostly fresh faculty members. It will take the new IITs about 10–20 years to achieve prominence. There are a number of eminent mid-career faculty in the established IITs and other premier institutions in India and in universities abroad, who are excited by the challenges and opportunities presented by the new IITs. Some technical people from R&D labs in industry are also attracted to the new IITs.

Such mid-career faculties who have already achieved renown and have experience in research and teaching could serve as leaders to catalyse the energy and ambitions of a group of young faculty. Such a group could achieve global renown in a few years. With say 5–10 such academic leaders and 100 young faculties, a new IIT could make a global impact in a few areas even within 5 years. For many routine matters in running the IITs, senior faculty are required. They serve as Heads, Deans, Chairs of Committees, members of the Senate, etc. These are all essential aspects of an IIT which cannot be served by either junior faculty or non-teaching staff.

A mid-career faculty who wishes to be transferred to a new IIT either for a few years or permanently, faces a number of hurdles. Most significantly, a person who has joined prior to 2004 may be on the old pension scheme, which is not transferable to the new IITs. This is a major long-term loss to the faculty and his

dependants after retirement. Further, the faculty will have a significant stake in his/her current location in terms of schooling for children, membership in clubs, setting up of residence and immovable property, besides setting up of labs, research students, and so on. Therefore, the individual needs considerable incentives to migrate to a new IIT. Individual Boards of new IITs could decide on such incentives. We also recommend that mobility of high-performing faculty between IITs should receive special support, particularly in the context of protecting pension arrangements. Since we are recommending sustaining faculty who are already on the old pension scheme through MHRD support, this should be possible. (Also see Appendix VII.)

Chapter 6

Staff at IITs

Every educational institute requires staff, other than faculty, to carry out a diverse set of support functions. These include administrative staff, scientific/technical staff and support staff. As the IITs move to expand and attempt to become high-quality research institutes, the question arises as to what should be the policy to attract, retain and nurture staff members who would be essential towards this growth. It must be noted that in the absence of good staff, the work of faculty members increases considerably.

As the IITs transform themselves to be totally autonomous and governed by their Boards, it is imperative that each IIT Governing Board is empowered to take all decisions with respect to staff. These include the numbers, the pay-scales, tenure of appointment and remuneration, as well as accountability and appraisals.

Even though there have been some excellent and committed staff members who have contributed very significantly to the growth of the IITs, overall, the experience of IITs in matters related to staff have not been very positive. A number of staff treat this as a “secure government job” and do the bare minimum that will help retain their jobs.

At the same time, upkeep of the IITs has not been what it should be for top-class institutes in the world. This could be partly due to the IITs not having an adequate operation budget (Opex) for this. The other reason could be inadequate planning in terms of where the Opex would come from when capital expenditure (Capex) is carried out. Yet another reason for this could be inadequate drive and motivation of staff carrying out these functions. The Committee’s recommendations in this context are presented in the following sections.

6.1 Support Staff

Whenever planning for capital expenditure on infrastructure/scientific equipment, it should be done in a way such that the sources for Opex requirements towards managing and maintaining this infrastructure/scientific equipment are identified at the outset. The emphasis would be to keep the infrastructure and equipment in top shape and functional till such time they are considered useful. The planning should include the strategy and resources required for a phase-out when the infrastructure/equipment is no longer in use and disposed of/replaced.

- a. Towards this, it is suggested that the complete infrastructure management and maintenance function of the IITs be outsourced to a facilities management company which has the capacity and capability to manage such an infrastructure and keep it in such shape as required by top-grade institutes (the outsourcing should include all expenditure, including replacement and consumables required). This company should be involved whenever new infrastructure is being planned so that its management and maintenance can be planned in advance. The company should be appraised in terms of the quality of the institute's infrastructure. It may be worth mentioning that most top educational institutes in China use this methodology and have gained considerably in terms of the looks and upkeep of the campus.
- b. A similar approach should be used for provision of security at such institutes. Complete outsourcing of all the support activities would help IIT management focus on more important matters. However, the existing staff needs to be protected for their tenure with all entitlements intact.

6.2 Scientific Staff

The IITs have always struggled to provide an adequate career path for its scientific staff. Many good staff had been engaged in the early days of the IITs, but the growth path for such staff has not been worked out well. Some of the scientific staff attempt to become faculty members at IITs, but often the IITs do not find them suitable for such positions. This results in frustration and lack of motivation, which impacts their performance.

- a. As a result, the IITs have almost stopped recruiting such scientific staff in recent years, even though it is recognized that high-quality scientific staff is essential, especially for experimental research.
- b. In recent years, the IITs have hired young temporary project staff, fresh out of colleges, who stay at the IITs for 3 to 5 years and then move on. The training they receive (some of them also pursue part-time Masters and PhD programmes) gives them a good career path in industry/scientific labs. The IITs are therefore playing an important role and this should continue and even be recognized as one of their important objectives. However, when they leave after a few years, it leaves the IITs with a handicap when it comes to managing their experimental facilities. The faculty has to therefore train new staff every few years.
- c. Therefore, while continuing to use temporary project staff and training them, new approaches are also required. One approach could be as follows: Whenever the IITs purchase expensive scientific equipment, they should request the suppliers to quote for placing a technical staff at the institute for the next 5 years (or the life of the equipment) for operations; this should be in addition to the annual maintenance contract (AMC). Expensive equipment should anyway be shared and used by multiple scientists. These should, as far as possible, also

be used by industry and/or the society. A trained operations staff would make this easier. Industrial users could be charged and scientists could charge such expenses to their projects. Thus, the institute would get trained staff from the day the equipment is commissioned. It is possible that the same person manages and maintains not just one piece of equipment, but the whole lab. This will help overcome the problem of getting trained staff without concerns of career paths for them. However, existing staff at all the IITs will have to be protected for their remaining tenures with all their entitlements intact. They should also be equipped to discharge their functions effectively. Wherever necessary, they should be given appropriate training within the country or abroad.

- d. Any scientific staff that the IITs hire on a permanent basis should be carefully looked at; their career path, compensation and motivation need to be examined. In the absence of clarity on these issues, scientific staff should be hired only on a temporary basis or leased from companies.

6.3 Technical Staff

Institutes like the IITs require some technical staff primarily for laboratory based teaching. Persons with engineering diplomas are usually hired by the IITs to fulfill this requirement. They play an important role in managing and maintaining the equipment in teaching laboratories and also help with instructions and supervision for students in the lab, thus reducing the workload of the faculty. They also perform some administrative functions for laboratories, including help in purchase and stock management. While many of them are very good, they often lack motivation as they grow older, after which they carry out minimum duties. They perform much better when they are younger and are learning. An effective

way to keep them motivated is to capitalize on their strong sense of belonging to the Institute. They should also have the opportunity to upgrade their skills through formal training in elite institutions in India or abroad.

- a. While the motivational aspects have to be examined by the department's management, one should examine whether such staff can be sourced from an agency for the first 5–10 years of their career. With the training that they will receive at the IITs, they could be important human resources for research labs and for industry.
- b. Since the number of PhD students is going to increase considerably, it should be possible to increasingly use them as teaching assistants, specifically for lab classes. Since there is likely to be a number of teachers from engineering colleges among PhD students, their teaching and lab experience at the IITs would train them to perform better once they return to their parent institutions. It should be noted that in Europe and the United States, graduate students (PhD students) play a major role in managing the labs in their departments. A certain level of hands-on skills should, in fact, be welcome.

6.4 Administrative Staff

While the IITs have had some excellent administrative staff (including finance staff and those administering academic programmes), IIT faculty have had to increasingly take up administrative roles. This shows that the IITs have not been able to hire and retain quality administrative staff in adequate numbers and keep them motivated. The compensation structure has not been able to attract people of high quality, as they are in high demand in industry.

- a. With increasing use of IT, the quantum of administrative tasks would generally reduce. The use of IT for carrying out most tasks in decision-making and process workflows needs to be accelerated.
- b. It should be noted that the IITs have occasionally hired senior experienced staff/consultants in recent years on a temporary basis. They are ex-defense personnel and from public/private sector companies or institutions after taking voluntary retirement. The performance of many of them has been good. The IITs should continue to attract such talent and even regularize them after watching them for a few years.

6.5 Project Staff

The IITs recruit project staff at various levels on a temporary basis. Some of the staff also pursue part-time Masters or PhD programmes at the institute. In recent years, some of them have been hired as post-doctoral fellows. While the time they spend at the institute helps them to train as scientific staff for the nation, their contribution to the institute is also quite significant. The IITs must recognize that such project staff is important for bringing R&D funds to the institute and for building R&D infrastructure. At the same time, some of them would contribute in teaching, especially in lab classes. Being temporary staff, they often do not enjoy the same privileges in the institute and are not treated with the requisite respect. Special effort is needed to address/ change this.

6.6 Autonomy and Role of Staff

- i. The IIT Boards should decide on the numbers, remuneration and pay-scales of staff.
- ii. It is suggested that most (may be about 70%) staff members are outsourced. These young staff members who start their career at the IITs and work there for 5 to 10 years would be well trained to be absorbed in industry. This way the IITs would get young motivated staff members.

While the aim should be to resort to outsourcing of functions to the maximum extent possible and drastically reduce the number of support staff on regular rolls in a progressive manner, the IITs do need to have professionally trained managers to manage and maintain the various support functions.

Chapter 7

Innovation and Entrepreneurship

7.1 The Need

As India grows economically and strives to be a global leader, we are faced with multiple challenges. These include poor infrastructure, low quality schools and colleges, a glaring urban-rural divide, resource depletion and pervasive pollution. It is clear that this country of one billion plus people cannot follow the beaten path to quickly overcome these challenges. Innovation is needed in technologies, in businesses and in society. In such a situation, the alumni and faculty of the IITs, the premier technology institutes and among the best centres of higher education in the country, have the responsibility to lay out the paths and directions that India needs in order to move forward. Thus, one of the key roles of IITs should be of driving innovation and entrepreneurship.

7.2 Benefits

Driving innovation and entrepreneurship has many benefits for the IITs. Successful innovation, especially when it is aimed at major problems facing the society, requires development of novel technologies. These result in patents and publications – the traditional measures of performance of faculty and research institutions.

Innovation and entrepreneurship also has a positive impact on teaching. This provides faculty first-hand knowledge of what is useful and used in industry. Thus his/her teaching can be made more interesting and relevant to the jobs that many students seek after graduation. Experience has shown that introducing real-world examples and insights that are not available in most textbooks is very exciting and

motivating to students. It keeps their interest in the course high and motivates them towards innovation and entrepreneurship. Another positive impact on teaching is that the faculty can invite R&D personnel from industry to deliver guest lectures. This again improves the learning experience. R&D personnel from industry can even become adjunct faculty, teaching entire courses and guiding student projects. Apart from enriching the academic environment, this reduces the teaching load on the full-time faculty so that they can spend more time on their academic pursuits.

Many universities encourage innovation and entrepreneurship in the hope of earning substantial royalties. Success stories such as that of Stanford University drive this ambition. Up to 2006, Stanford had earned \$1.09 billion from royalties on over 6400 patents⁵ Closer home, IIT Madras has earned over Rs. 6 crore in royalties from several tens of patents. While this is alluring, the faculty and administration must understand the realities. In the case of Stanford, one-third of the total royalty was earned from a single patent. The top 10 patents, a mere 0.16% of its 6400 patents, earned about 88% of the total royalty. Further, the payback period for the successful patents was typically 10–15 years. Likewise, at IIT Madras, 75% of the total royalties resulted from a single license – the corDECT WLL system. This royalty came 10–12 years after the technology was first licensed to industry. Thus, it is important to realize that innovation and entrepreneurship can yield substantial benefits only if it is pursued diligently for long periods. As the period of 10–15 years is much longer than the period between promotions, it is crucial that the promotion criteria of the IITs encourage such long-term commitment of faculty to the task. In any case, the rich learning experience that

⁵ E. Crawley et al., *Rethinking Engineering Education: The CDIO Approach*, Springer, 2010.

students gain on the path of innovation and entrepreneurship is the biggest advantage.

7.3 Recipe

Experience shows that innovation thrives in an ecosystem where three sets of people interact in an informal or formal environment. These include a faculty member, an experienced R&D person from industry and a youngster/student. The faculty member brings in breadth of knowledge and the ability to apply knowledge and techniques from one field to solve problems in another. An experienced R&D person from industry knows how to convert a lab prototype into a product which can be manufactured, which works in the field on a 24x7 basis and is acceptable to the user/consumer and, most important, which makes commercial sense. The strength of a bright youngster/student is that s/he does not know that "it cannot be done" and is therefore ready to plunge in and, once motivated, will work day and night on it. When these three sets of people interact, innovation thrives.

Fortunately, the IITs already have two of these three sets of people on campus. However, the industry person is often missing. In the normal course of functioning of the IITs, there is little opportunity for these three sets of people to be together. Most good universities in the West have attended to this issue by bringing R&D of industry into the campus or adjacent to the campus. The IITs also need to follow a similar path. This can be done in two ways. First, the faculty should engage in large and substantial projects sponsored by industry with deliverables that are tied to the business plans of industry. This ensures close collaboration between the faculty and industry. A more effective way is to bring industrial research labs to the campus. IIT-M has already taken the lead by setting up the IIT-M Research Park

adjacent to its campus. It has even evolved a credit system to measure the involvement of industry with IIT-M, and does not allow industries in the Research Park unless they meet a minimum credit requirement. Other IITs also need to follow a similar system. For this to succeed, the Government must provide the right policies and incentives.

Innovation requires good commercial understanding. As a consequence of their training, most faculty in IITs do not have this understanding. They do not understand the relationship between a bill of material, the cost of a product and the final price of the product. They have little idea about the costs of manufacturing, wastage, procurement, marketing, sales, distribution, finance and depreciation. With such poor understanding of commercials, the research problem that they take up would rarely touch issues that involve industry. A focus on innovation and entrepreneurship requires a change in the mindset of most faculty. They need to be convinced that commercial issues are important. They need to learn about these issues from industry through sponsored projects, consultancy and interactions in on-campus Research Parks.

The IITs have started along the road to innovation. Up to the mid 1990s, incubation of companies on campus was frowned upon in the IITs. Those who did incubate companies, did it under wraps. A decade later, it had become acceptable and most IITs now have some sort of incubation programme. To be effective, these programmes must be led by those faculty who, through experience, have a good understanding of innovation and entrepreneurship. The incubation cells should focus on providing training and support in commercial issues rather than simply providing space and computers. The IITs need to have enlightened policies regarding sharing of royalty income. The faculty should be encouraged to plough back a portion of the royalty into the next innovative idea, taking only a fraction as

salary. The IITs should not take a large fraction of royalty in the beginning, nor a large equity for its help in incubation. Such policies often kill the goose before it lays the golden egg. The IITs have to first nurture innovation and entrepreneurship before expecting any substantial resource generation from this.

The same is the case with the Intellectual Property Right (IPR) policy. The IITs have very little experience in generating and making significant revenue out of IPRs. This is something it needs to learn. It needs to understand what it takes to generate IPRs that will bring in large commercial gains. To learn this, it needs to work with industry and, in the beginning, give more than it wishes to take. As it gains experience, it would not only learn to generate significant commercially viable IPRs, but also to get the right commercial value for it. IIT administration sometimes do not understand this and tend to hurt a budding academic–industry interaction in its attempt to gain more.

7.4 Academic Structure

Innovation is inherently inter-disciplinary in nature. For example, in the 1960s, Gary Starkweather of Xerox brought together expertise in optics, electronics and mechanical engineering to invent the laser printer which has revolutionized printing.⁶ The IITs have built their departments as silos. Little inter-department work is done and, in fact, when faculty from different departments start working together, they are often even discouraged. Inter-disciplinary programmes have therefore rarely come up and even if they do, they are finally one or the other department's baby.

⁶ W. Brian Arthur, *The Nature of Technology: What it is and How it Evolves*, Free Press, 2009, pp. 117–18.

It is not easy to register a PhD student between an Engineering and Humanities department or an Engineering and Management department. If one does so, both the departments would make it difficult for the student/faculty, for they simply do not know how to manage this. There are many instances of IIT B.Tech students of Chemical or Mechanical Engineering or Metallurgy who have gone to the US to do a PhD in Computer Science and Electronics or Electrical Engineering and have carried out excellent research. Very rarely does this happen in the IITs. Similarly, many departments insist while recruiting that a potential faculty member must have a basic degree in the same department, even if otherwise the person is very good. These policies are counter-productive as far as creating a climate for innovation is concerned.

