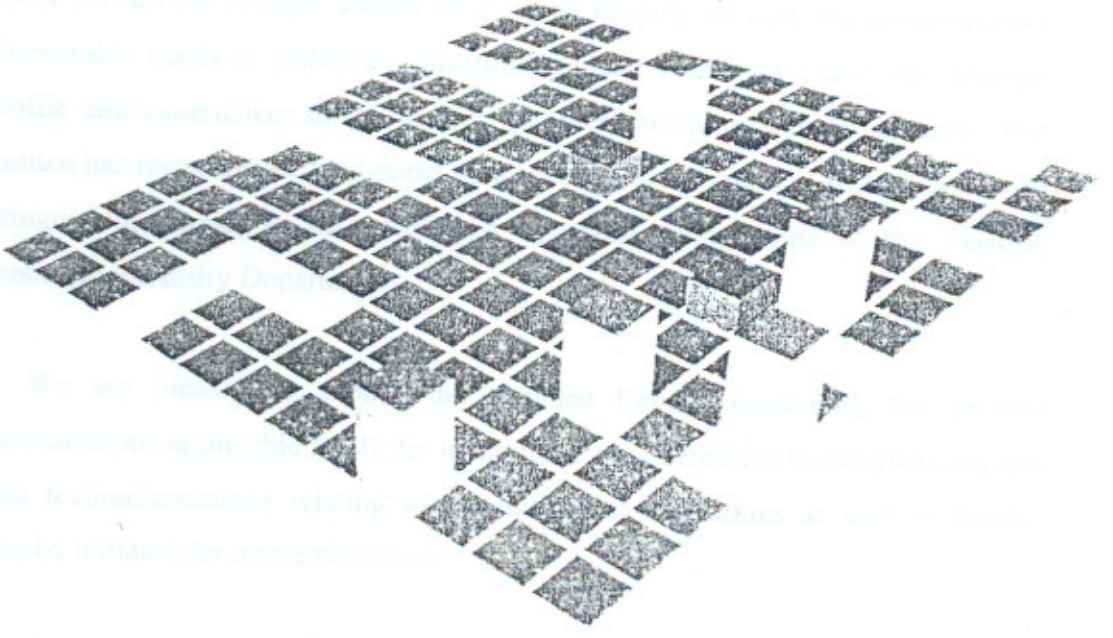
REPORT OF THE EXPERT COMMITTEE ON TRANSFORMATION OF SELECTED TECHNICAL INSTITUTIONS INTO A NEW SYSTEM OF INSTITUTES OF NATIONAL IMPORTANCE



Submitted to
MINISTRY OF HUMAN RESOURCE DEVELOPMENT
GOVERNMENT OF INDIA
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Letter of Transmittal

Dear Shri Ravi Mathur

It has been a valuable opportunity to the three of us in the Expert Committee constituted by the Ministry of Human Resource Development to make recommendations on upgrading seven Institutions identified by the S.K. Joshi Committee to the level of IITs.

Taking into account the basic intentions of the mandate of our Committee, we have made suggestions in the light of the concerns of the key stakeholders of the institutions and the data and information made available to us. The Committee perceived that a new concept should be evolved keeping in view the contemporary and foreseeable needs of technical education in India. This should take into account the profile and experiences of the leading technical institutions in the country. The Committee has recommended a distinct concept for a new system of Institutions, with a distinguishing name, to be established by transforming some of the existing Universities/University Departments.

We are pleased to submit the attached Report, containing the general recommendations applicable to all the institutions considered for transformation, and specific recommendations relating to the individual institutions as well as further steps to be initiated for implementation.

We will be available for any clarifications on the contents of the Report if the need arises.

With best regards,

Sincerely,

(Amitabha Ghosh)
13.02.2006

(D.V. Singh)
13-02-2006

(M. Anandakrishnan) 13 Feb 2006

ACKNOWLEDGEMENT

The Expert Committee gratefully acknowledges the spontaneous cooperation and appropriate support received from the various institutions and their functionaries. It deeply appreciates the initial briefings given by senior officials of the Technical Bureau of the Department of Secondary and Higher Education, MHRD, New Delhi who also provided relevant background documents and made necessary arrangements with the identified Institutions facilitating orderly visits of the Committee and collection of necessary data and information. The Committee is grateful for the excellent arrangements made by the Vice-Chancellors, Directors and Deans of the seven Institutions for its visits and for making available detailed information at a relatively short notice, without exception.

The Committee conveys its special gratitude to Prof. S.K. Dube, Director, IIT Kharagpur and his personal assistant Shri Tapan Kumar Dey for providing commendable logistic support for the Committee's visit to the two Institutions in Kolkata. The work of the Committee could not have been accomplished in a reasonable time but for the extensive facilities generously made available by Prof. Sanjay G. Dhande, Director, IIT Kanpur and the enabling support provided by K.N. Dakhle, Estate Officer. The efficient and multifarious assistance rendered by Atul Gangwar in documentation and preparation of different draft versions of the Report has been of immense value to the Committee. The Committee deeply appreciates the contribution of the two postgraduate students of IIT Kanpur, T.N. Subramanya and Gorky Srivastava who designed the elegant cover of the Report at a very short notice.

The services of the guest house and dining hall staff in providing prompt and cheerful service to the Committee is warmly recognized. The Committee places on record its deepest gratitude to Prof. Dhande and the members of the staff and students of IIT Kanpur who extended alround support to the Committee.

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EXECUTIVE SUMMARY

Arising out of the recommendations of the Committee of Experts constituted by the MHRD under the Chairmanship of Prof.S.K.Joshi on upgradation of seven institutions to the level of IITs, a three member Expert Committee was appointed by the MHRD to undertake an in-depth evaluation of the identified institutions. The Expert Committee, comprising Prof.M.Anandakrishnan, Prof.D.V.Singh and Prof.Amitabha Ghosh, gathered specific data and information, visited the institutions and held discussions with those that are interested in this matter. Based on the analysis of particulars made available to the Expert Committee, a set of recommendations is presented in this Report along with suggestions for implementation.

The Committee kept in view that this exercise is not for conversion of the identified Institutions into IITs but to assess their potential to be transformed into high level technological institutes of national importance, comparable to the stature of the IITs. The comparison is primarily related to the curricular framework and flexibility; the composition of the faculty members, their qualifications and achievement profile; the make up of the student population of all-India character and their admission process; the academic and physical infrastructure; the governance structure: and the sources of finance after the transformation from their present status. Additionally, the transformed institutions may also develop certain desirable characteristics, which are distinct from those of the IITs.

For this purpose, the Committee formulated a conceptual model of a high level technological institute of national importance, as described in Chapter 3. The features of this model are that it is an institute of national importance formed by an Act of Parliament with a nomenclature, Indian Institute of Engineering Science and Technology (IIEST). All IIESTs will together constitute a new system of institutions in technical education, developed by transforming promising existing technological institutions.Its governance system will be comparable to that of the IITs, including a Common Council for all IIESTs. Its policies for admission of students and appointment of faculty and staff will be analogous to those of the IITs. It should possess adequate space for development of facilities. Its primary source of financial support will be the MHRD.

In addition, these Institutions will not offer any terminal Bachelor's degree in engineering and technology (other than in Architecture) but will be devoted to offering programmes leading to 5-year integrated dual degrees (B.Tech-M.Tech); 2-year M.Tech; 5-year integrated M.Sc; 2-year Master's degree programmes in science, arts, architecture and management; and will have a substantially large proportion of doctoral candidates. The appropriate authorities of individual institutions will determine the nature of programmes and their intake capacity. A distinct feature of the IIESTs is that they will have specific provisions for international students and faculty. Accordingly, there will be some features in terms of academic and research facilities that will be more or less of common standard. Other features such as intake capacity, faculty strength, number of doctoral research scholars, etc. will vary among them.

The comparative characteristics of each institution were analyzed in terms of their attributes in academic achievements, infrastructure and governance system, as described in Chapter 5. Based on this analysis, the Expert Committee is of the view that the following five institutions: 1. Bengal Engineering and Science University. 2. Institute of Technology, Banaras Hindu University, 3. Cochin University of Science and Technology, 4. College of Engineering, Andhra University and 5. University College of Engineering and Technology, Osmania University, have the potential for transformation into IIESTs. Of course, such transformations will be possible only after delinking these Institutions at Varanasi, Hyderabad, and Viskakhapatnam from their respective parent Universities. So for as the Institute at Kochi is concerned it will require the separation of its campus at Kuttanad from the main campus to put it under a State level University in Kerala.

The engineering and technology departments of Jadavpur University and the Zakir Hussain College of Engineering and Technology, Aligarh Muslim University do not offer reasonable scope for transformation into IIESTs. Both the Institutions have constraints of spatial reconfiguration of existing engineering and technology departments into a contiguous and identifiable institutional entity. In case of Jadavpur University, there is a severe limitation of area available for further development. In these two cases, there appears to be difficulties in arriving at a governance system envisaged in the Joshi Committee Report. However, considering their academic merit, a one-time support of Rs.50 crore each, is recommended to enable engineering and technology departments of the University to develop specific Centres of Excellence.

The general recommendations for the five proposed IIESTs and specific recommendations for academic direction for each of them are shown in Chapter 6. The financial outlay for the period 2007-2012 required to fulfill common and specific goals of the five Institutions is shown in Chapter 7. As shown in Table 7.1, the budgetary allocation during the 11th Plan period varies from about 408 to 545 crores among the five Institutions with a total requirement of Rs.2407 crores for all the five. The actual allocation would be based on details of programme profiles and specific proposals for funds.

It is recognized that several prerequisites need to be fulfilled before the formation of the IIESTs. A set of tasks associated with the implementation process and an indicative time frame is shown in Chapter 8 and Figure 8.1.