In this context, the new IITs present a unique opportunity. Several of them have eschewed departments, grouping faculty in broad Schools instead. IIT Jodhpur does not even have Schools! In some of the new IITs, faculty offices and lab space are combined between disciplines to encourage inter-disciplinary interaction. In one case, a chemistry faculty who shares an office with a computer scientist has developed an interest in a new research area – molecular cryptography. A few years ago, IIT Madras offered up to Rs. 1 crore of internal funding to projects proposed by groups of faculty from at least 3 different departments. Several of these projects helped develop inter-disciplinary expertise. However, after the initial internal funding, the momentum has petered out in many cases due to the traditional departmental barriers.

The curriculum for B.Tech/M.Tech students follows the decades old traditional structure. It progresses from basics of the sciences, to basics of a particular discipline to advanced topics in that discipline. There is some flexibility to take electives, but these are often towards the end of the degree course and are carefully

restricted to fit students into a predetermined mould. This well-structured curriculum does not allow a creative student the freedom to do courses across departments, take off for a semester and try participating in a start-up and come back, or take up some project work instead of a course. The curriculum is designed for a mass of ordinary students; it does not cater to exceptional students. The structure goes against the promotion of entrepreneurship and innovation.

There are exploratory attempts to change this. For example, IIT Delhi has a course on design in the first year which gives students hands-on experience with designing and building useful products. The new IITs have the chance to quickly develop much more flexible curricula as they are not weighed down by decades of tradition and cumbersome processes. IIT Mandi is extending the IIT Delhi approach to give students hands-on design-oriented mini projects throughout their programme. This is patterned on the curriculum in Olin College, Boston, and the *conceive-design-implement-operate* (CDIO) approach being popularized by MIT.⁷

7.5 Summary

Enterprises born out of universities convert their research into products and processes. This brings in a new dimension to research. It enables faculty and students to learn commercial aspects and make their research so much more relevant. Incubation in universities is therefore essential for innovation.

Innovation, because of its exploratory nature, is prone to failure. Over 4 decades, Stanford University produced only 6400 patents—a very small fraction of

⁷ Linda Chao, 'Licensing to Companies in Asia: The Stanford Model', Oct 2006, <http://asia.stanford.edu/events/fall06/slides/061026-chao.pdf>

its paper publications during the same period. Less than 1% of these patents earned royalties of over \$1 million. Thus, the story of innovation is one of many failures, learning from the failures and occasionally succeeding, but very, very rarely hitting the jackpot. Innovation needs to be pursued with single-minded focus for 10–20 years to achieve even modest success.

The IITs have started along the road to innovation through incubation. The steps taken so far are only the initial ones. Significant changes in promotion policies, academic structures, curricula and mindset of the faculty, students and administration are required. However, the national need for focus on innovation in the IITs is overwhelming, both in terms of nurturing the spirit of innovation among students and also in creating new technologies. The benefits to the IITs and their faculty are also enormous.

Chapter 8

Scaling Engineering Education with Quality in India

India, with over a billion people and with more than half the population under 25 years of age, recognizes that education and development of human resources is paramount for the continuation of rapid inclusive growth. Over the years, engineering education has been recognized as a means to transform lives of middle and lower-middle class people; no doubt there is a huge hunger for quality engineering education. In the early 1980s, India had very few engineering colleges and graduated less than 25,000 engineering students every year. Most of these institutions were owned and funded by the Central or state governments, with the fees amounting to a small percentage of their total budget. Parents would line up to try and get their wards admission in this exclusive club.

It was in such a situation that a policy decision was taken, initially by some southern states but later extended across the country, to allow private engineering colleges to be set up. This policy led to the mushrooming of private colleges. As government revenues increased due to a growing economy, it also set up a few more institutes; however their growth was small. Today there are well over 3000 AICTE-approved engineering colleges and over a million admissions to these colleges each year. The problem of quantity has been thus solved.

This however is not true of the quality. As one goes beyond the IITs, the quality deteriorates significantly. There are several Central and state government-funded as well as private engineering colleges, which have endeavoured to achieve quality. But it has been a struggle. So when a 16 year-old, focused on high quality education, seeks admission in an engineering college in India, s/he does not know where to go. Many who can afford go to colleges in Australia, Europe and USA,

often preferring even the mediocre ones there. Others prepare for years to get into IITs, NITs and a few top institutions. Since very few (about 25,000 are able to get admission to these institutions, the others then reluctantly go to other colleges.

There is an urgent need for India to attend to this problem and provide quality engineering education to a much larger section of its population. The IITs, being the premier education institutes in the country, need to play a major role in overcoming this situation. The Committee has deliberated on what the IITs can do; it recommends here a plan to enable 100,000 youngsters every year to get admission in Central government-funded institutions providing quality engineering education. Hopefully, state governments' and private efforts would add to this significantly and result in a few hundred thousand quality seats. If this happens, it would go a long way in enabling India to provide quality and inclusive engineering education in India for its youngsters.

The Committee recommends the identification/creation of 50 Central government-funded institutions (other than the 20 IITs) which could be nurtured with the help of young IIT faculty and talented youngsters from industry. The objective will be to achieve quality education at the undergraduate level similar to what the best IITs today provide.

These 50 institutions could admit about 80,000 engineering students every year and include NITs, IISERs, NISER, IIITs and certain other institutions currently supported by the Central government. There are currently about 20 NITs and 10 new ones coming up. Similarly, there are 4 IIITs today and 6 new ones coming up. There are 5 IISERs and a NISER. There are several other Central government institutions. Some new ones would also come up. While a lot has been done to improve the quality of these institutions, they still need a push to go up the quality ladder. The Ministry of Human Resource Development is willing to provide

generous funds; but that alone will not improve the quality. The quality of the faculty needs to improve and the culture of these institutions needs to change.

These institutions need to be nurtured in order to take them to the next level of quality in undergraduate education and research. Only so much can be done from within these institutes. There has been some attempt in the past to get IIT faculty associated with NITs, but this has not helped much. The primary reason for this has been the association of established senior faculty of the IITs who have very little time on their hands to nurture these institutions, even if they wanted to.

In recent times, the IITs have occasionally attracted some very high quality young faculty. They have the energy and will to change the education system. The proposal is to involve such exceptional faculty in enhancing quality at these identified institutions. Now, even though they are young, they have their goals cut out and hands rather full with building their research groups at the IITs and, maybe, developing relationships with industry. Since they would not ordinarily involve themselves with identified institutes, the proposal has to be different in order to attract them.

It is proposed to identify 5 youngsters (about 35 years in age) for association with each of these identified institutions; the identification will be carried out in consultation with the Director and Chairman of the Board of Governors (BOG) of the identified institute. They will be inducted⁸ into the BOG and Senate of the institute and tasked with helping drive excellence in these institutions by leveraging their association with the IITs. One would expect them to⁹:

- a. Help an NIT Director take the institute to the next level of quality

⁸ Statutes of some of these institutions may not permit it today; they can be invited members, till the statutes are amended.

⁹ A side benefit of this will be that these young faculty members of the IITs will get trained to become future directors/leaders of institutes.

- b. Build relationships with the young faculty at NIT, and encourage and guide them to take their institute to a higher level of quality
- c. Nurture the department to which they belong by:
 - i. Connecting the department to a corresponding IIT department and building several faculty-to-faculty contacts.
 - ii. Enabling institute faculty to spend some time at their IIT during summer or in short-term courses and workshops.
 - iii. Getting PhDs from their IITs to join as faculty at the institute
 - iv. Encouraging UG students to join the IITs for PhD.
 - v. Working out joint research collaboration between the institute and their IIT. MHRD could provide a sum of up to Rs. 50 lakh to each of the 5 faculty members for such joint projects (a joint proposal will be evaluated before funding) for 5 years.
- d. The term of the Board would be 5 years
- e. One would expect the IIT faculty to spend 15 days in a year at a NIT (including Board, Senate and meetings with faculty)

In a similar manner, a select list of highly talented youngsters from industry will be prepared by the Chairpersons (and not the staff) of the four industry associations (CII, FICCI, ASSOCHAM and NASSCOM) for induction on the boards of these 50 institutions and to nurture them. These young industry persons should be highly qualified (a Master's degree from a reputed institution is the minimum qualification, and a PhD would be preferable), energetic and willing to spend at least 15 days in a year in the institute to make a difference. The Chairman, BOG and the Director of each of these 50 identified institutions would identify 3 youngsters from the list for induction in the Board to help nurture these institutions.

It is hoped that these talented young sons and daughters of India would be able to take the task of strengthening the undergraduate education in these institutions by creating a culture where excellence and innovation thrives. The plan will also build a network for each of the 50 institutions, which could be leveraged by them.

It is hoped that many state government-funded institutions and private institutions will take up a similar approach to strengthen their UG programmes.

Chapter 9

Conclusions and Recommendations

It is clear that India needs a major boost to the quality of higher engineering education. Frontline research, cutting edge technology, innovation and entrepreneurship alongside teaching and mentoring are key ingredients of high-quality education. This is crucial in the context of our national development aspirations, growing economy with inclusive participation, creating opportunities for our youth and building our competitiveness in the emerging knowledge-driven global economy. The IITs are by far the only institutions which can lead this process on a scale commensurate with the needs of our country. The IITs can also help several other higher engineering education institutions, particularly those with the potential to further catalyse this process and enhance our national capability towards this objective.

The transformation of IITs into institutions that meet such an objective would mean that the IITs have a talent pool comparable with the best in the world with capability to liberally support their creativity to realize the fullest potential. It also presupposes that the IITs have a flexible governance system that can innovate management support that is specific to the needs of taking new ideas and initiatives forward. Such an environment also attracts external talent and ideas.

The IITs thus need to further enlarge and strengthen themselves as major research institutions with focus on the development of high capability human resource. This inevitably would mean considerable scale up, particularly in terms of PhD programmes. It is necessary to calibrate this process in a manner that leads to sustained augmentation of quality. The IITs are presently under considerable strain on account of rapid expansion with considerable difficulties and backlog in

terms of faculty recruitment and augmentation of infrastructure. Bridging the gap between the present state and the end objective with respect to the IITs has to be a sustained long process spanning 10–15 years with most additional faculty strength inevitably coming from IIT PhDs since there are few other sources of high quality engineering PhDs within the country. Even the most aggressive recruitment of PhDs from foreign universities, which must be pursued vigorously, is unlikely to be adequate to meet domestic needs in time.

The IITs have distinguished themselves for the quality of their B.Tech degrees. IIT's brand image is primarily due to the very distinguished performance of its B.Tech students. A distinctive feature of the IIT B.Tech programme is its co-existence with an equally large postgraduate teaching and research domains. Certain parameters of this successful programme, such as a nearly equal UG : PG proportion and student : faculty ratio of 10:1, have stood the test of time and should be preserved.

Apart from the large-scale need for high quality engineering graduates to meet the needs of various segments of demand for them, there is also the need for high performing engineering graduates to be a feed into the postgraduate programme, more particularly the PhD programme. The number of B.Techs graduating from the IITs is unlikely to be adequate for this purpose. While intense efforts have been proposed to attract IIT B.Techs into PhD programme, it is also necessary to focus on other engineering education institutions of good quality (in particular the NITs, ISERs, etc.) to become feeders for quality graduate engineers into PhD programmes of IITs.

To support a significantly expanded and high-quality PhD programme, the research infrastructure at the IITs needs considerable augmentation. While doing so, the research has to be broad-based to cover various dimensions like research

on the frontiers; coordinated research involving several groups to address major areas of national priority, research to meet the needs of industry and the society, participation in the R&D needs of industry and of Government, etc. This would create holistic learning opportunities for students by exposing them to realistic hands-on experience and at the same time bringing significant resources into the IITs over a period of time.

Such an environment needs to be richly endowed and liberally supported. More important, it should have its own governance structure that can flexibly address the needs in specific cases without being constrained by the inflexibilities of governmental working. This is a prerequisite for attracting and retaining talent, which is at the core of the performance of such institutions.

It is proposed that the IITs be financially supported by the Government through plan budget to meet their infrastructure needs as well as the research needs of the Government. Research students, both at the masters and doctoral levels, should also be supported by the Government on a per student basis. The IITs should recover the full operational cost of education through fees and not derive any input through non-plan budget of the Government. A special and hassle-free bank loan arrangement has been recommended as part of the admission process to support and facilitate access to all eligible and deserving students.

We feel that it should be possible to make the IITs administratively and financially autonomous to realize the objectives enumerated above and reach the full potential of the IIT system. Key recommendations being made by the Committee include (i) self-empowered Boards comprising all key stakeholders, (ii) creating a system of mandatory peer reviews, (iii) mutually agreed respective commitments between the Government and IIT on the basis of an annual MoU

duly overseen by the IIT Council, and (iv) transparency in working. The Government's commitment to support research at the IITs to their maximum potential is an important assumption that forms the basis of the Committee's recommendations. The Committee also feels that all the recommendations should be considered as part of a single package and accepted or rejected as a whole, and not treated in parts.

The specific recommendations of the Committee are given below:

IITs as Research Institutions

1. Make IITs the Primary Research Institutes, with a focus on high quality frontier research and technology development within the Indian context.
2. Scale up PhD students from less than 1000 PhD graduates per year today to 10,000 PhD graduates by 2020-25 from about 20 IITs (15 existing IITs plus 5 new to be set up over the next several years in states where there are no IITs).
3. Scaling PhD scholars' admissions to include enabling bright UGs being admitted for PhD at the end of their third year, teachers from other institutes joining for PhD and significant numbers from industry joining sponsored/part-time PhD programme. It is strongly recommended that a fellowship scheme covering all categories of PhD students is in place.
4. The faculty: student ratio is 1:10; while the UG : PG ratio is close to 1:1.
5. Each IIT should aim to acquire technology leadership in at least 3 to 4 areas.
6. Research groups in one or more IITs to take up large projects together to address major national challenges
7. Set up research parks at each of the IITs similar to the IIT-M Research Park.

8. Enable Ministries to set up R&D labs in IITs to drive Technology Development relevant to national programmes being piloted by them.
9. Large-scale Executive M.Tech training programmes for industry jointly conducted with the IITs using video links.

Financial Autonomy and Governance

10. Government to financially support research at the IITs in the plan mode to realize their full potential for national needs in terms of research, technology and human resource in science, technology and entrepreneurship. For this purpose an annual outlay on the basis of Rs 1.5 lakhs per student should be made available to each of the established IITs. For the new IITs which are at present in project mode and do not have any significant endowment, an endowment grant of Rs. 50 crore per IIT (over next 5 years) may be made available to enable a degree of flexibility in academic activities.

The IITs need to expand infrastructure to support a scaled up academic and research programme as recommended above. This would also require capital funds for infrastructure expansion from the Government at Rs. 20 lakh per additional student. There is also a need to rejuvenate the existing ageing infrastructure at Rs. 5 lakh per student as existing on March 2011. Funds allotted for expansion taking place currently to accommodate OSC recommendations have been found to be inadequate and need to be increased to Rs 15 lakh per student.

11. MHRD to pay the full operating cost of education plus a scholarship for all postgraduate students (PhD, MS and M.Tech) as well as for undergraduate students from reserved category and economically weaker sections. Some merit-cum-means scholarship should also be made available to needy and

deserving students. A hassle free loan facility not requiring any collateral or parental guarantee to be made a part of the admission process. No student should be denied education in an IIT after getting admission due to lack of means.

12. Except for legacy payments like old pension, the IITs are to be financially independent of the non-plan budget of the Government. Fees are to be fixed at a level to cover operational expenditure.
13. IITs are to be totally independent of MHRD for their governance and management functions. They are to be run by their Boards with all rules and regulations made by their Boards. This includes management structure, rules and regulations for faculty/staff hiring and remuneration, approving of budgets and fixing fees, expenditure rules and processes and audit processes. C&AG audit to continue based on financial rules formulated by the Boards.
14. IITs need to enhance their financial inputs through donations. The donor should be eligible for a full deduction of their contribution against their income under the Income Tax Act as is currently allowed for any grants made to Universities in India under Sec 35AC of the Income Tax Act 1961. A notification or an amendment is essential in the law to include IITs in this list.
15. IIT Boards will select and appoint a Director using a search committee process. IIT Boards will nominate the Chairman to be appointed after approval of the IIT Council.
16. The Board will consist of one representative from the Central government, one from the state government, three industry persons selected from a panel recommended by the Chairmen of CII, FICCI, ASSOCHAM and NASSCOM (in a joint meeting), three scientists selected from a panel

recommended by four Indian Academy Presidents (INSA, NASI, INAE, IASC) (in a joint meeting), two alumni (who are not IIT employees), two faculty from the institute, one eminent citizen appointed by the Board, the Chairman and the Director. The panels recommended by industry association Chairmen and Presidents of Academy will need approval of the IIT Council.