Considering the need for many more high level technological institutions in the country and the limitations of starting them de-novo, the substantial scope for enriching the available talents and facilities through the new system of institutes of national importance, should be considered as a viable alternative. This report proposes one possible model for implementation.

Chapter 1

INTRODUCTION

1.1 Expert Committee

As a follow-up to the Report of the S.K. Joshi Committee "to identify Promising Academic Institutions to be upgraded into Indian Institute of Technology" the Ministry of Human Resource and Development (MHRD) invited the following seven so identified institutions to submit their Vision Documents for "upgradation to the level of IITs":

1. Institute of Technology, Banaras Hindu University, Varanasi (IT-BHU)
2. University College of Engineering combined with the University College of Technology, both belonging to Osmania University, Hyderabad. (UCET-OU)
3. Bengal Engineering and Science University, Howarh (BESU)
4. Jadavpur University's Engineering and Technology Departments, Kolkata. (JUET)
5. Zakir Hussain College of Engineering and Technology, Aligarh Muslim Unviersity, Aligarh. (ZHCET-AMU)
6. Andhra University College of Engineering, Vishakhapatnam (AUCE)
7. Cochin University of Science and Technology, Kochi. (CUSAT)

The Joshi Committee had suggested that before taking the final decision on its recommendation, "the Ministry may like to set up a small expert group. The group would need to visit the institutions listed, to assess the suitability of institutions through such visits and also assess first hand the problems of transformations of these institutions to IIT-like institutes. The group can then arrive at the quantum of one time financial support needed for managing such a transformation of the institutions in the event the government decides to upgrade any of them." [1]

[1] *Report of the Expert Committee to identify Promising Academic Institutions to be upgraded into Indian Institute of Technology, (Jan 2005).*

Accordingly, the MHRD appointed an Expert Committee (EC) comprising the following members:

(i) Prof. M. Anandakrishnan - Convener
Former Vice-Chancellor, Anna University
and former Professor, IIT Kanpur

(ii) Prof. Amitabha Ghosh - Member
Former Director, IIT Kharagpur
and Professor, IIT Kanpur

(iii) Prof. D.V. Singh - Member
Former Vice-Chancellor, University of Roorkee
and former Vice-President,
Indian National Academy of Engineering

1.1.1 The Terms of Reference

The terms of reference of the EC (Annexure I) are as follows:[2]

"(i) to examine the Vision Documents and give necessary suggestions to meet the goals;

(ii) to identify the gaps in resources and suggest measures to raise the additional fund requirement; and

(iii) to suggest a Plan of Action for upgrading the identified institutions to the level of IITs."

1.2 Visits and Discussions

Initially the EC held a meeting with Shri Ravi Mathur, Joint Secretary, and other officials of the MHRD in Delhi on September 23, 2005 for a briefing. Shri Mathur explained that the Universities/University Institutions imparting technical education were short-listed by the Joshi Committee on the basis that they had the potential for consideration of one-time MHRD support during the 11th Plan period to enable them to strengthen to the level of IITs. It was clarified that the intention was not to convert these Institutions into IITs. The members of EC were given copies of

[2] *Office Memorandum F.No.9-11/2003-TS-1 (Vol-2) from MHRD dated 6-9-2005 (Annexure I)*

the Joshi Committee Report and the Vision Documents of the seven identified Institutions.

The EC discussed the broad criteria for making the assessments and the additional information required for the purpose. A template was finalized and sent to the seven identified Institutions requesting them to provide the required information prior to the visits of the EC. These data and information were updated during the visits and discussion with the officials and faculty members of the Institutions. The data and information were further supplemented by receiving information in the format provided to the Institutions by the EC during the visits. The particulars so gathered were confined only to the engineering and technology related programmes and activities of the Institutions.

1.2.1 Visit Schedules

The EC visited the seven Institutions according to the following schedule:

IT/BHU	16-17 November 2005;
ZHCET/AMU	18-19 November 2005;
UCET/OU	25-26 November 2005;
AUCE	27-28 November 2005;
JU	01-02 December 2005;
BESU	02-03 December 2005;
CUSAT	12-13 December 2005

During the visits the EC heard the presentations by the Vice-Chancellors, Registrars, Finance Officers, The Deans, Directors, Heads of Departments/ Schools/ Centers, Wardens and other senior officials and sought their clarifications and views on the issues relating to upgradation/ transformation. Discussions were also held separately with groups of faculty, staff and students to elicit their views and suggestions. The EC visited major academic facilities, student hostels, faculty residences, cultural and other campus amenities and the proposed land area to be utilized for the purpose of transformation.

Some institutions were under the impression that the purpose of the MHRD initiative was to convert them into IITs. To dispel this notion, the EC clarified that the intention was not to convert the Institutions into IITs but to assess the scope to transform the existing engineering and technology institutions to the level of IITs, possibly with goals and objectives comparable but distinct from those of the IITs. It was also made clear that the transformation would require several key prerequisites to be met in terms of governance structure, admission policies, faculty profile, the possibilities of configuring a distinctly identifiable campus area of adequate size, etc. The Acts and Statutes of the Institutions and the details of their campus plan to accommodate the various proposals were also obtained. Additional information on summary profiles of faculty and institutional performance along with modifications of initial proposals and cost estimates were requested to be furnished within 10 days after the visit of the EC.

1.3 Finalization of Report

The EC met at IIT-Kanpur during the periods 9 to 13 January 2006, 21 to 23 January 2006 and 8 to 12 February 2006 to analyse the available data and information to finalize its Report.

Chapter 2

NEED FOR ALTERNATE SYSTEMS OF EXCELLENCE IN TECHNICAL EDUCATION IN INDIA

2.1 Historical Background of Engineering Education in India

The British Period

The formal education in India began with the establishment of Survey Schools by the British; the Madras Survey School, being the first, was started in 1794, it later grew into Engineering College Guindy. Survey education was expanded later by starting survey classes in Bengal (1817), Bombay (1844), and United Provinces (1845). The first Engineering College, the Roorkee College, was established in 1847. It was the first engineering College in India and the second in the World, which later became the Thomason College of Civil Engineering in 1856.

A College was started in 1854 at Bombay to teach Civil Engineering to Surveyors. The Civil Engineering College, Calcutta started in 1856, which later became Bengal Engineering College Shibpur. As a follow-up of Wood's Education Dispatch (1854), three Universities were established in the then presidency towns of Bombay, Calcutta and Madras. These were the earliest Universities of the British India.

Under the Stanley Scheme of 1859 initiated by the Secretary of State for India in London, the vacancies in the Public Works Departments of the Government were filled by direct recruitment in England. This affected the employment of the products of the Indian Engineering Colleges. By late 1890's a number of Survey and Industrial Schools were started in the Presidencies of Madras and Bombay. At a higher level, the Victoria Jubilee Technical Institute was established in Bombay in 1887.

At the end of the 19th Century, the technical education system in India comprised four engineering colleges at degree level, about twenty survey and

technical institutions and about fifty industrial schools. In the First Industrial Conference held at Banaras in 1905. the desirability of establishing at least one central polytechnic institution for the whole of India and one technical college in each province, was impressed on the Government.

The Swadeshi Movement of the first decade of the 20th Century led to the urge of Swadeshi education also. During this period, many national educational institutions, free from the Government control, were established as for example, the National Council of Education, Bengal (1906), which later became Jadavpur University and some others. A few of them also imparted technical education. In the decades that followed some more institutions imparting technical and industrial education at various levels and in different disciplines of technology were established.

After the World War I, the Government became a little more responsive to public demand of technical education. The situation which was stagnant during the War period, began to improve. Several institutions were established during the War and in the decades thereafter. They include Banaras (then Benares) Hindu University (1916), Harcourt Butler Technology Institute, Kanpur (1920), Calcutta University College of Science and Technology (1920), Bihar Engineering College, Patna (1924), Indian School of Mines, Dhanbad (1926), Maclagan College of Engineering, Lahore (1930), Andhra University, Vizag (1933), University Department of Chemical Technology, Bombay (1934), and Aligarh Muslim University (1935). Some Colleges were started in the Princely States of India in 1937. Many other colleges in the four regions of the country were started in subsequent years.

There was a lack of coordination at the all India level and to some extent at the provincial level on the issues of contents and durations of the educational programmes. The nomenclatures, 'Engineering', 'Technical', 'Technological', or 'School', 'College', and 'Institute' were arbitrarily used and did not indicate the level of the programmes.

Abbott and Wood Report commissioned by the Government of India in 1937 stated that provision for technical education at all levels was too inadequate for a large country like India and that there was no integrated policy and there was no

coordinating agency for its proper development. Later for coordination and standardization of courses, the All India Association of Principals of Technical Institutions was formed in 1941. Several technical institutions were established in different parts of the country during this period. As recommended by the Abbot-Wood Committee, a Polytechnic was established in Delhi in 1941.

Pre-independence Initiatives

In 1944, the Central Advisory Board of Education was asked by the Reconstruction Committee of Viceroy's Executive Council to give a Report on the post-war education development in India. In the light of the Report, the Government set up an ad-hoc Committee in 1945 under the chairmanship of N.R.Sarkar to advise the provision for advancement of technical education.

On the recommendations of the Sarkar Committee, a national agency, All India Council for Technical Education (AICTE, then not a Statutory body), was established in 1945 for planned and coordinated growth of technical education in India. In 1947 at the time of Independence, Polytechnic education was severely lacking in respect of eligibility, duration, standard and management. At that time, only 53 institutions conducted Diploma courses in the country with an intake capacity of 3670 students. The major task of AICTE was therefore, coordination , standardization and improvement of Polytechnic education. The action on the other recommendations, which led to establishment of IITs, was taken by the Government of India after Independence. Section 2.3 deals with the establishment and growth of IITs.

The number of engineering colleges in the year 1946 was 46 with an intake capacity of 2500 students. These colleges catered predominantly to the needs of the various Government departments such as Public Works, Railways, Electricity, Telecommunications, Irrigation, etc. A very small proportion of engineers found opportunities in private sector companies engaged in engineering operations. The intake capacity for Post Graduate Education in engineering was a mere 30 students in 1947. Most had to go abroad to obtain postgraduate education in engineering.

Earlier Initiatives in Independent India

The Government of India, after Independence, recognized the importance of quality technical education for the economic and industrial growth of the country, which required the future generation of engineers to be competent, innovative, good designers and excellent product manufacturers.

The Radhakrishnan Commission Report (1949) made several recommendations on technical education emphasizing the need of new types of engineering and technical institutions in India. As a consequence of these recommendations, several new developments took place in the subsequent years.

In 1959, under the chairmanship of M.S.Thacker, a Working Group on Technical and Vocational Training and also a Committee on Postgraduate Education and Research were constituted. Another important step in the development of technical education was the appointment of Kothari Commission (1964). The Kothari Commission Report contained many recommendations, which included the importance of practical training and industry-institute interaction.

During the first two decades after Independence, the expansion in technical education was accompanied by massive investments by the Government in infrastructure in the academic institutions. In the late fifties, faced with a serious shortage of faculty in technical institutions, a Technical Teachers Training (TTT) programme was started. Reasonably attractive fellowships were offered to fresh graduates to induce them to study for a post-graduate degree in one of the established institutions in the country and later join the teaching profession. Some teacher trainees were also sent abroad for acquiring higher qualifications

2.2 Growth of Technical Education

On the recommendation of the Engineering Personnel Committee, which was appointed by the Planning Commission in 1955, the Government of India initially decided to establish eight Regional Engineering Colleges (REC). In order to provide each State with a Regional Engineering College, seven more were approved for establishment during the Third Plan period, bringing the total number of RECs to

fifteen by 1972. Two more were added later, one in Jullandhar (1985) and the other in Hamirpur (1989).

The Technical Teacher Training (TTT) programme, which was started in the late Fifties, resulted in creation of a large pool of dedicated teachers. After the TTT programme was phased out, the Quality Improvement (QIP) for improving the quality of technical education and developing the faculty of engineering institutions was launched by the Government of India in 1970. This programme is operated in 25 engineering/technical institutions; seven of them are major QIP centres and eighteen are minor centres. This programme provides opportunity for continuous upgrading of knowledge and skills of persons who are already in the teaching profession. Over the years a large number of faculty acquired higher degrees from leading institutions in the country under the programme.

In order to assess the impact of foreign technical assistance on the development of technical education in India and to determine the areas needing to be further developed and supported through the foreign technical assistance programme, the Government of India appointed a Committee under the chairmanship of Y. Nayudamma (1978). Another Committee also under the chairmanship of Nayudamma was constituted at about the same time to review the postgraduate education and research in engineering and technology and make recommendations for further development. Whereas, little is known about the outcome of the former, several recommendations of the latter were implemented.

The National Policy on Education (NPE 1986) was a major development in the field of education. NPE came out at a time when the role and impact of private institutions imparting technical education were not known or even perceived. NPE was, therefore silent on this aspect and so was the resulting Programme of Action (POA 1992).

2.2.1 Postgraduate Education in Engineering and Technology

The postgraduate education in engineering and technology in India had a late start. The postgraduate programmes in the country started in a few institutions in early 1950's but the doctoral programmes were not common until early 1960's. The recommendations of the Thacker Committee (1959-61) and of the Nayudamma Committee (1978-89) played a role in the development of the postgraduate education. These Committees were constituted by the then Ministry of Education and their Reports were submitted directly to the Ministry for perusal and action.

Later a Review Committee on Postgraduate Education in Engineering was constituted by AICTE in 1995 under the chairmanship of P. Rama Rao, which submitted its Report to AICTE in 1999. The actions on this Report have been slow and sporadic. The postgraduate education in India remains weak and needs urgent attention. With a weak postgraduate education in engineering, the technology base will be weak and India will not be able to become a front runner in the field of technology, industrial productivity and the service sector, which determine the growth and development of the country.

Rama Rao Committee Report

Rama Rao Committee supported the 'GATE' system of admission, recommended the increase of the duration of M.E./M.Tech programme from 18 months to 21 months, and enhancing the scholarship to postgraduate students, with a provision of its periodic review. The duration of the programme was, however increased to 24 months.

The Rama Rao Committee recommended strengthening the one year postgraduate diploma programmes in suitable disciplines with industrial/application orientation (maintenance of thermal power stations, plastics engineering, industrial engineering, VLSI design, CAD, Information Technology, et al). These programmes could be aimed at key industry personnel and the concerned industries should be expected to invest in setting up links with selected institutions. The Diploma programme could be offered both on-campus and in Distance Education mode.

The Rama Rao Committee recommended enrolling foreign students to post graduate programmes, particularly in emerging areas since many countries may not have the facilities in those areas. The Committee emphasized an assured placement through active linkages with potential employers. It recommended that programmes in new areas be started after careful considerations of all aspects and with due care and listed 35 representative areas. The Committee at the same time recommended restructuring or even at the same time restructuring or even phasing out of the outdated programmes.

2.3 Vision and Development of IITs.

The initiatives to conceive a grand design for technical education in India and implement the concept true to its spirit, in the form of Indian Institutes of Technology (IITs) is one of the greatest hallmarks of visionary development in independent India. The performance of the IITs during the last four to five decades has provided a sense of fulfillment. Their achievements, in producing high quality engineers and technologists and in undertaking advanced R&D missions, have received worldwide recognition. Though their future directions may depart from the original design, there is every hope that they will continue to maintain their world class reputation and their brand image.

Considering the ambitious economic and social development goals of post independent India, the need for training engineers in much larger numbers and in diverse disciplines was acutely felt. While a number of Engineering Colleges were started adopting the conventional pattern of engineering education there was a desire to establish a few technological institutions which would provide World class technical education and would have the dynamic characteristics to adopt themselves to rapid changes in engineering knowledge and its applications.

The Viceroy's Executive Council appointed a committee in 1945 under the chairmanship of N.R.Sarkar to consider the development of higher technical institutions in India. In its interim report submitted in 1945, the Sarkar Committee recommended the establishment of not less than four Higher Technical Institutions, one each in the North, East, South and the West. The objectives of these institutions

were expected to be similar to those pursued by the Massachusetts Institute of Technology, USA. The key features of the proposed programme were non-specialized orientation and integrated curricula supported by institutional processes that would encourage Indian students to think creatively. The products of these institutions were expected to be "creative scientist-engineers" and technical leaders with a broad human outlook and individuals with "creative initiative in future situations". All students were expected to have a strong core knowledge of basic sciences, engineering sciences, humanities, and technical arts besides the professional courses in chosen disciplines.

This visionary report gave rise to the birth of the first Indian Institute of Technology at Kharagpur in 1951 followed by four other IITs at Bombay, Madras, Delhi and Kanpur in the late fifties and early sixties. The IIT at Guwahati, Assam started functioning since 1992. The University of Roorkee was converted into an IIT in 2001.

2.3.1 Key Attributes of IITs

As against the earlier system of engineering colleges, which were mainly established and funded by the State Governments, the IITs were conceived as Institutes of National Importance established by an Act of the Parliament and funded liberally by the Central Government with a very high degree of functional autonomy. The academic and administrative autonomy of the IITs with an appropriate level of policy coordination among them and with necessary advice and consent from the Government of India enabled them to fulfil these missions quite sucessfully. They have now come to be recognized as hallmarks of high standards in technical education in India serving as benchmarks of quality and educational process for other technical institutions.

During the sixties and seventies, four of the IITs had the benefit of intensive support and collaboration with designated foreign institutions through inter-governmental agreement. IIT Madras collaborated with German institutions, IIT Delhi with British institutions, IIT Bombay with institutions of the erstwhile Soviet Union and IIT Kanpur with American institutions. Because of substantial foreign aid

associated with such collaborations, it became possible to attract some of the outstanding institutions abroad to come forward and assist the respective IITs. Making pragmatic use of the collaborations, the IITs developed their academic and research programmes not as carbon copies of those of the foreign institutions but adopted their most desirable features and integrated them to meet the indigenous requirements. In due course, these collaborations have been tapered off and the IITs have become fully self-reliant.

Students consider admission to the IITs as a coveted achievement after their secondary education. The Joint Entrance Examination (JEE) for all the IITs, results in the cream of the students getting selected for the IITs, based on an all-India ranking and preference of the students. The IT-BHU and the Indian School of Mines. Dhanbad and a few others also admit their students through JEE. The intake capacity of different IITs range between 500 to 700 at UG level. The strength of post-graduate enrolments in the IITs is approximately 60% of that of the undergraduate students.

The quality of the academic programs of IITs is sustained by an academically strong and eminently qualified and committed faculty in addition to well equipped laboratories and modern academic infrastructures such as the library, computing facilities, and well maintained hostels besides other facilities for sports, games. residential houses and other community facilities. Nearly all the students are provided with hostel accommodation and most of the faculty members have housing facilities thereby enabling the students and faculty to derive maximum benefits from the various academic facilities and also develop healthy interaction among them. These facilities have attracted the best minds towards the IITs, with a high degree of freedom and flexibility in pursuing their educational and research careers.