17. The IITs will sign a MoU with MHRD every year in line with the aims and policies of the Government of India. The MoU should include budgets and fees approved by its Board, capital expenditure (plan money), pension money and scholarships that MHRD would provide and expansion needs (if any). It would also include aims and goals set by the IIT for the year. The MoU would need to be reviewed and approved by the IIT Council.
18. The Visitor may require the IIT Council to appoint an external review committee for each IIT once in 5 years. The report of the review committee and action taken is to be made public. The Government may require the IITs to take appropriate action in light of the findings of the review committee.
19. The emergency powers of the Visitor over the IITs are to continue.

Faculty

20. Scaling up of quality faculty is the key. It is required to scale up to 16,000 faculty members in about 10 years (from a little over 4000 currently).
21. Part-time/Adjunct faculty from industry, visiting faculty and post-doctoral in IITs to be strengthened.

22. Faculty pay-scales and remuneration is to be decided by the respective Boards. Pay-scales have to be decided within the financial constraints of the institute.
23. The Board of each IIT will decide on the roles, responsibilities and appraisal of their faculty. Faculty roles include teaching, research, technology development and industrial consultancy, as well as policy/standards development. Besides, they may be involved in administration. It is suggested that each faculty sets their yearly goals and the time they would spend in these 5 activities. At the end of each year, they would carry out a self-appraisal and provide evidence of their work. Departmental committees will review the appraisals for Assistant Professors and an institute-level committee will review the appraisals for others. Once in 5 years, an external review of these appraisals will be carried out.
24. Today, the IITs and their faculty do not have the experience and expertise to take into account the “technological development and industrial consultancy roles” played by the faculty during their appraisals and evaluation. This needs to be strengthened.

Role of Staff

25. The IIT Boards will decide on staff numbers, remuneration and pay-scales.
26. It is suggested that most staff members be hired as outsourced staff on contract. Young staff members who start their career at the IITs and work for there 5–10 years would be well trained to be absorbed in industry. This way the IITs would get young motivated staff members.

Innovation and Entrepreneurship

27. The IITs must recognize that technology development, innovation and nurturing entrepreneurship are some of their key tasks.
28. The IITs must also recognize that Innovation thrives when faculty, experienced industry persons and students interact in formal and informal environments. The creation of such an ecosystem is a necessity.
29. The B.Tech and M.Tech Curriculum is very structured and does not allow creative students to do courses across departments, take off for a semester for a start-up venture and come back or take up some project work instead of a course. The curriculum is designed for large numbers of ordinary students and not for exceptional students. This needs correction. Similarly, the IITs do not easily allow students of one branch to do MS/PhD in another. Even while hiring faculty, they look for B.Techs only in the discipline they are to teach. The system needs to adopt greater flexibility to provide greater choice to students so that they are better prepared for a chosen career option.
30. IIT faculty members have poor commercial understanding. This comes in the way of technology development or innovation. Greater interaction with industry in the product development mode should be adopted.
31. Entrepreneurship is not about space or computers; it requires nurturing a business. Only faculty who understand this should drive entrepreneurship cells.

Scaling Engineering Education with Quality in India

32. India, with its billion people, has huge demand for quality engineering education. Unfortunately, even though more than a million students are

admitted to engineering colleges today, except for the IITs and some other institutions, the quality of education in most other engineering colleges is not of the desired quality. The Committee recommends a plan to create at least 100,000 quality engineering graduates per year through Central government-funded institutions alone. Hopefully, the state governments and private efforts would add to this significantly.

33. The Committee recommends identification/creation of 50 Central government-funded institutions (other than the 20 IITs) which could be nurtured with the help of young IIT faculty. These would include NITs, ISERs, NISER, IIIT and certain other institutions. This would be done through 5 enthusiastic young faculty members with a proven level of excellence for each such institution, who would be identified in consultation with the Director and Chairman of the Board of Governors for induction in the Board and Senate of these institutions. They would be tasked with driving excellence in these institutions by leveraging the IITs. An outlay of Rs. 50 lakh each should be made available to such faculty to support research in the institute with IIT collaboration.
34. With their advent at a historic cusp in the evolution of technical education in India, the new IITs present a unique opportunity for a major upward movement in the IIT system. Without the legacy of many decades of established tradition, a new IIT can boldly experiment with radically new ways of teaching, research and administration. In teaching, the shortage of experienced faculty could be turned into a benefit by judicious use of multimedia and networking technologies to augment the classroom experience. In research, apart from setting up state-of-the-art facilities, the

new IITs can build collaborative relationships with like-minded institutions around the world. (Also see Appendix VII.)

In the established IITs, the Directors and Board spend much of their time and energy dealing with vexatious issues such as service conditions of long-time staff. This distracts from their ability to spend quality time on academic innovations and impact. The new IITs could devise administrative and staffing structures that avoid these vexatious issues.

The Board, the Director and the faculty of the new IITs should be selected for their openness to new ideas and should be encouraged to experiment with teaching, research and administration.

The new IITs have a unique potential to catalyse the transformation of the IIT system. Hence, they need special treatment to ensure that they realize this potential by building on the strengths of the IIT system while avoiding its weaknesses.

Appendices

Appendix-I : Dr Anil Kakodkar Committee, Its Constitution and Functioning

F.NO.19-3/2009-TS 1
Government of India
Ministry of Human Resource Development
Department of Higher Education
Technical Section-1

Shastri Bhavan, New Delhi
3rd February, 2010

Subject: Constitution of a Committee to recommend autonomy measures to facilitate IITs scaling greater heights.

In the 40th Meeting of Council of IITs held under the Chairmanship of Hon'ble HRM on 19th October, 2009 (refer minutes issued vide F. No. 19-3/2009-TS. 1 dated 24th November 2009), it was decided that a committee, comprising Dr. Anil Kakodkar, Chairman, BoG, IIT Bombay, and four other members to be nominated by him, may be constituted for suggesting a roadmap for the autonomy and the future of the IITs as world class institutions for research and higher learning.

2. Accordingly, it has been decided to constitute a Committee under the Chairmanship of Dr. Anil Kakodkar, Chairman, BoG, IIT Bombay, to suggest a roadmap for the autonomy and future of the IITs. Composition of the Committee will be as under:

- | | |
|--|----------|
| 1. Dr. Anil Kakodkar,
Chairman, BoG, IIT Bombay | Chairman |
| 2. Shri T.V. Mohandas Pai,
Member of the Board &
Director
Human Resources,
Education & Research and Admn,
Infosys,
Plot No.44, Electronic City,
Hosur Road, Bangalore - 560 100 | Member |
| 3. Shri Hari Bhartia,
Co-Chairman, MD of Jubilant Organosys, | Member |

1-A, Sector 16-A, Institutional Area,
Noida- 201031, U.P.

- | | |
|--|---------------------|
| 4. Prof. Ashok Jhunjunwala,
Deptt. of Electrical Engineering,
IIT Madras, Chennai | Member |
| 5. Dr. K. Mohandas,
Vice-Chancellor,
Kerala University of Health Sciences,
Thrissur, Kerala | Member |
| 6. Shri Ashok Thakur,
Additional Secretary, MHRD | Member
Secretary |

The Terms of Reference of the Committee are as follows:

1. To suggest a roadmap for strengthening Financial, Administrative and Academic autonomy of the IITs;
2. The issue of autonomy is closely linked with the capacity of institutions to raise their own resources including through increase in fees in the IITs albeit in a gradual manner. While doing so interest of the weaker sections of the society could be taken care of. The Committee is to suggest a "means-blind system" wherein scholarships are provided to the deserving, and a system of education loans dovetailed into it. For the students who continue to research and take up teaching assignments as a career, a system of interest loan scheme could be explored;
3. The Committee to suggest ways and means to retain/attract top B.Tech students within the IIT System and outside to Postgraduate and PhD programmes. Institutes should be incentivised by way of higher funding based upon the number of Postgraduate students enrolled and number of PhDs awarded each year;
4. The Committee could consider the issue of faculty induction and development. Measures to improve the strength of IIT faculty may be suggested for adoption and implementation;

5. To suggest a self primed system within the IITs to achieve the optimal level of intake of students each year (UG and PG), which but for the MHRD initiated OSC expansion programme has remained stagnant. The Committee could explore the possibility of releasing funds to the institute on per student basis to incentivise growth;
6. To suggest means to raise the resources/corpus of the IITs through research project from the Government, Industry, Consultancy, Donations from alumni, etc., and to explore the possibility of matching grants from the Ministry;
7. During the XI Plan period, the IITs have been in an expansive mode in that it doubled its numbers from 7 to 15. The Committee to take stock of the present expansion programme and also suggest the future course of action in terms of inclusion, expansion and excellence in the XII Plan period and beyond;
8. The Committee will also look into possible synergies that could be developed from not only interaction and collaboration amongst the IITs, e.g., consortium of IITs to take up research projects etc., but also linking up with other National Institutes like IIMs, IISERs, IISC, IIITs, NITs, etc. The Committee will also look into the role that IITs have been playing and could play in the future to increase its role as a human resource and technology provider in support of inclusive national development in a rapidly developing/growing economy; and
9. The Committee would also review a few similar exercises that have taken place elsewhere in the world to understand the process involved to arrive at credible recommendations. For this purpose, the Committee could invite a few eminent leaders from some of the successful institutions for discussions and advice. The Committee would also consult different stakeholders, e.g., IIT Management, Faculty, Alumni, Industry, S&T agencies, Technical Education experts, etc. The Committee may also take into account Prof. P Rama Rao. Committee recommendations and others while working out a roadmap for IITs to scale new heights.

(Ashok Thakur)
Additional Secretary, MHRD

Distribution

1. Dr. Anil Kakodkar, Chairman, BoG, IIT Bombay 2. All members of the
Committee 3. Director of all IITs

Copy to: PS to HRM/ PS to MoS/Sr. PPS to Secretary(HE)

Meetings of the Committee

The Committee met 10 times during the period February 2010 to December 2010. At least one meeting was scheduled at each of the 5 established IITs. The Committee made use of their visit to each IIT campus to meet and get the views of a section of its faculty. All meetings were of 1 day duration except the 2-day 7th meeting that took place at Delhi. The Committee met once at the Infosys Campus at Mysore. The Committee also made a 5-day visit to China. Details of the meetings are as follows:

No.	Date	Place	Remarks
1.	05 Apr 2010	IIT Bombay	Session with Directors of IITs
2.	28 Apr 2010	IIT Bombay	
3.	06 Jun 2010	IIT Madras	Session with faculty of IIT Madras
4.	26 Jun 2010	Infosys Campus, Mysore	
5.	10 Jul 2010	IIT Kharagpur	Session with faculty of IIT Kharagpur Session with Directors of IITs
6.	11 Aug 2010	IIT Delhi	Meeting with Secretary DST Session with faculty of IIT Delhi
7.	3 Sep 2010	Delhi	Sessions with various ministries and industry federations
	4 Sep 2010	CSIR Vigyan Kendra	
8.	24 Sep 2010	IIT Bombay	Session with faculty of IIT Bombay
9.	18 Oct 2010	IIT Bombay	
10.	03-06 Nov 2010	China visit	
11.	29 Nov 2010	IIT Kanpur	Session with faculty of IIT Kanpur
12.	12 Dec 2010	IIT Bombay	Committee meeting and review
13.	01 Jan 2011	IIT Bombay	Review of the report and session with directors
14.	15 Jan 2011	IIT Delhi	Review of the report and meeting with Honourable Minister of HRD.
15.	02 Feb 2011	IIT Madras	
16.	20 Feb 2011	IIT Bombay	

The Terms of Reference of the Committee and their compliance are as follows:

ToR No.	ToR in details (with key terms in bold)	Compliance
1.	To suggest a roadmap for strengthening Financial, Administrative and Academic autonomy of the IITs;	Totality of the report outlines a roadmap and a 15-year plan to take IITs to next logical phase – it includes expansion in number of IITs, increase in graduating UGs and PGs, Research that will cater to frontier areas as well as of local relevance and much more to be realized from an accountable IIT system.
2.	The issue of autonomy is closely linked with the capacity of institutions to raise their own resources , including through increase in fees in the IITs albeit in a gradual manner . While doing so, interest of the weaker sections of the society could be taken care of. The Committee is to suggest a "means-blind system" wherein scholarships are provided to the deserving , and a system of education loans dovetailed into it. For students who continue to research and take up teaching assignments as a career , a system of interest loan scheme could be explored;	Raise their own resources - Increase in fees in the IITs albeit in a gradual manner. Chapter 4, Section 4.3 : Key recommendations on Fee & Scholarships.
		Interest of the weaker sections/scholarships to the deserving. Chapter-4, Section 4.3 Full fee support from Govt to UG students from weaker sections/ deserving UG students as well as to all PG students. Section 4.8 : Introduction to Special Loan Scheme & also Appendix-V Loan Scheme for IIT Students from SBI, Appendix-VI Educational Loan Scheme by Indian Bank's Association
		Students who continue to research and take up teaching assignments as a career. Chapter 4, Section 4.8 : Introduction to Special Loan Scheme/incentives for students to pursue PG studies and take up career as faculty/researcher in key national programmes.
3.	The Committee to suggest ways and means to retain/attract top B.Tech students within the IIT System and outside to Postgraduate and PhD programmes. Institutes should be incentivized by way of higher funding based upon the number of Postgraduate students enrolled and number of PhDs awarded each year ;	Retain/attract top B.Tech students within the IIT System and outside to Postgraduate and PhD programmes Chapter 3, Section 3.2
		Higher funding based upon the number of Postgraduate student enrolled and number of PhDs awarded each year; Chapter 4, Section 4.3
4.	The Committee could consider the issue of faculty induction and development . Measures to improve the strength of IIT faculty may be suggested for adoption and implementation;	Faculty induction and development Chapter 5
		Measures to improve the strength of IIT faculty Chapter 5
5.	To suggest a self primed system within the IITs to achieve the optimal level of intake of students each year (UG and PG), which but for the MHRD	Optimal level of Intake Chapter 3, Section 3.2.1. Recommendation for 10,000 PhD per year with commensurate changes

	initiated OSC expansion programme has remained stagnant. The Committee could explore the possibility of releasing funds to the institute on per student basis to incentivize growth;	in other numbers keeping time tested optimum UG:PG ratio of 1:1 and student:faculty ratio of 10:1.
		Funds to the institute on per student basis to incentivize growth; Chapter 4, Section 4.3 on Financial Autonomy
6.	To suggest means to raise the resources/corpus of the IITs through research project from the Government, Industry, Consultancy, Donations from alumni, etc., and to explore the possibility of matching grants from the Ministry;	Raise Funds : Government & Industry: Chapter 3, Section 3.7 : Idea of encouraging and enabling various government departments and ministries to set up R&D labs at IITs Chapter 3, Section 3.8 : Idea of Executive M.Tech Programme, also see Appendix-IV Chapter 7 : Innovation & Entrepreneurship, idea of Research Parks therein Donations from Alumni, etc. Chapter 4, Section 4.6 specifically encourages IITs to start an aggressive drive to get endowments, scholarship grants and funds from their Alumni and other donors to meet at least 10–15% of their needs on an annual basis over time.
7.	During the XI Plan period, the IITs have been in an expansive mode in that it doubled its numbers from 7 to 15. The Committee to take stock of the present expansion programme and also suggest the future course of action in terms of inclusion, expansion and excellence in the XII Plan period and beyond;	Take stock of the present (OSC) expansion programme Chapter 4, Sections 4.6 and 4.10 makes specific recommendations on funding related OSC expansion. Course of action in terms of inclusion, expansion and excellence Chapter 3, Section 3.3. Addresses Diversity on Campus and issue related under representation of women in UG programme at IITs.
8.	The Committee will also look into possible synergies that could be developed from not only interaction and collaboration amongst the IITs, e.g., consortium of IITs to take up research projects etc., but also linking up with other National Institutes like IIMs, IISERs, IISc, IIITs, NITs , etc. The Committee will also look into the role that IITs have been playing and could play in the future to increase its role as a human resource and technology provider in support of inclusive national development in a rapidly developing/growing economy; and	Linking up with other National Institutes like IIMs, IISERs, IISc., IIITs, NITs Chapter 3, Section 3.4 specifically recommends research groups drawn across all institutions IITs, NITs, IISERs, IISc, etc. to join hands to address key national challenge Increase its role as a human resource and technology provider in support of inclusive national development Chapter 7 on Innovation and Entrepreneurship Chapter 8 on Scaling Engineering education

9.	<p>The Committee would also review a few similar exercises that have taken place elsewhere in the world to understand the process involved to arrive at credible recommendations. For this purpose, the Committee could invite a few eminent leaders from some of the successful institutions for discussions and advice. The Committee would also consult different stakeholders, e.g., IIT Management, Faculty, Alumni, Industry, S&T agencies, Technical Education experts, etc. The Committee may also take into account Prof. P Rama Rao Committee recommendations and others while working out a roadmap for IITs to scale new heights.</p>	<p>Review a few similar exercises that have taken place elsewhere in the world Chapter 1, Section 1.11 on China visit</p>
		<p>Consult different stakeholders Chapter 1, Section 1.10. Stakeholder's voice Appendix-II : Online survey</p>
		<p>Take into account Prof. P Rama Rao Committee recommendations Chapter 1 : Introduction</p>

Appendix II : Details of Online Questionnaire, Analysis and Results

The Kakodkar Committee conducted an online survey to seek stakeholder inputs. The survey was a questionnaire comprising 58 questions grouped under 12 themes. All questions had a text box where respondents could express their detailed opinion if they so desired. Forty-six questions, in addition, had radio-buttons for respondents to quickly indicate their reaction by choosing one of 3 options like Agree/Disagree/No Comments. The 12 questions that did not have radio-buttons were question nos. 4, 8, 13, 14, 15, 17, 24, 25, 29, 43, 44 and 52. Radio-button responses are readily available for interpretation as to what percentage agreed, disagreed, etc. Textual responses had to go through a detailed content analysis to extract the general sentiments expressed.

The online survey opened on 1 July 2010 on an experimental basis and was announced to all stakeholders through an e-mail campaign on 3 July 2010. The response was overwhelming and the survey finally closed on 31 July 2010.

The online survey offered an opening page with a short message on its overall objective for those signing in. The respondents were then requested to categorize themselves into one of the 13 categories. Each respondent could fall into more than one category. During the 1-month run of the survey, 5170 people visited the site. Of these, only 3755 provided inputs. The number of responses in each of the 13 categories is shown below. (It may be noted that the sum of all individual categories will not match the total responses as each respondent could belong to more than 1 category). The respondents were requested to categorize themselves.

	Category	No of responses
	All categories put together	3755
1	Alumni of IIT	2050
2	Industry that hires IIT students	356
3	Industry that sponsors funded research at any IIT	86
4	Industry that hires consultants from IIT faculty	82
5	Industry at large	167
6	Educationist	214
7	Government official	65
8	Faculty of IIT	498
9	Current UG student of IIT	1658
10	Current PG student of IIT	537
11	Current PhD student of IIT	479
12	Public at large	231
13	Staff of IIT	120

The table below lists the 12 themes, questions within each theme and summary of radio button response and text responses.

Theme	Question	Summary of responses indicated through radio button	Summary of responses indicated through text box
1. IIT as a brand	<ol style="list-style-type: none"> 1. 'Brand IIT' has been a good thing 2. IITs are NOT doing enough to sustain and promote the brand 3. IITs are not fully/optimally leveraging the brand. 	<ul style="list-style-type: none"> – 94% of all stakeholders feel “Brand IIT has been a good thing”. Only 81% of IIT staff feel so. – 57% of all stakeholders feel IITs are not doing enough to sustain the brand. 	<p>IITs not promoting/sustaining “Brand IIT” adequately and not optimally leveraging it (<i>Discordant note: Not world-class, brand due to alumni success</i>).</p>

<p style="text-align: center;">2. IIT as an academic institution</p>	<p>4. What steps/means to be taken to benchmark academic standards for becoming world-class institutions</p> <p>5. IITs are adequately addressing challenges like dwindling faculty, foreign universities setting up shop in our country, private universities, etc.</p> <p>6. IITs quickly adopt and offer new courses, responding to advancing knowledge and technological changes such as green technologies, nanotechnology, biotechnology, etc.?</p> <p>7. Should funding be based/enhanced on the number of PG students and PhD scholars enrolled, and PhDs awarded?</p> <p>8. What steps/strategy should the IITs adopt to retain/attract top B.Tech students from within and outside the IIT system for PG and PhD programmes?</p> <p>9. Should IITs innovate to attract experienced industry personnel for research?</p> <p>10. Is there a need for innovative programmes such as Doctorate in Engineering (D. Engg.) especially aimed for professionals from industry?</p> <p>11. Is the move to expand to include non-technical areas such as Arts, Law, Medicine, etc. justified?</p> <p>12. Should IITs become full-fledged Universities by such diversification/inclusion, or retain its present character?</p>	<p>Only 25% of all stakeholders feel IITs are doing enough to address challenges like dwindling faculty, foreign universities coming to India, private universities etc. This feeling is even stronger with only 12% of “industry hiring IITians” and also “public at large” feeling so. But 40% of PG and PhD students felt that IITs are coping.</p> <p>57% of all stakeholders feel IITs are agile in updating curriculum to keep pace with changing times. But this dips to 33% to 40% for industry interacting with IITs.</p> <ul style="list-style-type: none"> – 60% of all stakeholders feel funding should be linked to postgraduate activity. – 83% of all stakeholders feel IITs must innovate to attract industry personnel in research. – Only 40% feel IITs should expand into art, law, medicine, etc. 	<ul style="list-style-type: none"> – Not adequately addressing emerging challenges like dwindling faculty, and private and overseas players entering the arena. <i>Remedy: Aggressive recruiting, increased salaries, accountability, performance-based incentives, better campus amenities.</i> – Promptly respond to advancing knowledge and technology by starting appropriate courses. – Should innovate to attract experienced industry personnel for research; should start industry oriented courses (e.g., D.Engg.). – Should not diversify to include non-technical disciplines (Arts, Law, Medicine) – <i>brand dilution</i> - but may partner with such institutions with similar ethos. <i>(Staff voted for diversification).</i> – Several suggestions for achieving “world-class status”:- <i>Improved infrastructure, curricula, industry relevant research, international accreditation, admitting international students, flexibility in choice of branches/timing, etc.</i> – Suggestions for attracting/retaining B.Tech students for PG and PhD programmes: <i>Renowned faculty, “world class” research projects, cutting edge and industry oriented research, better infrastructure, attractive scholarships, international exposure (through research, student exchange, conference attendance, etc.), reconnecting with original mentor institutions (established IITs).</i>
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">3. IIT as a scientific research institution</p>	<p>13. What is and should be the focus of scientific research at IITs?</p> <p>14. How to ensure adequate funds to do world-class research?</p> <p>15. What needs to be done to enable IITs for doing path-breaking scientific research?</p>	<p>These questions did not have radio-buttons.</p>	<p>Suggestions for enhancing the quantum and quality of research and their focus:</p> <ul style="list-style-type: none"> – <i>On Focus of Research:</i> Both basic and applied research (industry oriented, India centric, societal and environmental issues), interdisciplinary and inter-institutional (other IITs, CSIR Labs, etc.), each IIT focusing on specific areas. – <i>On Sources of Funding:</i> Government, Industry, International agencies and alumni, Tuition fee increase. – <i>Student centric measures:</i> More PG and PhD programmes, reduction of current overemphasis on UG programme, encouraging UG research, NITs taking over UG programmes and/or new IITs becoming performance based research institutions (<i>Faculty</i>). – <i>Institutional and Administrative measures:</i> Lab. modernization, collaboration with alumni and industry, better student-teacher ratio, creation of research director and permanent non-teaching positions (<i>Semi-privatization of labs.</i>).
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">4. IIT as a technical /technological institute</p>	<p>16. Do IITs need to play a larger role in shaping the technical education of the country (like AICTE) in general?</p> <p>17. How can IITs play a part in uplifting the general technical skills in the country?</p> <p>18. Should IITs focus on developing skills in selected areas like water resource management, urban planning, structural consultancy, hardware development, etc. in the country?</p> <p>19. Do IIT students have enough industry exposure?</p> <p>20. Is there a need for industrial training for the PGs and research scholars of IITs?</p>	<ul style="list-style-type: none"> - 64% feel IITs must play a role in shaping technical education in the country. - 80% feel IITs must focus on select areas like water resource, urban planning, etc. needed by the country. - Only 16% feel IIT students have enough industry exposure. - 75% feel even PG and PhD students must be exposed to industry. 	<ul style="list-style-type: none"> - Should play a larger role in developing technical education in India. - Should focus and develop in selected areas (water resource management, urban planning) without compromising on basic research. Government may set up “centres” in selected areas. - Students (all categories) should have more industrial training/exposure. - Should focus on generating leadership in key areas/problems relevant to the country. - Suggestions to uplift general technical skills in the country: <i>Training teachers for improving technical education, distant learning programmes, web-based classes/lectures, producing top-class PhDs and holding workshops for schools and engineering colleges.</i>
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<p style="text-align: center;">5. IITs as Technology Provider</p>	<p>21. Have IITs played a significant part in technology R&D?</p> <p>22. Have they played a significant part as a provider of commercially viable/successful technologies?</p> <p>23. Are there effective, industry friendly mechanisms in place for technology transfer and commercialization – such as assessing the potential of innovation, suitability for the intended purpose, readiness for exploitation, technology proving facility/incubation centre?</p> <p>24. How much detailed engineering and other start-up issues can/should be handled by the IITs?</p> <p>25. What follow-up help can be given after transfer takes place – such as the innovation team being assigned to industry for initial handholding - How should such an exercise be funded and administered with minimal or no "red-tapism"?</p> <p>26. Will such an aggressive innovation-fostering programme hinder academic activities?</p>	<ul style="list-style-type: none"> – Only 40% feel IITs have played a role in technology R&D. – Only 28% feel IITs have created viable/successful technologies. – Only 23% feel IITs have put in place mechanisms for technology transfer/commercialization. – Only 20% are concerned that aggressive innovation-fostering activity will hinder academics. 	<ul style="list-style-type: none"> – No significant contribution to technology R&D or in providing viable technologies. – No effective technology transfer/commercialization mechanisms. – Reasons for the overall low contribution/involvement: <i>Poor marketing of IITs' capabilities and achievements, lack of faith of government and industry, blind conviction in foreign collaboration, over-emphasis on publications as against patents.</i> – Suggestions for improvement on this score: <i>Setting up industrial parks (IIT-M), faculty heading national labs, industry oriented education, etc.</i> – Only 19% felt that an aggressive innovation-fostering programme will hinder academic activities; <i>33% of faculty thinks that it might.</i>
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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">6. IIT as an Instrument of Creativity and Innovation</p>	<p>27. Are IIT students trained in creative thinking? If not, should they be?</p> <p>28. Should there be a formal course that covers lateral thinking, mind mapping, brain storming and idea generation, etc.?</p> <p>29. What steps, if any, are already in place/to be adopted for IPR generation and protection?</p> <p>30. Should there be plans for establishing effective machinery for IPR protection, exploitation/commercialization (Single Window) like the Office of Technology Transfer of Caltech?</p>	<ul style="list-style-type: none"> - Stakeholders are equally divided on the issue that creative thinking is lacking in IIT students. - 70% feel that formal courses must inculcate creative/lateral thinking in students. - 72% want effective machinery towards IPR protection, while only 5% oppose it, with 23% not having an opinion. 	<ul style="list-style-type: none"> - Creative thinking is necessary for nation building, but a formal course is not the answer; opinion divided on IIT students' creative thinking ability. - Suggestions for IPR generation and protection: <i>Easily accessible IPR offices with knowledgeable and interested faculty heading them, law courses with focus on IPR, courses in research ethics, programmes on the logistics of patenting, etc.</i>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">7. IIT as an employer/organization</p>	<p>31. Is IIT a great place to work in?</p> <p>32. Should IITs recruit or co-opt foreign faculty? (i.e., attract international faculty like US universities for improving the diversity of faculty)?</p> <p>33. Are IITs bureaucratic organizations - huge, unwieldy and with outdated systems?</p> <p>34. Do IITs require organizational reforms?</p> <p>35. Do IITs need to be agile and have modern systems of management-human, finance, materials, etc.?</p>	<ul style="list-style-type: none"> - Only 60% feel IITs are a great place to work in. But 80% of faculty, staff and PG students feel so. - 90% feel IITs should improve diversity in faculty with international faculty. - Stakeholders are equally divided on the issue that IITs are bureaucratic with outdated systems. - 72% recommend organizational reforms. - 84% feel IITs need modern systems of management of humans, finance and materials. 	<ul style="list-style-type: none"> - 60% feel IITs are a good place to work in (<i>faculty and students - 80%</i>); but could be better if organizational decay (<i>politics, groupism, power play</i>) is prevented, and infrastructure and pay packets improved. - Organizational reforms to make IITs "simple, nimble and sharp" with more autonomy, and decoupling of academic and administrative duties. - Alumni are the most enthusiastic votaries for "change"; <i>but no comments from the staff or government officials.</i> - Foreign faculty will improve diversity and quality (90%), <i>but teaching style and pay disparity could become issues.</i>