The governance structure of IITs is designed in a way to provide a holistic and sound advice and guidance to the Director and faculty of the IITs. The Board of Governors comprising eminent persons with a high level of objectivity and vision is basic to achieving a high academic stature and reputation.

The fee structures of students, which used to be nominal in the early stages. have been substantially increased to about Rs.30000 per year in recent years but the

fees still amount to only about 5% of the government support. The Central Government support to each IIT is of the order of Rs.100 Crores per year. The revenue generation of the IITs outside of the governmental support. has become substantially large to the extent of nearly 30 to 40% of the total expenditure. For any major initiatives in the field of engineering and technological development, the Governments of the State and Center as well as the corporate sector have come to rely heavily on the expertise available with the IITs not only because of their infrastructure and knowledge, but also on their objectivity and credibility.

A large proportion of the graduates of IITs not only in engineering but also in the science and humanities disciplines are readily accepted by eminent institutions abroad either for advanced studies and research or for employment. In fact, one of the major concerns in India has been that the talents produced by the IIT benefit the institutions and corporations abroad more than they do in India. However, in recent years, this concern has abated, partly because of higher rate of return of IIT graduates after their foreign studies and partly because of a highly significant level of cooperation of the IIT graduates abroad with Indian institutions. and to a large extent higher levels of salaries offered by organizations within India.

The influence of IITs on the national development may be considered from many different prospectives. It is a well-known fact that a large number of corporate heads and prime movers of industry and business in India and abroad are the products of the IITs. The successful leaders are not limited only to the field of Information Technology but are spread over many different enterprises ranging from management services, manufacturing concerns, service industries and the Indian Administrative Services. The quality of mind and the integrity of knowledge base associated with the IIT education are evident from the career paths chosen by its graduates.

2.4 Current Skew in Technical Education

The need to develop a larger number of high calibre technical institutions is urgently warranted to rectify the high degree of distortion in the growth pattern of technical education in India. There has been a rapid increase in the number of degree level engineering institutions in recent years, but most of them cater to the 4-year

undergraduate degree programmes. In just two years, there has been a 28% growth in the intake capacity of AICTE approved institutions not counting those in the universities outside the purview of AICTE. (Table 2.1)

Table 2.1

Growth in Intake capacity in UG Engineering

Year	2002-03	2003-04	2004-05
Number of Engineering College	1208	1265	1355
Total Intake Capacity	359721	380803	459407

The proportion of enrolment in engineering and technology relative to those in other disciplines is shown in Table 2.2

Table 2.2

Students Enrolment: Faculty-Wise*: 2002-2003

S.No.	Faculty	Total Enrolment	Percentage to Total
1.	Arts	41,58,606	45.07
2.	Science	18,34,493	19.88
3.	Commerce/Management	16,60,238	17.99
4.	Education	1,32,572	1.43
5.	Engineering / Technology	6,92,087	7.50
6.	Medicine	3,00,669	3.25
7.	Agriculture	55,367	0.60
8.	Veterinary Science	14,765	0.16
9.	Law	2,98,291	3.23
10.	Others	80,745	0.88
	Total	92,27,833	100.00

* Provisional

Source: University Grant Commission

At the same time, the number of institutions and their intake capacity at the M.Tech and Ph.D level has remained the same and the actual admissions to these programmes has shown declining trends. The number of doctorates awarded per year in the decade 1990 to 1999 has increased from 8388 to 10951 in all fields of study. But the number of doctorates in Engineering has been erratic with a low of 298 to a high of 696 per year during the last decade (Table 2.3)

Table 2.3

Number of Doctorate Degrees Awarded in Field of Study

Faculty	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	Growth 90-98 (%)
Natural sciences	2 950	..	3 386	3 467	..	3 861	3 498	3 894	3 836	30.0
Social sciences	290	..	453	515	..	612	502	541	541	86.6
Humanities	3 210	..	3 621	4 039	..	3 957	4 245	4 058	4 189	30.5
Engineering and technology	629	..	323	329	..	374	298	744	696	10.7
Medical sciences	140	..	116	145	..	135	133	200	190	35.7
Agricultural sciences	715	..	611	769	..	780	968	849	785	9.8
Veterinary sciences	145	..	112	114	..	138	152	122	101	-30.3
Education	188	..	247	308	..	295	295	342	310	64.9
Law	51	..	72	73	..	75	65	67	75	47.1
Others	65	..	129	164	..	170	252	249	228	250.8
Total	**8 383**	**..**	**9 070**	**9 923**	**..**	**10 397**	**10 408**	**11 066**	**10 951**	**30.6**

Source: Binod Khadria (2004). "Human Resources in Science and Technology in India and the International Mobility of Highly Skilled Indians, OECD Working Paper.

"Without supporting the acquisition of knowledge for its own sake, our options become dangerously limited."

Carl Sagan

"Knowledge rests on knowledge, what is new is meaningful, because it departs slightly from what was known before."

Robert Oppenheimer

By international comparison, India's performance in producing doctoral degree graduates is highly inadequate (Table2.4). Out of a total output of 10500 Ph.Ds in 2001, science and engineering together account for 5100, of which the number of engineering Ph.Ds in estimated as about 800 only.

Table 2.4

Comparison of Doctoral Degrees Awarded

Country	Year	All Subjects	Science and Engineering
USA	1999	40744	26354
Germany	1999	24746	11098
UK	1999	14208	8521
Japan	1999	13703	10320
France	1999	10241	6703
China	1975	0	0
	1985	234	125
	2001	12465	7617
India	1975	2015	1909
	1985	7139	3976
	2001	10500	5100

Source: U.S. National Science Foundations, Science and Engineering Indicators (2002 & 2004)

India's vision to become a developed country and a knowledge society would necessarily require a high level research capability for which doctoral research programmes are indicators. The technical education system is skewed towards low-end capability, mainly because 90% of the system is in the hands of private investors, who neither find the financial returns in post-graduate programmes attractive, nor do they have the faculty resources for this purpose.

It is essential that the development of high-end technical capability be supported in Government institutions. The post-graduate and doctoral programmes will not attract sufficient number of candidates unless they are provided with scholarships and fellowships. Very few in our socio-economic systems can afford to come for post-graduate and doctoral studies on their own funds. The nation should treat the support to Ph.D programmes in engineering and technology as an investment in creating its knowledge asset.

SCIENCE AND TECHNOLOGY POLICY 2003

Government of India

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Extracts

- *To vigorously foster scientific research in universities and other academic, scientific and engineering institutions; and attract the brightest young persons to careers in science and technology, by conveying a sense of excitement concerning the advancing frontiers, and by creating suitable employment opportunities for them. Also to build and maintain centres of excellence, which will raise the level of work in selected areas to the highest international standards.*

- *To provide necessary autonomy and freedom of functioning for all academic and R&D institutions so that an ambience for truly creative works is encouraged, while ensuring at the same time that the science and technology enterprise in the country is fully committed to its social responsibilities and commitments.*

- *Mechanisms will be established to review on a continuous basis the academic and administrative structures and procedure in the science and technology system at all levels, so that reforms could be effected to meet the challenges of the changing needs.*

- *Government will make necessary budgetary commitments for higher education and science and technology. It will, through its own resources and also through contribution by industry, raise the level of investment to at least 2% of GDP on science and technology by the end of the Tenth Plan. For this, it is essential for industry to steeply increase its investments in R&D. This will enable it to be competitive, achieve greater self-reliance and self-confidence, and fulfill national goals.*

- *A major initiative to modernize the infrastructure for science and engineering in academic institutions will be taken. - - - Science, engineering and medical departments in academic institutions and universities and colleges will be selected for special support to raise the standard of teaching and research. To begin with, a significant number of academic institutions, specially the universities, as also engineering and medical institutions, would be selected for this support to make an impact. Flexible mechanisms for induction of new faculty in key areas of science would be developed. Constancy of support and attention will be ensured over at least a ten-year period.*

The recent pull towards Information Technology related occupations has created decline of other disciplines. No nation can show sustained economic growth by I.T. sector alone without comparable strength in manufacturing, construction, agriculture, etc. The proposal to increase the number of high-calibre institutions should aim at eliminating such distortions deliberately in the long-term interest of the nation.

2.5 Need for More Institutes of National Importance

India needs many institutions providing high quality technical education and a policy which will empower them to provide education at par with the best in the World and offer good opportunity to the students who aspire for technical education and more importantly, for a carrier in engineering.

In addition to the existing seven IITs, there are demands, to establish new IITs in some States. For some years now there were proposals to convert the Regional Engineering Colleges (RECs) into IITs. Eventually they were designated as National Institutes of Technologies with deemed university status. Simply renaming institutions, which do not possess the inherent strength as IITs, will not necessarily provide them the reputation and brand image of the IIT system. Hence it will be essential to imbibe those attributes, which made the IITs perform so well, and assess whether some of the existing institutions can rise upto these qualities.

Out of nearly 200,000 students who take JEE, only about 3000 get selected for admission to IITs. It will be reasonable to assume that at least 15000 more students from the JEE lot, also have equal academic attainments and are entitled to comparable education. Herein lies a very serious concern of technical education in India. Technical education is highly preferred by students for future career choices and therefore, the number of deserving students who are denied the opportunity of IIT education, will grow. Incremental investments in IITs to enlarge their intake capacities will not be sufficient to meet the needs of highly trained people with the level of competence which can give a technological edge to the country.