<p style="text-align: center;">8. IIT as a societal organization</p>	<p>36. Is the society and neighbourhood reaping any benefit with the presence of IITs?</p> <p>37. Should they not be benefited?</p> <p>38. Should IITs have some initiatives similar to the Corporate Social Responsibility of companies?</p> <p>39. Is there a need for IITs to utilize their expertise in getting involved in solving local problems such as sanitation, water management, traffic, etc., of their vicinity?</p>	<ul style="list-style-type: none"> - 63% feel society is reaping any kind of benefit from the IITs. But surprisingly, only 50% expect such benefits. - 63% subscribe to concepts like “corporate social responsibility” initiatives from IITs. - 84% urge IITs to engage with society’s problems like sanitation, traffic, etc. 	<ul style="list-style-type: none"> - 63% felt that the society is benefited, but only to the extent of having a large institution in the neighbourhood (<i>Livelihood through services to the campus residents, etc.</i>). - 63% subscribe to concepts like “corporate social responsibility” initiatives (<i>teaching in the villages, helping other colleges, helping in pollution control, green technologies and SMEs</i>). - IITs should engage with society through local governments, NGOs, etc. to address local problems (<i>sanitation, traffic, etc.</i>). - <i>Main aim is to produce good engineers and scientists; benefit to the immediate locality incidental; aim to be an international organization (3%, mostly alumni)</i>
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<p style="text-align: center;">9. IIT as a catalyst for economic development</p>	<p>40. Should IITs focus/play a greater role on being a catalyst for economic development through incubating knowledge enterprises?</p> <p>41. Should IITs engage in solving problems for industry?</p> <p>42. Are IITs accessible to industry for their needs?</p> <p>43. What is the expectation of the industry from IITs?</p>	<ul style="list-style-type: none"> - 85% feel IITs should play a greater role as a catalyst for economic development. - An overwhelming 93% feel IITs must engage with industry to solve industry's problems. - Only 45% feel that IITs are accessible to industry for problem solving. But 72% of faculty think they are accessible 	<ul style="list-style-type: none"> - Should act as a catalyst for economic development (<i>incubating knowledge enterprises, collaborating with industry to solve problems, by producing engineers and a talent base to solve real and practical industry problems</i>). - Most stressed the need to address real-life problems/ challenges faced by society, incubation of enterprises that cater to societal problems, even if economic development is not the immediate result. - Focus on specialized or complex problems which industry cannot solve. But most felt that IITs are not easily accessible/responsive (<i>except to "big" industries</i>), and some also doubted IIT faculty's ability/expertise to solve industry problems. - Encourage small industries to consult IITs' expertise with active student and faculty participation, advertise the resources available in IITs (<i>Students' perspective</i>). - Industry's expectations from IITs: <ul style="list-style-type: none"> ▪ <i>Solutions to industry problems</i> ▪ <i>Foster innovative ideas for futuristic technologies</i> ▪ <i>Provide high quality and competent employees/manpower</i> ▪ <i>Develop long-term associations and better relations.</i>
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10. General	<p>44. What should be the primary focus of IITs - teaching, research, consultancy or others?</p> <p>45. Have they been able to formulate their vision, mission and objectives with shared clarity?</p> <p>46. Should IITs cooperate, complement or compete with each other?</p> <p>47. Should/could the IITs play a lead role in forming consortia among themselves and with IISERs, NITs, IIMs to take up large research development, environmental protection, infrastructure development, etc.?</p> <p>48. Should IITs set up campuses outside India?</p>	<ul style="list-style-type: none"> - Only 29% feel IITs have formulated their vision, mission with shared clarity, but most felt they have not been implemented. - 87% feel IITs must complement and cooperate with each other, and not compete. - 87% feel IITs, IISER, NITs and IIMs must all join hands to take up large national projects. - Only 36% think IITs should set up campuses outside India. 	<ul style="list-style-type: none"> - 34% felt teaching, research and consultancy should be the primary focus, with consultancy given lesser weight-age. Majority opined that teaching should be the main focus for UGs (large scope for improvement in the quality of teaching), and research for PGs. (Two categories of faculty, one only for teaching, the other mostly for research; lone, but interesting, response) - <i>(Framing of the question on formation of consortia lacked focus on details; hence responses were ambiguous, more like wishful thinking)</i>
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11. Funds	<p>49. Should IITs depend solely on government funds?</p> <p>50. Are they adequately funded?</p> <p>51. Should/could the IITs strive for financial independence and autonomy?</p> <p>52. If so, measures/strategy to be adopted for raising resources/corpus from industry (tech. transfer, consultancy, etc.), government, alumni, philanthropists, etc.</p> <p>53. Are they doing enough to attract funds?</p> <p>54. Should IITs be made self financing institutions: * By increasing students' fees, and * Government providing fees for PhD scholars?</p> <p>55. Should mutually agreed performance-based differential pay be instituted/allowed for the faculty?</p>	<ul style="list-style-type: none"> - Only 11% think IITs must solely depend on government funds. - 27% feel IITs are adequately funded. But 69% of IIT staff feel that funding is adequate. - 66% feel IITs must strive for financial independence and autonomy. This feeling is stronger with industry; 76% of industry feels so. - Barely 22% feel IITs are doing enough to attract funds. - Only 32% feel IITs should be made self-financing by raising fees, etc. - 71% feel performance-based differential pay for faculty is good. 	<ul style="list-style-type: none"> - The large majority felt that IITs are not adequately funded; but voted for financial independence from the government. <i>(Staff believe otherwise)</i> - Most felt that IITs are not doing enough to raise funds. About 46 strategic permutations have been suggested for <i>raising resources/corpus</i>. This included: <ul style="list-style-type: none"> ▪ Effective technology transfer mechanisms and IP revenue generation (majority) through Technology Transfer Offices with the assistance of management schools (internal and external). ▪ Industrial consultancy. ▪ Use of dedicated financial management services, joint ventures, banking collaboration, tax free philanthropy, alumni funding, etc. ▪ More efficient use of management schools towards effective strategy design for raising resources. ▪ "Radical" privatization (USA model). ▪ Academic activities through government funding; Only 32% feel IITs should be made self-financing by raising fee, etc. - <i>Majority of the respondents agreed that performance-based differential pay structure should be instituted.</i>
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<p style="text-align: center;">12. Performance</p>	<p>56. Is the performance of IITs being evaluated and addressed adequately?</p> <p>57. Have the previous review reports (e.g., Nayudamma, Rama Rao) been properly assessed and optimal follow-up actions taken?</p> <p>58. Are there metrics in place for continuous/periodic evaluations?</p>	<ul style="list-style-type: none"> - Only 17% feel the performance of IITs is adequately evaluated and addressed. - Only 4% think that IITs have taken follow-up actions on previous review committee reports (Nayudamma and Rama Rao). 30% think IITs have acted while 66% have no idea about it. - Only 15% feel metrics for evaluation are in place. 	<ul style="list-style-type: none"> - Most were not aware/did not think IIT performance gets evaluated; nor are there metrics, if any, used for continuous/periodic evaluation. <i>Some suggestions for this:</i> <ul style="list-style-type: none"> ▪ Rigorous and bias-free evaluation criteria for faculty, other than students' evaluation. ▪ System as a whole should be evaluated. ▪ Competition among IITs can serve as an automatic periodic evaluation system. - Most were not aware of previous reviews (e.g., Nayudamma, Rama Rao)/recommendations; those who did thought there were no effective follow-up action. <i>Only 8 faculty members responded; 4 of them unaware of such exercises.</i>
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Appendix III : QS World Rankings

QS World Rankings for the top 10 ranks, followed by some of the best known institutions, and also the first entry for each country ending with that for India, is tabulated below.

Reproduced from <http://www.topuniversities.com/>

Rank 2010	Name	Country
1	University of Cambridge	United Kingdom
2	Harvard University	United States
3	Yale University	United States
4	UCL (University College, London)	United Kingdom
5	Massachusetts Institute of Technology	United States
6	University of Oxford	United Kingdom
7	Imperial College, London	United Kingdom
8	University of Chicago	United States
9	California Institute of Technology (Caltech)	United States
10	Princeton University	United States
13	Stanford University	United States
16	Cornell University	United States
17	Johns Hopkins University	United States
18	ETH Zurich	Switzerland
19	McGill University	Canada
20	Australian National University (ANU)	Australia
23	University of Hong Kong (HKU)	Hong Kong
24	University of Tokyo, The	Japan
25	Kyoto University	Japan
29	University of Toronto	Canada
31	National University of Singapore (NUS)	Singapore
32	Ecole Polytechnique Fédérale de Lausanne	Switzerland
33	École Normale Supérieure de Paris	France
34	Carnegie Mellon University (CMU)	United States
40	Hong Kong University of Science & Technology	Hong Kong
45	University of Copenhagen	Denmark
47	Peking University	China
49	Osaka University	Japan

50	Seoul National University (SNU)	Korea, South
51	Ruprecht-Karls-Universität Heidelberg	Germany
52	Trinity College, Dublin	Ireland
54	Tsinghua University	China
56	University of Amsterdam	The Netherlands
62	Uppsala University	Sweden
68	University of Auckland	New Zealand
74	Nanyang Technological University (NTU)	Singapore
75=	Washington University in St. Louis	United States
75=	University of Helsinki	Finland
77	University of Glasgow	United Kingdom
78	University of Alberta	Canada
79	KAIST - Korea Advance Institute of Science & Technology	Korea, South
80	London School of Economics and Political Science (LSE)	United Kingdom
86	Katholieke Universiteit Leuven	Belgium
93	Lomonosov Moscow State University	Russia
94	National Taiwan University (NTU)	Taiwan
100	University of Oslo	Norway
109	Hebrew University of Jerusalem	Israel
143	University of Vienna	Austria
148	Universitat de Barcelona	Spain
150	KTH, Royal Institute of Technology	Sweden
151	Shanghai Jiao Tong University (SJTU)	China
187	Indian Institute of Technology Bombay (IITB)	India

Appendix IV : Note on Executive M. Tech Programme

Industry feels there is a need for their employees to get a higher degree while working. One critical constraint is that these employees cannot spend any residency period at the IITs or other institutes. The entire programme has to be based on online interaction and supervision of projects, etc., by qualified mentors at their workplace. The pace at which an employee goes through the programme has to be variable, depending on the employee's abilities and workload at different times. As such, the constraints imposed by the course structure/schedule must be as few as possible. Despite these constraints, the programme must be innovative and create degrees with high intrinsic and brand value.

The IITs would be experimenting with several new pedagogical and procedural methods if they were to implement an M.Tech programme that overcomes the above-mentioned constraints. Several articles of faith have to be overcome. For example, nothing can replace face-to-face teaching, labs are a core requirement and cannot be jettisoned and project guidance cannot be left to non-faculty. Naturally, there will be uncertainties about the success of a new programme incorporating several radical changes.

One way to insulate the risks associated with the new programme from the existing, smoothly running programmes is to create a new degree called the Executive M.Tech (EMT) degree, to distinguish it from the existing residency based M.Tech programme. Many leading universities adopt such an approach.

The EMT programme will consist entirely of online (live lectures and web-based assignment/exam) courses offered in the evenings or on weekends, and a project supervised entirely by a qualified mentor at the workplace. The courses will be taught by IIT faculty and the evaluations will be done by them. There will be no evaluation of assignments that may be given. A course may have some

discussion sessions for assignments. Solutions may be uploaded by the teacher. The student will not be required to visit any IIT for either attending courses or taking exams. There will be no lab courses. The project will also be evaluated by IIT faculty. First the proposal will be evaluated and approved, and then the thesis and student will be evaluated. The student will be physically present for the viva. It is good to have at least one face-to-face meeting with the student. It is also possible to include at this time a breadth-oriented comprehensive viva based on the courses taken. This viva evaluation could be only for the purpose of feedback to the employer on the degree of transformation that has occurred in the student. It could also be given credits if desired.

The project is a very important component of postgraduate education in the IIT system. In order to ensure that the potential supervisor, employer and student clearly understand what is expected, a detailed document will be provided that explains (i) the types of projects (analytical, simulation, modelling, experimental, prototype development, research-oriented), (ii) the amount of work expected, (iii) the quality of literature survey and reporting in the thesis, and the (iv) sanity checks on the experimental and simulation results expected. IPR issues will be also be dealt with. Sample theses that represent the different types and quantum of work that is acceptable will also be provided.

In case the employer/supervisor desires co-supervision by an IIT faculty member (particularly in the case of some latest technology or area of research), this can be arranged by mutual consent. There will be separate payment for this (along the lines of retainer consulting) and IPR issues will be also dealt with clearly.

Project evaluation will be done by an independent faculty committee not including the supervisor or co-supervisor. If desired, interim evaluation can also

be obtained by a committee member based on a video-conference presentation, in order to ensure the project is on the right track. This evaluation will be informal and not count for the final grade.

While online courses and absence of labs enable the programme to scale, it is equally important to have the projects locally supervised without IIT faculty co-supervisors for scaling to happen. However, this throws up the issue of identifying suitable local supervisors. This can be ensured by (i) limiting the programme initially to companies with a certain minimum size and number of Masters' degree holders, (ii) getting the company's ethos, facilities, technology level and supervision capabilities explicitly evaluated by an IIT faculty committee before inclusion, (iii) documenting the skills and experience necessary for potential supervisors, and (iv) assisting HR in selecting a pool of supervisors in the initial stages. All faculty assistance at these stages can be compensated on a retainer basis.

Two operational modes are possible for the programme: (i) each IIT having its own programme, and (ii) a common programme jointly operated by the IITs. The latter may have difficulties associated with Senate jurisdiction and awarding of degrees. The former may work quite well for the established IITs and may even lead to healthy competition, but the newer IITs may be required to partner with their erstwhile mentors for some time. Further, to give the students the maximum possible latitude in taking courses at times when their workload is less, we may need to allow a student to register for a course offered by a sister IIT, may be up to a maximum of 50% of the total credits. The course grade will be transferred to the IIT with which the student is registered at the end of the course.

An industry Board will interact with the IIT(s) to define the curriculum for different disciplines. The current practice in several disciplines in various IITs is to define very specialized M.Tech programmes with narrow curricula. These arise

from requirements faced by the nation and by industry at different times. For the EMT programme, however, it will be better to avoid specialized streams and define only at the level of broad disciplines (CSE, EE, ME, etc.). The selection of coherent lists of courses by students can be ensured by (i) employer's HR department, (ii) tele-counselling by faculty advisors, or (iii) pre-defined baskets of core courses from which a student has to select his/her core courses, or a combination thereof. There are no scaling issues in all these one-of activities.

A typical EMT requirement would be ten 40-hour courses (with each course divided into 2 modules of 20 hours) and a project.

Every IIT will create cubicles where a faculty member can give a live lecture that will be multicast. He/she will use a tablet PC or equivalent technology for live development of material (preferred to canned slides, which however could also be used). The students' faces are also shown live to the teacher and live interaction is possible. The e-material can be uploaded to a site automatically. Tutorial assignments can also be uploaded. Exams will be given at the appropriate time by invigilators on-site and the faculty member may be available online for clarifications, if any.

Let us assume a third of IIT faculty (i.e., 1000 out of 3000 today) is interested in teaching in the evenings or on weekends. Let us assume the average faculty member will teach 2 hours a week for 24 weeks in the year, i.e. about 50 lecture hours or 2.5 modules per year. This works out to 2500 modules or 1250 courses in all. As the number of faculty in the IIT system increases to 16,000, assuming only 4000 of the 16,000 teachers teach for 50 hours a year, the number of modules increases to 10,000 modules or 5000 courses.

Given the remote nature of this programme, it will be prudent to limit the number of students per course to 30 to begin with. About 30 faces on 2 or 3 large

split screens in front of the teacher could still result in one-on-one interactions, name recall, etc., all of which will lead to better outcomes. This means we can award $1250 * 30/10 = 3750$ degrees per year. As the number of faculty teaching scales to 4000, the number of degrees could go up to 14,800 degrees per year. This seems a reasonable number to begin with (it is more than twice the total number of M.Tech degrees currently awarded every year by all the IITs together).

There is tremendous scope for scaling. There can be more students per class, more lectures per week by a faculty member, more faculty members (as IITs grow to have 10,000 faculty members in all) participating, good faculty from other institutions being included, other institutions themselves being included, etc. The number of degrees awarded could easily increase to 50,000 per year.

Courses will begin and end at all times of the year. Project thesis submissions and evaluations too will occur throughout the year. There is no system of semesters in this programme. This spreading out of the workload is important for the scaling of this programme. A degree will be awarded as soon as the requirements are completed. There is no Convocation. However, the EMT degrees awarded in an academic year will be listed in that year's Convocation record.

Even with a fee of Rs. 25,000 per student per course, each 40-hour course will generate Rs. 5 lakh (with just 20 students). Of this, Rs. 2.5 lakh can go to the faculty member (@ Rs. 6000 per lecture) and a similar amount to the Institute. If a faculty member chooses to have an assistant (graduate student) for solving assignments, etc., the remuneration for the TA will be subtracted from the faculty member's remuneration. A faculty member can add potentially Rs. 5–6 lakh per year to his/her income. Each Institute will earn around Rs. 10 crore per year. If the costs (Internet, office staff, capex) are higher than anticipated in this note, the course fee can be increased. The purpose of the above calculation is only to show

that there is considerable latitude even while ensuring good remuneration for faculty and Institute, while still keeping the course affordable. Project thesis evaluations and viva examinations will also earn remuneration for the faculty member. The fee should be commensurate with the number of hours spent per student, and should attract quality time from the faculty member.

Faculty performance will be assessed through feedback as well as blind evaluation during online lectures. Besides, popular faculty will attract more students and under-performing ones will see partially filled classes. Faculty remuneration can be linked pro-rata to the number of students registered. By the same token, a faculty member can decide not to offer a course if there is insufficient registration. The process should ensure that only quality faculty members continue to teach and there is accountability. By the same token, students who do not do well in the examinations will be declared unsuccessful without fear of pressure from the employers. Every Institute can have a separate office, staffed by employees paid directly from the programme (and not government employees), to run the programme (scheduling, enrolment, accounts, etc.) though much of the work can be automated.

Everyone – student, teacher, employer, supervisor, Institute – must be on their toes to ensure quality. Even the employer has to arm the HR department to keep a close watch on the selection of students and monitor performance, final outcomes, supervisor performance (it should impact their compensation), etc. This should not be a “fill it, forget it” kind of programme for any of the stakeholders. Outstanding teachers should become stars in their own right, known across the industry and academia for their rating. They must come to be valued as much as those who make seminal research contributions. Industry must be held to account to show action where their claims are – do they really want so many M.Techs? Are

they willing to commit mindshare to the effort? Are they willing to empower supervisors, and later their Executive M.Techs? The cost of the programme, and its attraction to the faculty, seem to be the least of the potential problems.