Considering the large size of Indian economy, there is no doubt that we need many more institutions, which perform at a level of excellence in education and research, which is comparable to that of the IITs. For this to happen, the institutions which are proposed to be upgraded to the level of IITs should possess the capacity and potential to acquire the basic attributes of the IITs. Starting more new IITs will be difficult in view of requirements of large scale funding and also of a large number of competent faculty. The physical and academic infrastructure of the existing IITs are worth several thousand crores at current prices. Funds of this magnitude cannot be made available if several new IITs are to be built and established de-novo. The existing IITs were able to build strong faculty and academic traditions with full national and international co-operation when there were not so many competing priorities for Government funding and not as much market demand for good teachers. The prevailing situation now is very different and requires new straregies for developing World class institutions. Therefore, it is prudent and appropriate to identify some of the existing institutions which are capable of acquiring the distinctive features of IITs.

The institutions so identified need not be called IITs, but should be developed in a manner, which would distinguish them as outstanding institutions. There should be another category of high level institutions in india to meet the demand of good technical education which can not be fully met by the IITs, NITs and some well known universities, without necessarily calling them IITs, but enabling them to acquire many attributes of IITs and innovate new ones. For instance, the system for designing the academic programmes, the flexibility in offering new topics, the freedom for students to engage in cross-disciplinary programs, the transparent and accountable system of internal evaluation and grading, the assessment of teachers by the students and an autonomous and responsive government system, are some of the features which are responsible for high level of competence shown by IIT graduates. Some of the potentially capable institutions can emulate the IITs, if they can overcome the constraints of earlier governance system and academic practices.

Fortunately there are several technical institutions in India, which have long traditions and reputation in producing engineers and technologists who have professionally distinguished themselves in India and abroad. However, these

institutions have not earned the same degree of brand recognition and stature for several reasons. Each one is an individual institution and not part of a collective system as are the IITs. Many suffer from a lack of high degree of autonomy and freedom. None of them command the level of financial resources as the IITs do.

Several of the existing Institutions have highly qualified faculty who are capable of performing at levels comparable to those of the IITs, if the institutional constraints are removed. At the same time, the need to develop more high calibre technical institutions does not mean creation of more IITs. This need can be addressed to by a transformation of some of the promising institutions by incorporating the best features and practices of IITs and adding other attributes that can result in an alternate system of excellence in technical education in India. Despite the high degree of reputation and recognition enjoyed by the IITs, there are indications that their levels of performance and fulfilment of their objectives could be at a risk of decline due to gradual development of a sense of complacency. A parallel system of institutions with comparable level of excellence and stature, will provide a healthy and competitive academic and research environment to maintain the systemic dynamism in technical education.

Chapter 3

A CONCEPTUAL MODEL FOR TRANSFORMATION

3.1 Key Features

A set of distinguishing features are proposed to be incorporated as a basic requirement of the upgrading efforts in order to provide a special character to these few Institutions to become favourably comparable to the IITs in many respects and at the same time distinctly different from them in other respects.

3.1.1 Governance

One of the key features of the IITs, which is responsible for their attaining eminence in technical education, is their independent governance system. Each IIT has a Board of Governors which is free from political nuances, headed by a distinguished academic or an industrialist of repute, with its membership comprising mostly professionals. Despite significant variations in their programmes, curricular structure, grading system and so on, they all have common policies in certain aspects such as admissions, service conditions, etc. The Council of the IITs, chaired by the Minister of Human Resource Development, acting as an advisory body, promotes synergy and co-ordination among them. Thus, over the decades, they have acquired a distinct common brand image as India's foremost prestigious technical institutions.

By the same token, it is observed that there are many other high level Institutions in India such as Indian Institute of Science, some Central and State Universities, the Indian Institutes of Management and a few deemed universities, which have also established national reputation, and have relatively high degree of autonomous governance structure.

Hence it is an important prerequisite for the transformed institutions to have an independent governance structure for creditable performance, besides having a Council of the transformed institutions for facilitating synergy and brand image.

Some variation in the compositions of other organs of governance may be necessary among the transformed institutions depending on the historical and local situations, so long as the principles of true autonomy and self-governance are fully protected. The nature and functions of such other organs as the Academic Council, Finance Committee, Building and Works Committee, etc., should be reflected in their respective Statutes.

As in the case of the IITs, the Honorable President of India would be the Visitor of the transformed institutions. Their legal status as Institutes of National Importance and their functions should be prescribed by an Act of Parliament. Their financial resources for capital and recurring expenditure should be derived from the Central Funds. Other funds such as from the State Governments or other national/international funding agencies, if any, should be without strings attached to preserve their autonomous character.

The Chief Executive of the transformed institutions should be designated as the President. Other offices should be prescribed in the respective Statutes. All consultative and advisory bodies of the transformed institutions such as faculty council, student council, staff council, professional associations, etc., should be defined and structured in a way to promote the institutional goals and objectives free from political character and overtones.

3.1.2 Academic Goals and Objectives

It is envisaged that the category of transformed institutions would have a distinct structure of academic programmes and their reach. In the course of next five years, these institutions will offer only M. Tech. M.Sc and Ph.D level programmes. Considering the large intake capacity in India, of about five lakhs a year for 4-year undergraduate degree programmes, these new transformed institutions shall establish a new trend of 5-year integrated dual degree (B.Tech - M.Tech) programmes and

phase out their existing 4-year Bachelor's degree programmes. This academic structure should enable offering of innovative programmes with a larger scope of inter and multidisciplinary electives which is not easily possible now in the 4-year time frame. This will also facilitate out-turn of M.Tech degree holders in much larger number than is possible at present to meet the growing demands from academic institutions and industries. The 2-year M.Tech programme may also be offered by admitting B.Tech graduates from other institutions. The curriculum structures of the 2-year M.Tech may be so evolved as to optimize the faculty resources and create compatibility and a unity of purpose between the 5-year M.Tech and 2-year M.Tech in terms of their professional capabilities.

The admissions to the 5-year M.Tech should be on an All India basis through a national level entrance test such as JEE of the IITs or AIEEE or a joint entrance examination evolved by the transformed Institutions. Similarly the admissions to 2-year M.Tech would be based on approved national level examinations. In other words, the students admitted to these institutions would be on all-India merit, with provision for reservation only to those who are entitled by the national statutory requirements.

A substantial proportion (say 20 to 30%) of intake of students admitted to 2-year M.Tech and Ph.D programmes should be earmarked for international students. Deliberate and sustained efforts should be made through all available channels to secure good international students to these institutions, possibly as a joint and concerted effort by the transformed institutions.

In order to promote them as high calibre post-graduate and research Institutions, a substantial number of M.Tech scholarships and Ph.D fellowships should be available to the 5-year M.Tech students in their fifth year, and to the 2-year M.Tech students and to Ph.D scholars for a 4-year duration.

The international students admitted to these programmes should also be provided with scholarships and fellowships in the same way as the Indian students. This will be a bold, unique and exemplary initiative, which will enrich the academic profile and the cultural ambiance of the Institutions and bring enormous goodwill

from the international community. The young men and women trained in the leading institutions, many of whom would definitely be acquiring important positions and responsibilities in their countries, will have emotional attachments and academic roots which were nurtured in India.

The number of scholarships and fellowships should be based on the utilization capability of the individual institutions depending on their intake capacity and actual admissions, faculty strength and their qualifications, besides available facilities for project work and research.

The unique academic goals of the transformed institutions should be fully reflected through innovations such as a high degree of flexibility and generous interdisciplinary options, transparent internal evaluation and credit systems with scope for joint degree programmes among departments. There should be a provision for transfer of credits by appropriate arrangements with prestigious universities/ institutions within and outside India.

> *"Excellence is achieved by the mastery of fundamentals."*
>
> **Vince Lombarah**
>
> *"No one can become really educated without having pursued some study in which he took no interest."*
>
> **T S Eliot**

Other innovative features in the teaching and learning processes as adopted by the IITs and other institutions in India and abroad should be suitably incorporated. These would include freedom to faculty to introduce academic innovations in their courses, opportunity to pursue concurrent courses outside the curriculum structure and other value adding courses. Each institution must establish a rigorous academic schedule and ensure they are strictly adhered to as an essential aspect of a high caliber institution. The schedule should be organized in a way, which provides scope for summer courses.

The academic programmes must have strong components of natural sciences and humanities and social sciences. This will be possible only if the departments

offering these courses, are not treated merely as service departments but are established with their own academic programmes at Master's and Doctoral levels, as seen in the case of IITs. It is proposed that the transformed institutions may offer 5-year integrated M.Sc and 2-year M.Sc and M.A. programmes besides doctoral programmes of viable size.

After these Institutions are established, their performances and academic impact as well as the parameters of accountability should be reviewed by high-level committees at regular intervals, perhaps once in 7 years.

3.1.3 Faculty and Staff Resources

Eventually what will transform these institutions, which have their own past experiences and traditions, to attain international reputation and recognition is their ability to attract and retain first-rate faculty. With the intake of meritorious students, and by exposing them to highly competent and dedicated faculty in a vibrant academic environment, the institutions would be in a position to acquire national and international prestige. The IISc, IITs and IIMs have demonstrated this.

Since the excellence and standing of the Institutions will rest on the high quality of faculty, the best possible faculty would have to be inducted on an all-India basis to fill up existing and new vacancies. This will also result in a more balanced composition, overcoming their predominantly local and regional character at present.

Doctoral degree should be an essential qualification for all positions starting from Assistant Professor. The cadres may be similar to those of the IITs with positions of Professor, Associate Professor and Assistant Professor. The position of Lecturers should be minimized and be treated as temporary. The cadre structures, salary scales and service conditions should be similar to those followed in the IITs.

For purposes of estimation of faculty strength, a student-teacher ratio (STR) of 8 to 1 may be adopted. Currently the STR in the institutions being considered for upgrading is of the order of 15 to 1 or more. This ratio cannot be changed in short term. Each Institution should set out a time frame of not-more than 5 years to improve

the STR. Whatever be the STR, there should be a general policy of flexible cadre structure to attract talented persons at higher levels. There should also be provision to recruit faculty in-absentia based on good and strong credentials and reliable peer recommendations. In any case, appointment to all levels should be by open selections and not by promotions.