Appendix V : Suggested Loan Scheme for IIT Students from SBI

As our educational institutions expand their capacity and increase their enrolment, it becomes important to create loan schemes for students on reasonable terms to enable such growth. The IITs have an ambitious agenda of growth and are in need of a special loan programme for their students. This document speaks of the contours of such a scheme.

1. The student loan programme should be a special programme created exclusively for IIT students so that there is proper branding and special terms.
2. The quantum of the loan should be such that it meets with at least 90% of the financial needs of the student for the programme for payment of fees and also for their personal and hostel expenses. The loan could be in the range of Rs. 8–11 lakh for a 4-year undergraduate programme and Rs. 5–8 lakh for a postgraduate programme.
3. The loan needs to be granted on the personal guarantee of the student without reference to the parents and without any asset backing the loan. It is suggested that the loan be granted along with the admission document of the IIT so that it is seamless and hassle free. Every student who joins an IIT does so after a rigorous admission process and is in great demand in the market for employment. The employment record is close to 100% with multiple offers for the students starting with an annual compensation of Rs. 6–10 lakh, depending on the stream chosen. Hence the loan offer should happen simultaneously with the admission process.
4. Payment of interest should be deferred till at least 6 months after completion of the course and the student gets his degree.

5. For those students whose parental income is less than Rs. 4.5 lakh per annum, the HRD ministry has a special scheme whereby the interest during the period of study is paid by the GoI and the bank should tie up directly with GoI so that this benefit is available to the student.
6. The loan interest rate should be reasonable so that it is attractive to the students.
7. It is suggested that the repayment period for the principal amount be a minimum of 7 years after completion of study so that the repayment terms are easy on the student.
8. IIT will maintain a record of the loan granted so that students who do not repay the loan would necessarily be put in touch with the bank when they come to the IIT for any service after completion of their course.
9. The student would necessarily be asked to take a UID and be part of the credit bureau to enable tracking of the loan throughout the tenure of the loan. This will enhance the quality of the loan.
10. In the event of a student choosing to go abroad and having a loan at that point of time, the IIT will ask for a clearance from the bank before it gives any recommendations or any service. This will be done as part of the loan agreement which the IIT will take on record. However, the IIT will bear no liability for any default on this condition.
11. The HRD ministry will create a fund called the Student Loan Fund at the rate of 4% of the overall loan amount which will be kept in an escrow account with the bank so that the risk of default is reduced and the bank has recourse to this fund. This will also take care of any default due to students failing the course and being unable to repay the loan in the future. The escrow account will be a deposit account so that interest accrues and this can

defray part of the cost. This is a sweetener so that the bank gives loans at the time of admission on the guarantee of the student alone. These loan terms are better for the student as well.

12. In the event that a student of an IIT, who has taken a loan, does an M.Tech or MS programme in the IIT system, repayment of the loan should start after completion of the M.Tech/MS programme. As an incentive, the interest during the study period will be paid by the Government.
13. Similarly, if a student who has taken a loan does a PhD, then the interest during the PhD programme should be paid by the Government and repayment of the principle should commence after completion of the PhD programme. Any incentive given for completion of the PhD programme will be directly paid to the bank.
14. The bank should have full infrastructure in every IIT to service the needs of the students.
15. In the initial stages, the intake of students could be around 10,000 per year with probably 60% availing the loan.

Appendix VI : Educational Loan Scheme by Indian Banks' Association

This is a Central Scheme to provide Interest Subsidy for the period of moratorium on Educational Loans taken by students from Economically Weaker Sections from scheduled banks under the Educational Loan Scheme of the Indian Banks' Association to pursue Technical/Professional Education studies in India

Introduction

One of the major concerns of the Government is to ensure that nobody is denied professional education because he or she is poor. The Indian Banks' Association (IBA) had formulated a comprehensive model educational loan scheme for adoption by all banks aimed at providing financial support from the banking system to deserving/meritorious students for pursuing higher education in India and abroad.

Objective of the Scheme

The Government of India has now approved a scheme to provide full interest subsidy during the period of moratorium, i.e., Course Period plus one year or six months after getting a job, whichever is earlier, on loans taken by students belonging to Economically Weaker Sections from scheduled banks under the Educational Loan scheme of the Indian Banks' Association, for pursuing any of the approved courses of studies in technical and professional streams from recognized institutions in India. The nomenclature of the Scheme would be "Central Scheme to provide Interest Subsidy (CSIS) for the period of moratorium on Educational Loans taken by students from Economically Weaker Sections from

scheduled banks under the Educational Loan Scheme of the Indian Banks' Association to pursue Technical/Professional Education studies in India”.

Applicability of the Scheme

The Scheme could be adopted by all scheduled banks and would be applicable only for studies in recognized Technical/Professional Courses in India. The interest subsidy shall be linked with the existing Educational Loan Scheme of IBA and restricted to students enrolled in recognized Technical/Professional Courses (after Class XII) in India in Educational Institutions established by Acts of Parliament, other Institutions recognized by the concerned Statutory Bodies, Indian Institutes of Management (IIMs) and other Institutions set up by the Central/state governments.

Interest Rates

The interest rates charged on the educational loan shall be as per the BPLR/Base Rate of the individual banks and as per the provisions for interest rates under the IBA Model Educational Loan Scheme.

Moratorium Period

Under the Central Scheme, the interest payable by the student belonging to EWS for availing of the Educational Loan for Technical/Professional Courses in India for the period of moratorium, i.e., Course Period plus one year or six months after getting a job, whichever is earlier, as prescribed under the Educational Loan Scheme for the Indian Banks' Association, shall be borne by the Government of India. After the period of moratorium is over, the interest on the outstanding loan amount shall be paid by the student in accordance with the

provisions of the existing Educational Loan Scheme of Banks and as may be amended from time to time, whichever is earlier.

Income Limit/Proof

The benefits of the Scheme would be applicable to those students belonging to economically weaker sections, with an annual gross parental/family income with upper limit of Rs. 4.5 lakh per year (from all sources). Income proof shall be required from the students from such public authorities which are authorized by the state governments for certification of income status for this Scheme, including Central and State Sector Schemes. The present scheme is intended to cater to the needs of students belonging to economically weaker sections with prescribed upper parental gross income limit of the family from all sources, which is based on economic index and not on social background. The scheme is independent of any other schemes which may cater to EWS.

Competent Authority

The Ministry of HRD, Government of India, shall issue an Advisory before 31 March 2010 to all the state governments requesting them to designate appropriate authority or authorities who are competent to issue income certificates, based on economic index and not social background, for the purpose of this Scheme.

The Banks shall implement the Scheme in those states where the certification authority has been notified as per the advisory from the Ministry of HRD, Government of India.

Eligibility for Interest Subsidy

The interest subsidy under the Scheme shall be available to the eligible students only once, either for the first undergraduate degree course or the postgraduate degrees/diplomas in India. Interest subsidy shall, however, be admissible for integrated courses (graduate + postgraduate).

Interest subsidy under this Scheme shall not be available for those students once they discontinue the course midstream, or who are expelled from the Institutions on disciplinary or academic grounds. However, the interest subsidy will be available only if the discontinuation was due to medical grounds for which necessary documentation to the satisfaction of the Head of the educational institution will have to be given.

Appendix VII: How to Set up a New IIT

The objective should be to add more "quality IITs" and not just yet another IIT. That is, the objective is not to create institutions that will merely become almost as good as the established IITs, but to establish institutions that will bring to the table something new that the established IITs cannot do. In other words, just as parents are happy to see their son or daughter do better than them, we must expect the new IITs to do better than the older generation. It means that these need far more care and attention in the planning and establishment than what we saw in recent years.

Sequence:

- a) Identify the site (near an industrial area and/or complementary educational institutions; with good access including an airport) and have the site transferred to the Government.
- b) Appoint a visionary Chairman and an interim Board.
- c) After (a) is complete, appoint the Director. Identify institutions in India and overseas that may support/mentor the Institute in its early years. Earmark some funds for doing the non-routine (call it contingency, if you so like) that may not be possible with government grants; such funds can be used at the entire discretion of the Director and the Board.
- d) Bring a few mid-level and senior academics on board, part-time or full-time, on deputation or on loan. May need to use discretionary funds to enable this. The Director and this team will spend up to 6 months to work out the vision and plan for a new IIT. This is critical and only after this, one can recruit faculty and students.
- e) In parallel, start the process of architect selection for creating the master plan.
- f) Recruit the initial set of faculty, and thereafter students. Set up temporary facilities in some academic institution to start the classes. The construction

of the permanent campus is already in the process while all this is happening.

- g) With this sequence, it is expected that the academic activities (research and teaching) will start within 6-12 months after the Director is appointed.

Appendix VIII : Amendments to The Institutes of Technology Act, 1961 (ACT)

In line with the discussions and recommendations in the report, the following amendments to the Act are suggested. This would enable the IITs to have greater administrative and financial autonomy. This will also facilitate in taking IITs to excellence and greater relevance and meet the national objectives.

**The Institutes of
Technology Act,
1961**

[as amended by Institutes of Technology (Amendment) Act, 1963]

**(Amendments needed pursuant to the recommendations of the Dr Kakodkar Committee are
shown herein)**

The Institutes of Technology Act, 1961

[as amended by Institutes of Technology,] (Amendment) Act, 1963]

THE INSTITUTES OF TECHNOLOGY ACT, 1961

ARRANGEMENT OF SECTIONS

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PRELIMINARY

SECTIONS

1. Short title and commencement.
2. Declaration of certain institutions as institutions of national importance.
3. Definitions.

CHAPTER II

THE INSTITUTES

4. Incorporation of Institutes.
5. Effect of incorporation of Institutes. Powers of Institutes.
6. Power of Institutes.
7. Institutes to be open to all races, creeds and classes.
8. Teaching at Institute.
9. Visitor.
10. Authorities of Institutes.
11. Board of Governors.
12. Term of office of, vacancies among, and allowances payable to members of Board.
13. Functions of Board.
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15. Functions of Senate.
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18. Deputy Director.

19. Registrar.
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21. Grants by Central Government.
22. Fund of the Institute.
23. Accounts and audit.

SECTIONS

24. Pension and provident fund.
25. Appointments.
26. Statutes.
27. Statutes how made.
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29. Ordinances how made.
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CHAPTER III

THE COUNCIL

31. Establishment of Council.
32. Term of office of vacancies among, and allowances payable to members of Council.
33. Functions of Council.
34. Chairman of Council.
35. Power to make rules in respect of matters in this Chapter.

CHAPTER IV

MISCELLANEOUS

36. Acts and proceedings not to be invalidated by vacancies. etc.
37. Power to remove difficulties.
38. Transitional provisions.
39. Repeal and savings.

THE SCHEDULE

**THE INSTITUTES OF TECHNOLOGY,
ACT, 1961**

No. 59 of 1961

[as amended by Institutes of Technology (Amendment)
Act, 1963]

An Act to declare certain institutions of technology to be institutions of national importance and to provide for certain matters connected with such institutions and the Indian Institute of Technology, Kharagpur.

Be it enacted by Parliament in the Twelfth Year of the Republic of India as follows;-

CHAPTER I

PRELIMINARY

1. (1) This Act may be called the Institutes of Technology Act 1961.

(2) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint, and different dates may be appointed for different provisions of this Act.

Short title
and
commence
-ment

2. Whereas the objects of institutions known as the Indian Institute of Technology, Bombay, *the college of Engineering and Technology, Delhi; *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.

Declaration
of certain
Institutions
of national
importance.

Definitions

3. In this Act, unless the context otherwise requires, -

(a) "Board", in relation to any Institute, means the Board of Governors thereof;

(b) "Chairman" means the Chairman of the Board;

(c) "Corresponding Institute" means, -

*As per
Institutes of
Technology
(Amended)
Act 1963

*As per
Institutes of
Technology
(Amended)
Act 1963

(i) in relation to the society known as the Indian Institute of Technology, Bombay, the Indian Institute of Technology, Bombay;

* (ia) in relation to the known society as the College of Engineering & Technology, Delhi, the Indian Institute of Technology, Delhi.

(ii) in relation to the society known as the Indian Institute of Technology (Kanpur) Society, the Indian Institute of Technology, Kanpur, and

(iii) in relation to the society known as the Indian Institute of Technology, Madras, the Indian Institute of Technology, Madras;

(d) "Council" means the Council established under sub-section (I) of section 31;

(e) "Deputy Director", in relation to any Institute means the Deputy Director thereof;

(f) "Director", in relation to any Institute means the Director thereof;

(g) "Institute" means any of the Institutions mentioned in section 2 and includes the Indian Institute of Technology, Kharagpur, incorporated under the Indian Institute of Technology (Kharagpur) Act, 1956;

5 of 1956

(h) "Registrar", in relation to any Institute, means the Registrar thereof;

(i) "Senate", in relation to any Institute, means the Senate thereof;

(j) "Society" means any of the following societies registered under the Societies Registration Act, 1860, namely;-

21 of 1860

*As per
Institutes of
Technology
(Amended)
Act 1963

(i) the Indian Institute of Technology, Bombay;

* (ia) the College of Engineering and Technology, Delhi;

(ii) the Indian Institute of Technology, (Kanpur) Society;

(iii) the Indian Institute of Technology, Madras;

(k) "Statutes and Ordinances" in relation to any Institute, mean the Statutes and Ordinances of the Institute made under this Act.

CHAPTER II
THE INSTITUTES

Incorporation of Institutes

4. (I) Each of the Institutes mentioned in section 2 shall be a body corporate having perpetual succession and a common seal and shall, by its name, sue and be sued.

*As per Institutes of Technology (Amended) Act 1963

*(IA) The College of Engineering and Technology, Delhi, shall on such incorporation; be called the Indian Institute of Technology, Delhi.

(2) The body corporate constituting each of the said Institute shall consist of a Chairman, a Director and other members of the Board for the time being of the Institute.

Effect of Incorporation of Institutes

5. On and from the commencement of this Act;-

(a) any reference to a society in any law (other than this Act) or in any contract or other instrument shall be deemed as a reference to the corresponding Institute;

(b) all property, movable and immovable; of or belonging to a society shall vest in the corresponding institute;

(c) all the rights and liabilities of a society shall be transferred to, and be the rights and liabilities of the corresponding Institute; and

(d) every person employed by a society immediately before such commencement shall hold his office or service in the corresponding, Institute by the same tenure, at the same remuneration and upon the same terms and conditions and with the same rights and privileges as to pension, leave, gratuity, provident fund and other matters as he would have held the same if this Act had not been passed, and shall continue to do so unless and until his employment is terminated or until such tenure, remuneration and terms and conditions are duly altered by the Statutes:

Provided that if the alteration so made is not acceptable to such employee, his employment may be terminated by the Institute in accordance with the terms of the contract with the employee or, if no provision is made therein in this behalf, on payment to him by the Institute of compensation equivalent to three months' remuneration in the case of permanent employees and one month's remuneration in the case of other employees.

6. (I) Subject to the provision of this Act, every Institute shall exercise the following powers and perform the following duties, namely:--

Power of
Institutes

(a) to provide for instruction and research in such branches of engineering and technology, sciences and arts, as the Institute may think fit, and for the advancement of learning and dissemination of knowledge in such branches;

(b) to hold examinations and grant degrees, diplomas and other academic distinctions or titles;

(c) to confer honorary degrees or other distinctions;

(d) to fix, demand and receive fees and other charges;

(e) to establish, maintain and manage halls and hostels for the residence of students;

(f) to supervise and control the residence and regulate the discipline of students of the Institute and to make arrangements for promoting their health, general welfare and cultural and corporate life;

(g) to provide for the maintenance of units of the National Cadet Corps for the students of the Institute;

(h) to institute academic and other posts and to make appointments thereto (except in the case of the Director);

Amend to delete " (except in the case of the Director);"

Substitute it as under:

“to institute academic and other posts and to make appointments thereto including in the case of the Director”

(i) to frame Statutes and Ordinances and to alter, modify or rescind the same;

(j) to deal with any property belonging to or vested in the Institute in such manner as the Institute may deem fit for advancing the objects of the Institute;

(k) to receive gifts, grants, donations or benefactions from the Governments and to receive bequests, donations and transfers of movable or immovable properties from testators, donors or transferors, as the case may be;

(l) to co-operate with educational or other institutions in any part of the world having objects wholly or partly similar to those of the Institute by exchange of teachers and scholars and generally in such manner as may be conducive to their common objects;

(m) to institute and award fellowships, scholarships, exhibitions, prizes and medals; and

(n) to do all such things as may be necessary, incidental or conducive to the attainment of all or any of the objects of the Institute.

Amend to add after clause (m), a new clause (n), and clause (o), and reclassify clause (n) above as clause (p)

(n) To borrow money for the Institute on such terms and conditions as may be decided by the Board subject to prior approval from the Government in writing and to create assets of the Institute in the forms of buildings, hostels, land, laboratories, convention centres, research centres and the like as may be necessary.

(o) To purchase, construct, install any property, plant or equipment or any asset of similar nature as decided by the Board.

(2) Notwithstanding anything contained in sub-section (1), an Institute shall not dispose of in any manner any immovable property without the prior approval of the Visitor.

Institute to be open to all races, creeds and classes.

7. (1) Every Institute shall be open to persons of either sex and of whatever race, creed, caste or class, and no test or condition shall be imposed as to religious belief or profession in admitting or appointing members, students, teachers or workers or in any other connection whatsoever.

(2) No bequest, donation or transfer of any property shall be accepted by any Institute which in the opinion of the Council involves conditions or obligations opposed to the spirit and object of this section.

Teaching at Institute

Substitute the word "Council" by word "Board" as under

No bequest, donation or transfer of any property shall be accepted by any Institute which in the opinion

of the Board involves conditions or obligations opposed to the spirit and objectives of this section

8. All teaching at each of the Institute shall be conducted by or in the name of the Institute in accordance with the Statutes and Ordinances made in this behalf.

Visitor

Amend Clause 8 as follows to include "research and other related activities"

All teaching, research and other related activities at each of the Institutes shall be conducted by or in the

name of the Institute in accordance with the Statutes and Ordinances made in this behalf.

9. (1) The President of India shall be the Visitor of every Institute.

Add a new clause 9(2) as follows after 9 (1);

(2) The Visitor may require a review of every Institute once in five years by a group of eminent and accomplished individuals of International standing to be recommended by the IIT council. The report of this group should be reviewed by the concerned Board of Governors and the IIT Council and the corrective actions if any taken thereon. Such reports and the response of the Board of Governors and the IIT Council shall be in the public domain.

(2) The Visitor may appoint one or more persons to review the work and progress of any Institute and to hold inquiries into the affairs thereof and to report thereon in such manner as the Visitor may direct.

Renumber old 9(2) as 9(3).

(3) The Visitor may appoint one or more persons to review the work and progress of any Institute and to hold inquiries into the affairs thereof and to report thereon in such manner as the Visitor may direct.

(3) Upon receipt of any such report, the Visitor may take such action and issue such directions as he considers necessary in respect of any of the matters dealt with in the report and the Institute shall be bound to comply with such directions.

Authorities
of Institutes

Renumber 9(3) as 9(4)

(4) Upon receipt of any such report, the Visitor may take such action and issue such directions as he considers necessary in respect of any of the matters dealt with in the report and the Institute shall be bound to comply with such directions.

Authorities
of Institutes

10. The following shall be the authorities of an Institute,

(a) a Board of Governors;

(b) a Senate; and

(c) Such other authorities as may be declared by the Statutes to be the authorities of the Institute.

11. The Board of an Institute shall consist of the following persons, namely:-

Board of
Governors.

(a) the Chairman, to be nominated by the Visitor;

(b) the Director, *ex officio*,

(c) one person to be nominated by the Government of each of the States comprising the zone in which the Institute is situated, from among persons who, in the opinion of that Government, are technologists or industrialists of repute;

(d) four persons having special knowledge or practical experience in respect of education, engineering or science, to be nominated by the Council; and

(e) two professors of the Institute, to be nominated by the Senate.

Explanation:- In this section, the expression "zone" means a zone as for the time being demarcated by the All-India Council for Technical Education for the purposes of this Act.

Amend clause 11 as follows;

11. The Board of an Institute shall consist of the following persons, namely:-

(a) the Chairman, who, shall be a non-official person of eminence in education, science, engineering, technology or industry, to be recommended by the Board, and approved by the IIT Council

(b) the Director, ex-officio

(c) one eminent person who is an academician or an industrialist or Principal Secretary in-charge of higher technical education in the State to be nominated by the Government of the State in which the Institute is situated.*

(d) one person, to be the nominee of the Ministry of Human Resource Development, Government of India, to be nominated by the Minister

(e) three eminent representatives of industry to be selected by the Board from a panel of names proposed by a group consisting of Chairmen of CII (Confederation of Indian Industries), FICCI (Federation of Indian Chambers of Commerce and Industry), ASSOCHAM (The Associated Chambers of Commerce and Industry of India) and NASSCOM (The National Association of Software and Services Companies) and such panel being approved by the IIT Council.

(f) three eminent persons who are research scientists or technologists to be selected by the Board from a panel of names proposed by a group consisting of Presidents of INSA, IAS, NASI and INAE and such panel being approved by the IIT Council

(g) two eminent alumni of an IIT who are not employees of any IIT to be nominated by the Board.

(h) two Professors of the Institute, to be nominated by the Senate

(i) One eminent citizen appointed by the Board.

*As per
Institutes of
Technology
(Amended)
Act 1963

12. (1) Save as otherwise provided in this section the term of office of the Chairman or any

other member of the Board shall be three years from the date of his nomination.

Amend to modify Clause 12(1)

"Save as otherwise provided in this section the term of office of the Chairman or any

other member of the Board shall be an initial period of three years from the date of his appointment."

(2) The term of office of an ex officio member shall continue so long as he holds the office by virtue of which he is a member.

Substitute 12 (2) by the following

The term of office of a nominee of Government of India / State Government / Senate of the Institute/ex-officio member shall continue so long as he holds the office by virtue of which he is a member.

(3) The term of office of a member nominated under clause (e) of section 11 shall be two years from the 1st day of January of the year in which he is nominated.

Amend to modify Clause 12 (3) as follows

The term of office of a member nominated under clause (h) of section 11 shall be two years from the 1st day of the Month in which he is nominated

Add as clause (4) the following

Every retiring member, including the Chairman, except the member specified in clause 11(b), 11(c), 11(d), and 11(h) may be considered for another term of 3 years by the Board, subject to the recommendation of the Nominations Committee of the Board. The term of office of the Chairman shall be independent of the term already served on the Board as a member.

(4) The term of office of a member nominated to fill a casual vacancy shall continue for the remainder of the term of the member in whose place he has been nominated.

Renumber clause (4) as clause (5)

Substitute Clause 12 (5) by the following as clause (6)

(6) Every outgoing member shall vacate his office, unless stated above, upon completion of his term.

Insert clause 12 (7) and clause (8) as under

(7) The Board shall constitute a Nomination Committee of the Board to recommend members for appointment / re-appointment to the Board. The Nomination Committee shall consist of 3 members appointed by the Board from among themselves. The Nomination committee shall normally consider one of the Board members for the post of Chairman based on a transparent and approved process and criteria so that the person recommended is familiar with the working of the Board. The nomination committee may however look outside the Board to recommend a Chairman, upon the approval of the Board that such a step is necessary.

(8) All members of the Board shall be appointed by a majority decision of the Board based on the recommendations of the Nomination committee except members nominated by the Government or the Senate. The decision of the Board on this matter shall be final and binding. The appointment of the Chairman is however subject to approval of the Council.

Similarly Clause 12(6) to be renamed as Clause 12(9) and amended to read as under

(9) The members of the Board shall be entitled to such allowances for attending the meetings of the Board and any sub-committee thereof, if any, from the Institute as may be provided for in the Statutes but no member other than the persons referred to in clauses (b) and (h) of section 11 shall be entitled to any salary by reason of this sub-section.

Functions
of Board

13. (1) Subject to the provisions of this Act, the Board of any Institute shall be responsible for the general superintendence, direction and control of the affairs of the Institute and shall exercise all the powers of the Institute not otherwise provided for by this Act, the Statutes and the Ordinances, and shall have the power to review the acts of the Senate.

(2) Without prejudice to the provisions of sub-section (1), the Board of any Institute shall-

(a) take decisions on questions of policy relating to the administration and working of the Institute;

(b) institute courses of study at the Institute;

(c) make Statutes;

(d) institute and appoint persons to academic as well as other posts in the Institute;

Amend to modify Clause 13(2)(d) to change “institute and appoint” to “create and appoint”

d) create academic and other posts in the Institute and appoint persons to those posts as may be necessary. The Board may from time to time, determine the compensation policy and the service conditions for its employees based on the general guidelines of the Council.

Clause to be added after 13 (2)(d)

(e) appoint a Chairman and members of the Board as stated supra

(f) appoint the Director of the Institute and determine the terms and conditions of his employment

(g) to determine the fees payable by students undergoing instructions in the Institute, the fellowships to Research scholars from time to time and such other charges concerning the students.

(h) to expend the funds of the Institute for its working and for creation of assets/infrastructure upon such guidelines as it may prescribe, to determine its budget and generally carry out its financial affairs in a prudent manner.

Renumber subsequent clauses (e) to (g) as (i) to (k)

(e) consider and modify or cancel Ordinances;

(f) consider and pass resolutions on the annual report, the annual accounts and the budget estimates of the Institute for the next financial year as it thinks fit and submit them to the Council together with a statement of its developments plans;

(g) exercise such other powers and perform such other duties as may be conferred or imposed upon it by this Act or the Statutes.

(i) consider and modify or cancel Ordinances;

(j) consider and pass resolutions on the annual report, the annual accounts and the budget estimates of the Institute for the next financial year as it thinks fit and submit them to the Council together with a statement of its developments plans;

(k) exercise such other powers and perform such other duties as may be conferred or imposed upon it by this Act or the Statutes.

(3) The Board shall have the power to appoint such committees as it considers necessary for the exercise of its powers and the performance of its duties under this Act including the Nominations committee and , the Audit committee

Add as clause (4)

(4)The Board shall have the power to appoint a Director for the Institute based upon the recommendations of a search committee setup for this purpose with at least three members who are not members of the Board, being eminent academics, technologists, scientists, or industrialists. The recommendation of such committees may be accepted by the Board or if the recommendations are not accepted a new search committee will be reconstituted. The Committee shall conduct its search in an open and transparent manner to ensure objectivity. The Board shall conclude the process of appointing a new Director at least three months before the end of the term of the incumbent.

14. The Senate of each Institute shall consist of the following persons; namely:-

- (a) the Director, *ex officio* who shall be the Chairman of the Senate;
- (b) the Deputy Director, *ex officio*,
- (c) the professors appointed or recognised as such by the Institute for the purpose of imparting instruction in the Institute;
- (d) three persons, not being employees of the Institute, to be nominated by the Chairman in consultation with the Director; from among educationists of repute, one each from the fields of science, engineering and humanities; and
- (e) such other members of the staff as may be laid down in the Statutes;

Functions
of Board.

15. Subject to the provisions of this Act, the Statutes and the Ordinances, the Senate of an Institute shall have the control and general regulation, and be responsible for the maintenance, of standards of instruction, education and examination in the Institute and shall exercise such other powers and perform such other duties as may be conferred or imposed upon it by the Statutes.

16. (1) The Chairman shall ordinarily preside at the meetings of the Board and at the Convocations of the Institute.

Chairman
of Board.

Substitute Clause (16) 1 as follows

(1) The Chairman shall ordinarily preside at the meetings of the Board and at the Convocations of the Institute. In the absence of Chairman, the Board may appoint a Chairman for this specific purpose at the meetings of the Board and for the Convocations of the Institute.

(2) It shall be the duty of the Chairman to ensure that the decisions taken by the Board are implemented.

(3) The Chairman shall exercise such other powers and perform such other duties as may be assigned to him by this Act or the Statutes.

17. (1) The Director of each Institute shall be appointed by the Council with the prior approval

Director.

of the Visitor.

Substitute Clause 17(1) as follows

(1) The Director of each Institute will be appointed by the Board in an open and transparent manner through a search committee setup for this specific purpose.

(2) The Director shall be the principal academic and executive officer of the Institute and shall be responsible for the proper administration of the Institute and for the imparting of instruction and maintenance of discipline therein.

Amend to modify Clause 17(2) (Director)

(2) The Director shall be the principal academic and executive officer of the Institute and shall be responsible for the proper administration of the Institute and for the imparting of instruction and maintenance of discipline therein and for taking decisions on financial matters as per the powers delegated by the Board.

(3) The Director shall submit annual reports and accounts to the Board.

(4) The Director shall exercise such other powers and perform such other duties as may be assigned to him by this Act or the statutes or Ordinances.

Amend to modify Clause 17 (4) (Director)

(4) The Director shall exercise such other powers and perform such other duties as may be assigned to him by this Act or the statutes or Ordinances, or by the Board.

Insert Clause 17(5) as under

(5) The term of the Director shall be for an initial period of 5 years subject to retirement. The remuneration and terms of appointment will be decided by Board. The Director shall not be removed from his office except by 3/4th majority of the members of the Board approving the removal and only

upon grounds of gross misconduct, moral turpitude or upon conviction under law. The Director will be eligible for a re-appointed for second term of five years upon recommendation of the Search Committee and approval of the Board subject to retirement.

18. The Deputy Director of each Institute shall be appointed on such terms and conditions as may be laid down by the Statutes and shall exercise such powers and perform such duties as may be assigned to him by this Act or the Statutes or by the Director.

Deputy
Director.

19. (1) The Registrar of each Institute shall be appointed on such terms and conditions as may

Registrar

be laid down by the Statutes and shall be the custodian of records, the common seal, the funds of the Institute and such other property of the Institute as the Board shall commit to his charge.

(2) The Registrar shall act as the Secretary of the Board, the Senate, and such committees as may be prescribed by the Statutes.

(3) The Registrar shall be responsible to the Director for the proper discharge of his functions.

(4) The Registrar shall exercise such other powers and perform such other duties as may be assigned to him by this Act or the Statutes or by the Director.

20. The powers and duties of authorities and officers other than those hereinbefore mentioned shall be determined by the statutes.

Other
authorities
and officers

Grants by
Central
Government

21. For the purpose of enabling the Institutes to discharge their functions efficiently under this Act, the Central Government may, after due appropriation made by Parliament by law in this behalf, pay to each Institute in each financial year such sums of money and in such manner as it may think fit.

Fund of the
Institute.

22. (1) Every Institute shall maintain a Fund to which shall be credited -

- (a) all money provided by the Central Government;
- (b) all fees and other charges received by the Institute;
- (c) all money received by the Institute by way of grants, gifts, donations, benefactions, bequests or transfers, and
- (d) all money received by the Institute in any other manner or from any other source.

(2) All moneys credited to the fund of any Institute shall be deposited in such Banks or invested in such manner as the Institute may, with the approval of the Central Government, decide

Modify Clause 22 (2) as follows;

(2) All moneys credited to the Fund of any Institute shall be deposited in such banks or invested in such manner as the Institute may decide upon the approval of the Board based on general guidelines issued by the Government from time to time,

(3) The Fund of any Institute shall be applied towards meeting the expenses of the Institute including expenses incurred in the exercise of its powers and discharge of its duties under this Act.

Add a new clause 22(4) as follows;

(4) Any money considered surplus to the immediate needs of the Institute, or an endowment, or a gift of money may be invested in Bank deposits, securities, or other instruments as per the guidelines issued by the Government from time to time

Accounts
and audit.

23. (1) Every Institute shall maintain proper accounts and other relevant records and prepare an

annual statement of accounts, including the balance -sheet, in such form as may be prescribed by the Central Government in consultation with the Statutes. Comptroller and Auditor-General of India.

(2) The accounts of every Institute shall be audited by the Comptroller and Auditor -General of India and any expenditure incurred by him in connection with such audit shall be payable by the Institute to the Comptroller and Auditor -General of India.

(3) The Comptroller and Auditor-General of India and any person appointed by him in connection with the audit of the accounts of any Institute shall have the same rights, privileges and authority in connection with such audit as the Comptroller and Auditor -General of India has in connection with the audit of the Government accounts, and, in particular, shall have the right to demand the production of books, accounts, connected vouchers and other documents and papers and to inspect the offices of the Institute.

(4) The accounts of every Institute as certified by the Comptroller and Auditor-General of India or any other person appointed by him in this behalf together with the audit report thereon shall be forwarded annually to the Central Government and that Government shall cause the same to be laid before each House of Parliament.