These and such other flexible and forward booking measures would be essential to induct good faculty in the highly competitive market, where the demand for competent teachers is rising rapidly in India and abroad and the difficulties in finding suitable and motivated persons are increasing. The distinctive profile of these Institutions as post-graduate level research institutions of international character would be a factor in attracting good faculty.

Other incentives in terms of residential and other campus facilities of adequate quality will be an added factor to attract and retain good faculty. The possibility of job opportunities for the spouses and educational opportunities for the children within the campus or within reasonable distances from the campus is known to have induced high level of faculty retention.

Similarly, the availability of competent and trained staff to provide the administrative and technical support, which is compatible and in harmony with the highest academic aspirations, is essential. Considering the possibilities of technological innovations in many of the essential academic and administrative functions, the support staff should be developed to become multifunctional. The support staff should have an all-India character to the maximum extent possible. Their strength and cadre structure should be so evolved as to develop a core staff at the departmental and institutional level for essential functions, taking into account the scope for outsourcing many of the institutional activities in order to reduce long-term cumulative recurring staff costs.

The goal of attracting good students and faculty and their suitable performance is also dependent on the extent and quality of academic and physical infrastructure as also their upkeep, maintenance, presentability and availability to users. In this respect,

the Institutions should provide for the kind of infrastructures, which is compatible with their status as high calibre institutions.

3.1.4 Infrastructure

As demonstrated by the experiences of the IITs and other prestigious institutions in the country, special attention to infrastructure development is as important as efforts toward academic goals and achievements.

The Campus

It is proposed that all faculty and students should be provided with residential accommodation. This is known to have facilitated maximum output from faculty and students, in terms of academic performance and research output without the inhibiting constraints of time and distance. This has also facilitated a high degree of student-teacher interaction, high level utilization of library, laboratory, computer facilities and recreational and sports facilities.

Since these institutions are intended to accommodate a substantial proportion of international students, and visiting faculty from India and abroad, the residential facilities for the students and faculty should be of adequate standard comparable to international institutions. The Indian students should also be provided with the same system of accommodation as international students to discourage segregations and isolations.

Availability of uninterrupted power supply, adequate water supply, well-maintained garden, parks and lawns, properly maintained buildings, campus roads and signages, etc. should be an integral part of campus life, both academic and non-academic. Availability of high quality infrastructural facilities for cultural activities, sports and games and other entertainments is essential, as also reliable security and privacy from outside intrusions. Other amenities such as children's schools, shopping centre, restaurant etc should be only necessary if the campus is far removed from city limits. The institutions, which already have such facilities, including Bank, Post Office and Telecommunication Centres, should make provisions for modernizing them as required by the campus community.

Academic and Administration Facilities

The configuration or reconfiguration of the academic and administrative facilities should receive serious attention in keeping with the unique character of the institutions. These should be so designed as to offer sufficient scope for introduction of modern teaching methods as well as efficient administrative practices including modernization of processing of student services ranging from admission to graduation.

As a minimum requirement it is proposed that there should be a lecture hall complex, modern library, multipurpose student activity centre, an auditorium and a convention complex, essentially with a view to minimize proliferation of class-rooms, auditoriums and student facilities scattered across departments and hostels.

The laboratory and research facilities should be complemented with a central research facility, a central computer facility and a central fabrication facility in order to avoid fragmentation of such facilities scattered around the campus.

The Works department of the institutes is the enabling element to ensure smooth and orderly performances of the academic and research functions as also for quality of campus life. Their staff strength and their job definitions including outsourced activities should receive due attention.

One of the important aspects of administrative infrastructure in Indian institutions, which does not receive proper attention, is in providing student services and in administration of departmental and laboratory requirements. These are mostly governed by practices designed for revenue and civil service functions. The international level institutions dealing with intellectual and creative activities need a different design.

Communication

The availability of reliable and efficient communication facilities by way of telephones linking residences, hostels, departments, administration and other locations as well as with outside world is a reasonable expectation of a normal campus life. These are not luxuries anymore. With the availability of modern exchanges and

networking services, at an affordable cost, each Institute should pay priority attention to provide such essential services from the initial phase of transformation.

Similarly, extensive Internet connectivity and bandwidth capacity is now a normal requirement in a technological institution. The available bandwidth of 1 or 2 Mbps get consumed in no time. Hence the campuses should provide for 30 to 50 times greater bandwidth capacity (including wireless) along with proliferation of connectivity points through large Intranet and external connections. Adequate financial provisions for capital and recurring expenses should be available for this purpose.

Existence of major universities, other educational institutions, R&D centers and industrial complexes in the neighborhood of the transformed institutions will provide considerable scope for enhancing the academic and research activities of these Institutions. Even if this is not possible in all cases, they could seek relationships with selected institutions and organizations for developing mutually beneficial cooperation.

3.2 Naming the Transformed Institutions

Even though the Joshi Committee began with the assumption that the seven institutions will be considered for "upgradation into IITs", further deliberations had led to the conclusion that these institutions will be considered for "upgradation to the level of IITs". MHRD, in its brief to the EC. also indicated that the upgraded institutions will not be called IITs. In view of the distinct brand identity enjoyed by the IITs, it would create confusion to include other institutions in this category. Designating the University of Roorkee as IIT was exceptional in view of the stature of the University, which was comparable to that of IITs in most respects, except the governance system, which in some respect was distinctive and had its own merits.

Therefore, another distinguished category of high calibre institutions should be a logical option for addressing the long felt need for a larger number of excellent technical institutions providing high quality education and research programmes. Moreover, such institutions could provide a healthy competition to the IIT system.

Conferring a status as deemed to be universities to these Institutions will not be compatible with the objective of World-class stature for them. In fact, these Institutions are already State and Central Universities/University Departments.

In arriving at an appropriate name for this category of institutions, the underlying consideration is that it should be distinct from those of similar higher technological institutions in India, such as IITs and NITs. During its visits, the EC invited suggestions for a suitable name from the identified institutions also and received several suggestions. It is felt that in view of their all-India character and status as Institutes of National Importance, with substantial international character, the term "Indian Institute" should be a part of the name. Further, considering the predominance of post-graduate and doctoral programmes in these Institutions and strong orientation towards research in science, engineering, technology and other interdisciplinary areas the term "Engineering Science and Technology" should be included in the name. Thus, the EC proposes the name **"Indian Institute of Engineering Science and Technology" (IIEST)** for the transformed Institutions. This name would also signify to the international community the existence of a special category of higher technology institutions in India.

3.3 The New Directions

- ✓ The graduates with M.Tech. from dual-degree programmes will be the major group passing from IIEST system. Their level of technical knowledge and skill will be higher than those of the large number of B.E./B.Tech graduates who will be occupying the same space in the job market. The potential employers will have to be made aware of and sensitized about the new crop of IIEST graduates with higher level of education and training, to ensure that they get good career opportunities. Innovative approach and active linkages with all possible employers in the public and private sector and also the Government will have to be established, strengthened and sustained to reach a stage where there is a virtual guarantee of a job after obtaining a postgraduate degree.

- ✓ The postgraduate curricula of the 5-year dual-degree programme and the courses of the two-year postgraduate M.Tech programmes should be designed with great

care. The structure of programmes should be flexible to provide options to students to offer courses across disciplines, so that the IIEST graduates have an edge and are actively sought out by the employers. The programmes should be continually reviewed, restructured. Out-dated programmes should be phased out.

- ✓ Doctoral programmes need considerable strengthening both in quality and quantity. Each IIEST should structure the programme so that a doctoral thesis is not just a set of small perturbations on the existing knowledge but are tangible additions to or improvement of the state-of-the-art knowledge. Each IIEST should have adequate number of institutional Ph.D. fellowships/scholarships to enliven their academic milieu with achievements of front-line research.

- ✓ A large pool of qualified and experienced manpower with in-depth exposure to basic and applied R&D, industrial and engineering activities, and tacit knowledge. is available in the science and technology research laboratories. It would be of great value to utilize the services of these experts as Adjunct Faculty for knowledge transfer, research guidance and pedagogical inputs to update syllabi.

- ✓ The IIEST group should have live and active linkages to share knowledge expertise and physical resources. The IIEST system should have special research groups which should address the problems in the frontier areas requiring expertise in several disciplines to achieve a breakthrough. The modality of how these groups would be formed, how their mandate and tasks would be defined, and how they would be supported, should be jointly worked out by the IIESTs. Apart from the linkages amongst them, IIESTs should also establish links with the IITs and other prestigious engineering and technology institutions.

> *"Today knowledge has power. It controls access to opportunity and advancement."*
>
> **Peter Drucker**

- ✓ The Rama Rao Committee in its Report 'Reshaping Postgraduate Education and Research in Engineering and Technology, recommended that ***"— well-endowed agencies, in particular, DAE, DOS, DRDO and CSIR should more commonly serve as home for PG students to undergo training and carry out 10 - 12 months training-cum-project in their laboratories —".*** IIEST should establish linkages with these agencies so that they allow PG students to work in their laboratories during the Master's project phase of one year. Similar arrangements should be made with industries, particularly those which have corporate research laboratories of their own.

- ✓ All IIESTs should have both conventional and innovative faculty development programmes. These programmes should be effectively networked. In the beginning the programme should have a focus on the existing faculties. Apart from the faculty development programmes, IIESTs should have institutional activities which contribute to value addition to knowledge.

- ✓ Libraries are heart and soul of an academic institution. There will never be enough resources available to meet the requirements of each institution individually. The IIEST libraries should be networked so that the library resources could be shared effectively and optimally. The IIEST library should be modern and use state-of-the-art techniques for their management. The libraries should be equipped to provide modern library services.