24. (1) Every Institute shall constitute for the benefit of its employees, including the Director in such manner and subject to such conditions as may be prescribed by the Statutes, such pension. Insurance and provident funds as it may deem fit.

Pension
and
provident
fund.

(2) Where any such provident fund has been so constituted, the Central Government may declare that the provision of the Provident Funds Act, 1925 shall apply to such fund as if it were a Government Provident Fund.

25. All appointments on the staff of any Institute, except that of the Director, shall be made in accordance with the procedure laid down in the Statutes, by –

Amend to modify by deleting “ except that of the Director” and to redraft as under:

“All appointments on the staff of any Institute shall be made in accordance with the procedure laid down in the Statutes, by”

(a) the Board, if the appointment is made on the academic staff in the post of lecturer or above or if the appointment is made on the non-academic staff in any cadre the maximum of the pay scale for which exceeds six hundred rupees per month;

Substitute Clause 25 (a) as under

(a) the Board, if the appointment is made on the academic staff in the post of lecturer or above or if the appointment is made on the non-academic staff in any cadre by the Director based on the positions and pay scales approved by the Board. The Board may however delegate the appointment of Academic staff to the Director or a Committee constituted by the Board.

(b) by the Director, in any other case.

Amend Clause 25 to add as under (Appointments)

(c) The compensation, and terms and conditions of employment for Academic and Non-academic staff shall be decided by the Board from time to time. However, such compensation shall not be lower than the pay scales as determined by the Government for equivalent positions.

26. Subject to the provisions of this Act, the Statutes may provide for all or any of the following matters, namely:-

- (a) the conferment of honorary degrees;
- (b) the formation of departments of teaching;
- (c) the fees to be charged for courses of study in the Institute and for admission to the Examinations of degrees and diplomas of the Institute.
- (d) the institution of fellowships, scholarship, exhibitions, medals and prizes.

Modify Clause 26 (d) as follows:

(d) the institution of fellowships, assistantships, scholarships, exhibitions medals and prizes;

- (e) the term of office and the method of appointment of officers of the Institute;
- (f) the qualification of teachers of the Institute;

Modify Clause 26 (f) as follows:

(f) the qualifications of academic and other staff of the Institute;

- (g) the classification, the method of appointment and the determination of the terms and conditions of service of teachers and other staff of the Institute;

Modify Clause 26 (g) as follows:

(g) the classifications, the method of appointment and the determination of the terms and conditions of service of academic and other staff of the Institute;

- (h) the constitution of pension, insurance and provident funds, for the benefit of the officers, teachers and other staff of the Institute;
- (i) the constitution, powers and duties of authorities of Institute;
- (j) the establishment and maintenance of halls and hostels;

- (k) the conditions of residence of students of the Institute and the levying of fees for residence in the halls and hostels and of other charges;
- (l) the manner of filling vacancies among members of the Board;
- (m) the allowances to be paid to the Chairman and members of the board;
- (n) the authentication of the orders and decisions of the board;
- (o) the meetings of the Board, the Senate, or any Committee, the quorum at such meetings and the procedure to be followed in the conduct of their business;
- (p) any other matter which by this Act is to be or may be prescribed by the Statutes.

Statutes
how made.

27. (1) The first Statutes of each Institute shall be framed by the Council with the previous approval of the Visitor and a copy of the same shall be laid as soon as may be before each House of Parliament.
- (2) The Board may, from time to time, make new or additional Statutes or may amend or repeal the Statutes in the manner hereafter in this section provided.
- (3) Every new Statute or addition to the Statutes or any amendment or repeal of a Statute shall require the previous approval of the Visitor who may assent thereto or withhold assent or remit it to the Board for consideration.
- (4) A new Statute or a Statute amending or repealing an existing Statute shall have no validity unless it has been assented to by the Visitor.

Amend Clause 27 (3) and 27 (4) to be modified as under

Substitute the word "Visitor" by "IIT Council"

(3) Every new Statute or addition to the Statutes or any amendment or repeal of a Statute shall require the previous approval of the IIT Council who may assent thereto or withhold assent or remit it to the Board for consideration.

(4) A new Statute or a Statute amending or repealing an existing Statute shall have no validity unless it has been assented to by the IIT Council.

Ordinances.

28. Subject to the provisions of this Act and the Statutes, the Ordinance, of each Institute may provide for all or any of the following matters namely:-

- (a) the admission of the students to the Institute;
- (b) the courses of study to be laid down for all degrees and diplomas of the Institute;
- (c) the conditions under which students shall be admitted to the degree or diploma courses and to the examinations of the Institute, and shall be eligible for degrees and diplomas;
- (d) the conditions of award of the fellowships, Scholarships, exhibitions, medals and prizes;
- (e) the conditions and mode of appointment and duties of examining bodies, examiners and moderators;
- (f) the conduct of examinations;
- (g) the maintenance of discipline among the students of the Institute; and
- (h) any other matter which by this Act or the Statutes is to be or may be provided for by the Ordinances.

Ordinances
how made

29. (1) Save as otherwise provided in this section, Ordinances shall be made by the Senate.

(2) All ordinances made by the Senate shall have effect from such date as it may direct, but every Ordinance so made shall be submitted, as soon as may be, to the Board and shall be considered by the Board at its next succeeding meeting.

(3) The Board shall have power by resolution to modify or cancel any such Ordinance and such Ordinance shall from the date of such resolution stand modified accordingly or cancelled, as the case may be.

Tribunal of
Arbitration.

30. (1) Any dispute arising out of a contract between an Institute and any of its employees shall,

at the request of the employee concerned or at the instance of the Institute, be referred to a Tribunal of Arbitration consisting of one member appointed by the Institute, one member nominated by the employee, and an umpire appointed by the Visitor.

(2) The decision of the Tribunal shall be final and shall not be questioned in any court.

(3) No Suit or proceeding shall lie in any court in respect of any matter which is required by subsection (1) to be referred to the Tribunal of Arbitration.

(4) The Tribunal of Arbitration shall have power to regulate its own procedure.

(5) Nothing in any law for the time being in force relating to arbitration shall apply to arbitrations under this section.

CHAPTER III

THE COUNCIL

Establish-
ment of
Council

31. (1) With effect from such date as the Central Government may, by notification in the

Official Gazette, specify in this behalf, there shall be established a central body to be called the Council.

Add at the end of Clause 31 (1); "It shall meet at least twice in a calendar year."

31. (1) With effect from such date as the Central Government may, by notification in the Official Gazette, specify in this behalf, there shall be

established a central body to be called the Council. It shall meet at least twice in a calendar year.

- (2) The Council shall consist of the members, namely :-
- (a) the Minister in charge of 'technical education in the Central Government, ex officio,. As Chairman;
 - (b) the Chairman of each Institute, *Ex officio*;
 - (c) the Director of each Institute, *Ex officio*;
 - (d) the Chairman, University Grants Commission, *Ex officio*;
 - (e) the Director-General, Council of Scientific and Industrial Research, *Ex officio*;
 - (f) the Chairman of the Council of the Indian Institute of Science, Bangalore, Ex officio;
 - (g) the Director of the Indian Institute of Science, Bangalore, ex officio;
 - (h) three persons to be nominated by the Central Government, one to represent the Ministry concerned with technical education, another to represent the Ministry of Finance and the third to represent any other Ministry;
 - (i) one person to be nominated by the **AIIT**- India Council for Technical Education;
 - (j) not less than three, but not more than five, persons to be nominated by the Visitor, who shall be persons having special knowledge or practical experience in respect of education, industry, science or technology;
 - (k) three Members of Parliament, of whom two shall be elected by the House of the People from among its members and one by the Council of States from among its members.

Term of office of vacancies among and allowances payable to members of Council.

(3) An officer of the Ministry of the Central Government concerned with technical education shall be nominated by that Government to act as the Secretary of the Council.

32. (1) Save as otherwise provided in this section, the term of office of a member of the Council

shall be three years from the date of his nomination or election, as the case may be.

(2) The term of office of an ex officio member shall continue so long as he holds the office by virtue of which he is a member.

(3) A member of the Council referred to in clause (h) of sub-section (2) of section 31 shall hold office during the pleasure of the Central Government.

(4) The term of office of a member elected under clause (k) of sub-section (2) of section 31 shall expire as soon as he ceases to be a member of the House which elected him.

(5) The term of office of a member nominated or elected to fill a casual vacancy shall continue for the remainder of the term of the member in whose place he has been nominated or elected.

(6) Notwithstanding anything contained in this section an outgoing member shall, unless the Central Government otherwise directs, continue in office until another person is nominated or elected as a member in his place.

(7) The members of the Council shall be paid such travelling and other allowances by the Central Government as may be determined by that Government, but no member shall be entitled to any salary by reason of this Sub-section.

33. (1) It shall be the general duty of the Council to co-ordinate the activities of all the

Institutes.

(2) Without prejudice to the provisions of sub-section (1), the Council shall perform the following functions, namely: -

(a) to advise on matters relating to the duration of the courses, the degrees and other academic distinctions to be conferred by the Institutes, admission standards and other academic matters;

(b) to lay down policy regarding cadres, methods of recruitment and conditions of service of employees, institution of scholarships and freeships, levying of fees and other matters of common interest;

Add a new clause 33(2)(c)

(c) To approve the appointment of the Chairman of the Board based on the recommendation of the Board, and to approve the panels of the recommended names for selection of members of the Board . as per the details mentioned in clause 11.

Rename the clauses (c) below as (d)

(c) to examine the development plans of each Institute and to approve such of them as are considered necessary and also to indicate broadly the financial implications of such approved plans;

(d) to examine the annual budget estimates of each Institute and to recommend to the Central Government the allocation of funds for that purpose;

Delete existing clause 33(2)(d)

Add a new clause 33(2)(e)

(e) to approve a Memorandum of Understanding (MOU) between the Government and each Institute annually. The MOU will include a) the

academic accomplishments of the Institute including the research and technological outputs, b) the number of students to be admitted in various categories, c) the quantum and number of scholarships and assistantships to be provided by the Central Government for UG, Masters and PhD students, c) support to students from scheduled categories and those with weaker economic background d) incentives to students to get into research and teaching e) the quantum of support from the Central Government for pension payments, capital expenditure, research and such other matters as mutually decided

Rename the clauses (e)-(f) as (f)-(g)

(e) to advise the Visitor, if so required, in respect of any function to be performed by him under this Act; and

(f) to perform such other functions as are assigned to it by or under this Act.

34. (1) The Chairman of the Council shall ordinarily preside at the meetings of the Council.

Chairman
of Council.

(2) It shall be the duty of the Chairman of the Council to ensure that the decisions taken by the Council are implemented.

(3) The chairman shall exercise such other powers and perform such other duties as are assigned to him by this Act.

Power to
make rules
in respect
of matters
in this
Chapter.

35. (1) The Central Government may make rules to carry out the purposes of this Chapter.

(2) In particular and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:-

(a) the manner of filling vacancies among the members of the Council;

(b) the disqualifications for being chosen as, and for being, a member of the Council;

- (c) the circumstances in which, and the authority by which, members may be removed;
- (d) the meetings of the Council and the procedure of conducting business thereat;
- (e) the travelling and other allowances payable to members of the Council; and
- (f) the functions of the Council and the manner in which such functions may be exercised.

CHAPTER IV

MISCELLANEOUS

Acts and proceeding not to be invalidated by vacancies etc.

36. No act of the council, or any Institute or Board or any other body set up under this Act or the Statutes, shall be invalid merely by reason of –
- (a) any vacancy in, or defect in the constitution thereof, or
 - (b) any defect in the election nomination or appointment of a person acting as a member thereof, or
 - (c) any irregularity in its procedure not affecting the merits of the case.

Power to remove difficulties.

37. If any difficulty arises in giving effect to the provisions of this Act, the Central Government may, by order published in the Official Gazette, make such provision or giving such direction not inconsistent with the purposes of this Act, as appears to it to be necessary or expedient for removing the difficulty.

Transitional provisions.

38. Notwithstanding anything contained in this Act,-
- (a) the Board of Governors of an Institute functioning as such immediately before the commencement of this Act shall continue to so function until a new Board is constituted for that Institute under this Act, but on the constitution of a new Board under this Act, the members of the Board holding office before such constitution shall cease to hold office;

(b) *The staff committee constituted in relation to the College of Engineering and technology, Delhi and any Academic Council constituted in relation to any other Institute before the commencement of this Act shall be deemed to be the Senate constituted under this Act until a Senate is constituted under this Act for that Institute;

*As per
Institutes of
Technology
(Amended)
Act 1963

(c) until the first Statutes and the Ordinance are made under this Act, the Statutes and Ordinances of the Indian Institute of Technology, Kharagpur as in force immediately before the commencement of this Act shall continue to apply to that Institute and shall, with the necessary modifications and adaptation also apply to any other Institute, in so far as they are not inconsistent with the provisions of this Act.

5 of 1956.

39. (1) The Indian Institute of Technology (Kharagpur) Act, 1956 is hereby repealed.

Repeal
and
barings.

(2) Notwithstanding such repeal, the provisions of the said Act set out in the Schedule shall continue to have effect.

Provided that in the said provisions, the expression, "this Act" means the said provisions,

THE SCHEDULE

(See section 39)

Provisions of the Indian Institute of Technology (Kharagpur) Act, 1956, continued in force.

2. Whereas the objects of the institution known as the Indian Institute of Technology at Kharagpur in the district of Midnapore in the State of West Bengal are such as to make the Institution one of national importance, it is hereby declared that the institution known as the Indian Institute of Technology, Kharagpur, is an institution of national importance.

Declaration
of the Indian
Institute of
Technology
(Kharagpur)
as an
institution
of national
importance.

3. In this Act, unless the context otherwise requires,-

(a) "Board" means the Board of Governors of the Institute;

(b) "Chairman" means the Chairman of the Board;

(c) "Director" means the Director of the Institute;

(d) "Institute" means the Institute known as the Indian Institute of Technology, Kharagpur, incorporated under this Act.

Definitions.

4. (1) The first Chairman, the first Director and the first members of the Board who shall be the

persons appointed in this behalf by the Central Government, by notification in the Official Gazette, and all persons, who may hereafter be - come or be appointed as officers or members of the Board, so long as they continue to hold such office of membership, are hereby constituted a body corporate by the name of the Indian Institute of Technology, Kharagpur.

(2) The Institute shall have perpetual succession and a common seal, and shall sue and be sued by the said name.

5. (1) Subject to the provisions of this Act, every person who is permanently employed in the

Indian Institute of Technology at Kharagpur immediately before the commencement of this Act shall, on and from such commencement, become an employee of the Institute and shall hold his office or service therein by the same tenure, at the same remuneration and upon the same terms and conditions and with the same rights and privileges as to pension, leave, gratuity, provident fund and other matters as he would have held the same on the date of commencement of this Act if this Act had not been passed.

Transfer of
Service of
existing
employees
of the Indian
Institute of
Technology
at
Kharagpur.

(2) Notwithstanding anything contained in sub-section (1) the Institute may, with the prior approval of the Visitor, alter the terms and conditions of any employee specified in sub-section (i), and if the alteration is not acceptable to such employee, his employment may be terminated by the Institute in accordance with the terms of the contract with the employee or, if no provision is made therein in this behalf, on payment to him by the Institute of compensation equivalent to three months' remuneration.

(3) Every person employed in the Indian Institute of Technology at Kharagpur other than any such person as is referred to in sub-section (1) shall, on and from the commencement of this Act become an employee of the Institute upon such terms and conditions as may be provided for in the Statutes, and until such provision is made, on the terms and conditions applicable to him immediately before such commencement.

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Two teams painstakingly did the content analysis of stakeholder inputs. The first team at IIT Bombay was led by Dr. (Ms) Karuna Jain, Head, SJM School of Management, IIT Bombay, and consisted of her enthusiastic band of students Disha Bhanot, Govind Srivastava, Mengist H. Tadesse, Mukundan R., Ruchita Gupta, Sasadhar Bera, Sarang Kulkarni, Sheila Rao and Thiagu Ranganathan. Another vibrant student team at IIT Madras consisted of Vaishnavi Surendra, Aadya Singh, Gayathri Vijayaraghavan, Aditi Balachandar, Sunny Swetank and Althaf Shajahan.

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