> *"Whatever be the costs of our libraries, the price is cheap compared to that of an ignorant nation."*
>
> **Walter Cronkite**

- ✓ Quality education should be the hallmark of the IIEST system. Quality should be built in the system through internal mechanisms, self-appraisal and self-monitoring. The system should not depend entirely on inspection, assessment and external evaluation to achieve its quality goals. For an effective self-appraisal, each IIEST should evolve a documentation system to assist all those who perform academic functions and all those who manage and administer the system.

- ✓ Each IIEST should have peaks of excellence in chosen areas which are important and in which academic expertise and institutional strength are available. Around one or more of these areas, Centres of Excellence should be developed deriving the best expertise available across the disciplines in the Institute.

- ✓ Many of even the routine industrial operations and engineering processes and practices have been upgraded in the advanced countries. These developments have considerable underlying theory and engineering knowledge. The PG diploma programmes of one year duration are very appropriate to enable not only the working engineers to update their knowledge and skills but also those who intend to make a career in industry and service sector. Industry has to take particular interest to sponsor candidates for pursuing diploma programmes. The requirement of GATE may be relaxed for sponsored candidates.

- ✓ There is a good scope of attracting foreign students, particularly from developing countries, to postgraduate programmes in emerging areas of engineering and technology. In view of lower cost of education in comparison to the international costs of the same level and standard of postgraduate programmes, India is in a position to become a favorite destination of foreign students. Conscious and bold steps should be taken by IIESTs to admit foreign students up to 20 to 30% of the intake. This should be done in an organized manner and the selection and admission procedures should be streamlined for which the Government may make enabling provisions.

Chapter 4

SUMMARY CHARACTERISTICS OF IDENTIFIED INSTITUTIONS

4.1 Broad Characteristics

The statutory character of the seven institutions vary in terms of their Acts and Statutes and sources of supports. Three of them, BESU, CUSAT and JU, are State universities established by the legislation of the respective States. Of these BESU and CUSAT possess the whole character of engineering and technological institutions whereas JU is a general university consisting of engineering and technology departments dispersed in the campus among other departments. All the three receive block grants from their State governments, besides funds from central agencies and non-governmental and private organizations.

The BHU and AMU are Central Universities established by Acts of Parliament. They receive their regular capital and recurring grants through the UGC, besides funds from several other central agencies and non-governmental and private organizations. The engineering and technology departments of the two Universities, the IT-BHU and ZHCET-AMU, are constituted as distinct entities within the overall University governance system. The UCET-OU and AUCE are also distinct entities within the main Universities, which are State funded, besides other sources of revenue.

The nature of academic programmes, students, faculty and staff strength, quantum of financial resources, nature and extent of infrastructural facilities, etc., also are significantly different among the seven institutions. A summary of their basic characteristics, based on the data obtained from them at various stages, are presented in Section 4.2. The data are related to the five-year period, 2000-2005.

4.2 Comparative Data

The data on the number of engineering and technology programmes, student enrolment and output are shown in Table 4.1. The strength of regular faculty in engineering and technology and sciences and humanities departments and their qualifications are shown in Table 4.2. The strength of their regular support staff is shown in Table 4.3

Table 4.1

Programmes and Students (2000-2005)

Institution	UG			PG			Ph.D.	Others	
	No. of Pro-grammes	Enrol-ment	Output	No. of Pro-grammes	Enrol-ment	Output	Output	No. of Programmes	Output
IT-BHU	10	1948	1709	34	1057	713	112 + 34 (Applied Science)	10 (Dual deg) – 3 (Integrated)	-
UCET-OU	9	2059	1709	21	913	623	37	MS (by Res)	35
BESU	9	2023	1832	15	-	820	31	MCA, Materials Sc. etc	132
JUET	18	4330	3520	23	-	1058 (upto 2004)	166+60 (pharma-cy)	3 Part-time programmes	-
ZHCET-AMU	11	1831	1513	11	754	309	9 + 31 (Applied Science)	-	-
AUCE	14	1781	1569	23	1345	1110	85	MCA, M Sc (CS), M Sc (IS)	449
CUSAT	27	3129	1723	16	863	596	56 + 281 (Applied Science and Others)	MCA,MBE, MIB Part-Time etc.	455

Table 4.2

Regular Faculty (2005)

Institution	Total No.	With Ph.D.
IT-BHU	229	170
UCET-OU	127	57
BESU	212	136
JUET	304	203
ZHCET-AMU	188	113
AUCE	123	68
CUSAT	206	151

Note: Contract and ad-hoc faculty are excluded.

Table 4.3

Strength of Regular Support Staff (2005)

Institution	Administration	Academic	Technical	Infrastructural Support + Others	Total
IT-BHU	191	18	209	(With the University)	418
UCET-OU	43	69	81	115	308
BESU	143	125	35	134	437
JUET	34	-	228	(With the University)	262
ZHCET-AMU	39	3	165	32	239
AUCE	101	10	72	112	295
CUSAT	469	53	117	96	735

The R&D activities as reflected through publications and funds generated through sponsored projects and consulting are shown in Table 4.4 for 2000-2005. The grants received from the State, Central and other resources during the part five years are shown in Table 4.5

Table 4.4

Research and Development Activities (2000-2005)

Institution	Publications			Sponsored Project (Amount) Rs. (Cr)	Consultancies (Amount) Rs. (Cr)	Patents (Awarded+ filed)
	Ref. Journal	Conference & Others	Books & Monographs			
IT-BHU	462	485	21	20.33	2.24	37
UCET-OU	155	451	27	1.66+1.286 for National facility		Nil
BESU	836	738	53	14.53	0.64	16
JUET	1262	1172	54	16.5		34
ZHCET-AMU	455	688	19	1.09	0.14	5
AUCE	172	451	27	2.31	-	Nil
CUSAT	1179	831	35	18.49	0.757	8

Table 4.5

Grants from State, Central and Other Agencies (2000-2005)

Institution	State Grant Rs.(Cr)	Central Govt. Grants				Others Rs.(Cr)	International Sources Rs.(Cr)
		MHRD	UGC	AICTE	DST		
IT-BHU	Nil	-	102.83	-	-	4.38 (Internal revenue)	-
UCET-OU	43.94	-	2.68			0.549 (Internal revenue)	-
BESU	68.40	-	5.05			6.76 (Internal revenue)	2.16 (Alumuni)
JUET	75.43	24.55				2.7 (Internal revenue)	-
ZHCET-AMU	Nil	-	70.78			1.7 (Internal revenue)	-
AUCE	37.18	-	-	-	-	-	-
CUSAT	83.41	4.61	6.1	-	-	3.18 + (Self-financed courses)	-

The infrastructural facilities relating to academic programmes, residences, campus activities, etc. are shown in Table.4.6, 4.7, 4.8, 4.9 and 4.10

Table 4.6

Academic Infrastructure

Institution	Campus Area (Acres)	Academic (Building floor area) m^2	Library			Computer		Conference facilities and Auditorium m^2
			Area m^2	No. of Books	Journals **	Area m^2	No. of Systems	
IT-BHU	330	14451	1394	120838		*	60	2000
UCET-OU	320	25331	857	102525	247	1505	468	3540
BESU	121	25893	2285.5 +1600 (central lib)	141915		475	60	1268.3
JUET	~40 +Salt Lake complex	12057	1972 + 4680 (central library)	135616	*	*	*	*
ZHCET-AMU	~22	16886	1507	142856	68	1750+680 (distributed)	100+396	*
AUCE	167	15042	491	81779	62	740	282 (total)	1378
CUSAT	180+3	37156	2974.4	200053	281	1700	760	18760

* Specific data relating to only Engineering and Technology are not available.

** In addition, the Institutions subscribe to a substantial number of electronic journals.

Table 4.7

Common Facilities

Institution	Sports		Communication	
	Indoor games (area) m^2	Outdoor games (area)	Telephone Exchange size	Internet Bandwidth
IT-BHU	800	213505 m^2	100 lines	2 MBPS
UCET-OU	300	4 acres	Univ exchange	1MBPS
BESU	2500	34830 m^2	1500 lines	2 MBPS
JUET	14075 m^2 at Salt Lake complex		1000 lines	-
ZHCET-AMU	900	-	1024 lines	-
AUCE	500 (Univ)	25 acres	1100 (univ exch)	512 Kbps
CUSAT	150	16140 m^2	1000 lines	-

Table 4.8

Residential Facilities for Faculty and Staff

Institution	Faculty Houses	Guest Houses	Staff Houses
IT-BHU	~190	*	~180
UCET-OU	*	*	*
BESU	~214	1 (14 rooms)	~287
JUET	*	*	*
ZHCET-AMU	~20%	Univ. GH.	~15%
AUCE	Negligible	*	Negligible
CUSAT	48	3 (66 rooms)	101

* Facilities available for whole university

Table 4.9

Students Accommodation

Institution	Undergraduate Hostels		No. of Postgraduate students	No. of Research Scholars/ Projects Staff
	No. of Boys	No. of Girls		
IT-BHU	1400		400	50
UCET-OU	578	277	193	-
BESU	1080	140	70	15
JUET	446 + 150 (Salt Lake)	140	82 – 10 (Salt Lake)	60 (for whole univ.)
ZHCET-AMU	Boys 1077; Girls 750 (for whole University)			
AUCE	700		234	With University
CUSAT	Boys 734; Girls 584			

Table 4.10

Campus Amenities

Institution	Shopping Centre	School	Health Centre	Power Capacity	Cultural Activities Facilities
IT-BHU	Yes	3	Yes (BHU Med. College)	Whole University	
UCET-OU	No	2	Whole University	Whole University	1120 m^2 Auditorium
BESU	Yes	3	Yes	24 hr. power line of CESC	600 m^2 Inst. Hall
JUET	Yes	0	Whole University	Whole University	Open air theater
ZHCET-AMU	No	14 (Univ. schools)	Medical College of Univ.	University	University
AUCE	No	1	Whole University	University	500 seats Auditorium
CUSAT	Yes	Nil	Whole University	1Main+2 Substation	Open air auditorium+ Main Auditorium+ Club

An indication of the nature of governance system and student admission process is given in Table 4.11

Table 4.11

Governance and Student Admissions

Institution	Major Funding & Control		Status		Student Admission			
	State	Centre	Part of University	Whole and autonomous	IIT JEE	State Exam	Own Test	Reservation Polices
IT-BHU		✓	✓		✓			SC/ST only*
UCET-OU	✓		✓			✓		85% Telengana+15% rest of A.P.
BESU	✓			✓		✓		SC/ST only**
JUET	✓		✓			✓		SC/ST only**
ZHCET-AMU		✓	✓				✓	50% for Indian muslims 20% for AMU School
AUCE	✓		✓			✓		85% Coastal Andhra + 15% rest of A.P.
CUSAT	✓			✓		✓		SC/ST only**

* As per Central Government Regulations

**As per State Government Regulations

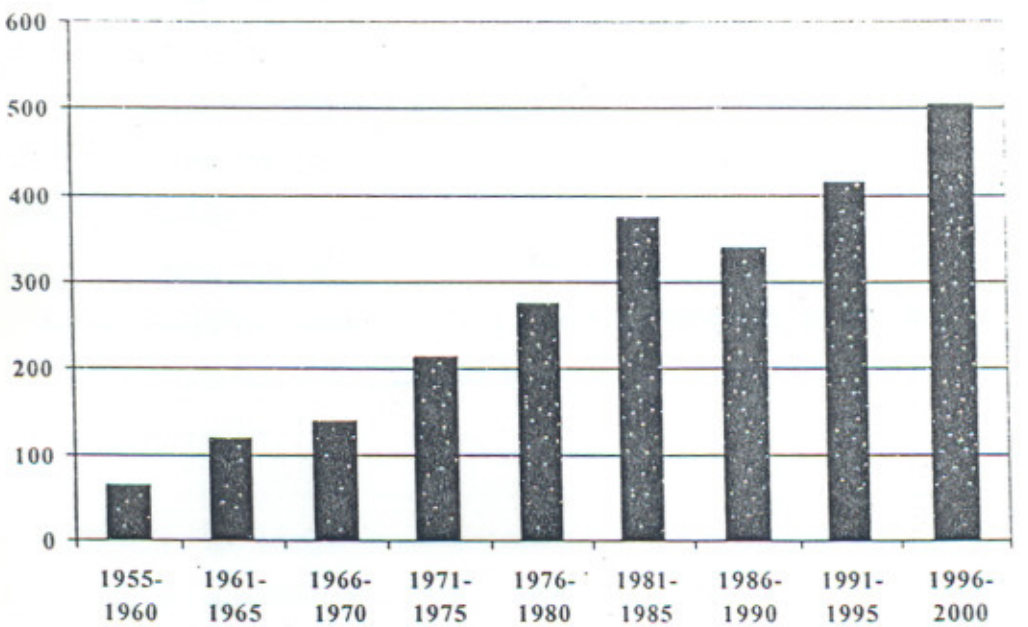
4.3 Inferences

The comparative figures shown in the summary tables above indicate the nature and extent of variation among the seven institutions.

The number of UG programmes in engineering and technology range from 9 to 27 with enrollment from about 1780 to 4330 (2000-2005). The 5-year outputs also vary considerably. The number of PG-programmes in engineering and technology range from 11 to 34 with corresponding variations in enrolment and output. The number of doctorates awarded during the past five years vary from a low of 31 to a high of 337, in engineering and other departments of the Institutions. For purpose of comparison, the growth of Ph.D programme from 1955 to 2001 in one of the IITs is shown in Figure 4.1.

Figure 4.1

Growth of Ph.D Programme in IIT Kharagpur



The faculty strength varies from 123 to 304 depending on student enrolment but with different STRs. The proportion of faculty with Masters and Doctorate qualifications is considerably different, indicating the need for major efforts for up-gradation of qualifications in some of the institutions.

The five year output of publications in refereed national and international journals range from 155 to 1260, indicating the extent of research activities. Similarly, The funds obtained through sponsored projects during the past five years vary from about Rs.1 crore to Rs.20 crores. The resources from consultancy vary from Rs.0.14 crore to Rs.2.24 crores. A comparison showns that the average number of publications per IIT in referred journals from the five older IITs, is of the order of 450 per year. During 2000-01 the average amount of funds generated per IIT through sponsored research and consultancy was of the order of Rs.20 crores which has increased considerably in the recent years.

The extent of variation in academic and physical infrastructure in these Institutions indicates the magnitude of additional funds required to bring them to a level of comparable quality. These data are further disaggregated for individual institutions in arriving at specific recommendations in Chapter 5.

Chapter 5

ANALYSIS OF RELATIVE CHARACTERISTICS

5.1 Methodology

The Expert Committee designed a template for receiving information and data from the seven identified institutions. The data and information were received in the first week of November 2005 and a preliminary study was conducted in a meeting of the EC at INSA, New Delhi on 11th November, 2005 before starting the visits to the Institutions. Further information and data were obtained during and after the visits. Whenever there were differences in the data furnished at different stages, the most recent data was used. The gist of the important and relevant information, shown in tabulated form in Chapter 4, were utilized for assessing the scope of and suitability for transformation of the identified Institutions.

The evaluation of these Institutions was carried out for the purpose of transforming them into autonomous Institutes of National Importance. The EC decided to consider their academic performance, infrastructure and the current governance system to assess the feasibility (and practicability) of creating autonomous institutions totally de-linked from their respective parent Universities or the State Governments, as the case may be, in accordance with the recommendations of the Joshi Committee.

To make the analysis more scientific and less subjective, a set of attributes relating to the academic activities, infrastructures and governance system was identified and score points were allocated as shown in Table 5.1. Depending on the nature of attributes, the score points were either continuous or discreet. For some attributes, the maximum score point was kept within a logical limit that was based on a justifiably optimum performance. In computing the total value of the characteristics of the Institutions based on the chosen attributes, weightages were assigned to different attributes as indicated within the parentheses. Score points for each attribute

for all the seven Institutions are shown in Table 5.2. The overall indices, indicating the suitability for transformation, are shown in Figure 5.1. The same figure also indicates the degree of academic performances. It becomes quite clear from this analysis that three Institutions, IT-BHU, BESU and CUSAT are more or less on equal footing so far as the suitability for transformation is concerned. BESU and CUSAT have the advantage that no de-linking from the parent universities is required but concurrence of the respective State Government will have to be obtained. On the other hand, the advantage of IT-BHU lies in the fact that it is already with the Central Government and only requires the consent of the parent University. The two institutions in Andhra Pradesh, UCET/OU and AUCE are both smaller than IT-BHU, BESU and CUSAT. These two Institutions would require the concurrence of the parent Universities and the State Government. Both have similar characteristics regarding their suitability for transformation.

5.2 Special Situation of JU and AMU

It has already been mentioned that de-linking the engineering faculty of JU from the parent University and that of ZHCET from AMU does not appear to be feasible. The space needed for further expansion, residential complex, students' hostel, etc. is severely limited in JU. The scope to form a spatially contiguous entity with distinctly identifiable boundaries for ZHCET and JUET is also very limited. Thus in the opinion of the Committee, these two Institutions will not be able to transform themselves into totally independent residential institutions as envisaged by the Joshi Committee.

Table 5.1 (a)

Attributes and Weightages

(a) Academic

- **Percentage of PG Students (5)**

0% 100%
1 → 4

- **Faculty qualification (10)**

0% 100%
Ph.D. Ph.D.
1 → 4

- **Publications in Journals (5) per faculty (2000-2005)**

<1 1-2 > 2
1 2 4

- **Sponsored Res/ Consultancies (5) Rs. per faculty (2000-05)**

≤ 10000 ≥ 10Lakh
1 → 4

- **Student-Teacher Ratio (2)**

≥20 ≤ 15
1 → 4

- **M. Tech Output (5) per faculty (2000-05)**

0 ≥ 10
1 → 4

- **Ph.D. Output (3) Total (2000-05)**

0 ≥50
1 → 4

Note: 1. The numbers in parentheses indicate Weightages.

2. Long arrows imply continuous variation in attribute scores.

Table 5.1 (b) and (c)

Attributes and Weightages

(b) Infrastructure

- **Campus area, acres (10)**

<50		>150
1	⟶	4

- **Student accommodation (5)**

<20%		≥ 50%
1	⟶	4

- **Faculty accommodation (2)**

0%		≥ 50%
1	⟶	4

- **Central Library (5)**
  (Eng & Tech). No of titles

≤10000		≥100000
1	⟶	4

Note: 1. The numbers in parentheses indicate Weightages.

2. Long arrows imply continuous variation in attribute scores.

(c) Governance

- **Administration (10)**

Part of Univ inseparable	Part of Univ, but separable	Independent
1	2	4

- **Student Admission (3)**

Institutional Test & heavy reservation	State Test and standard reservation	All India Test and standard reservation
1	2	4

- **Preference of Academic Community for independent governance and all India admission (2)**

Strong unwillingness	Conditional & divided opinion	Enthusiastically favourable
1	2	4

Note: 1. The numbers in parentheses indicate Weightages.

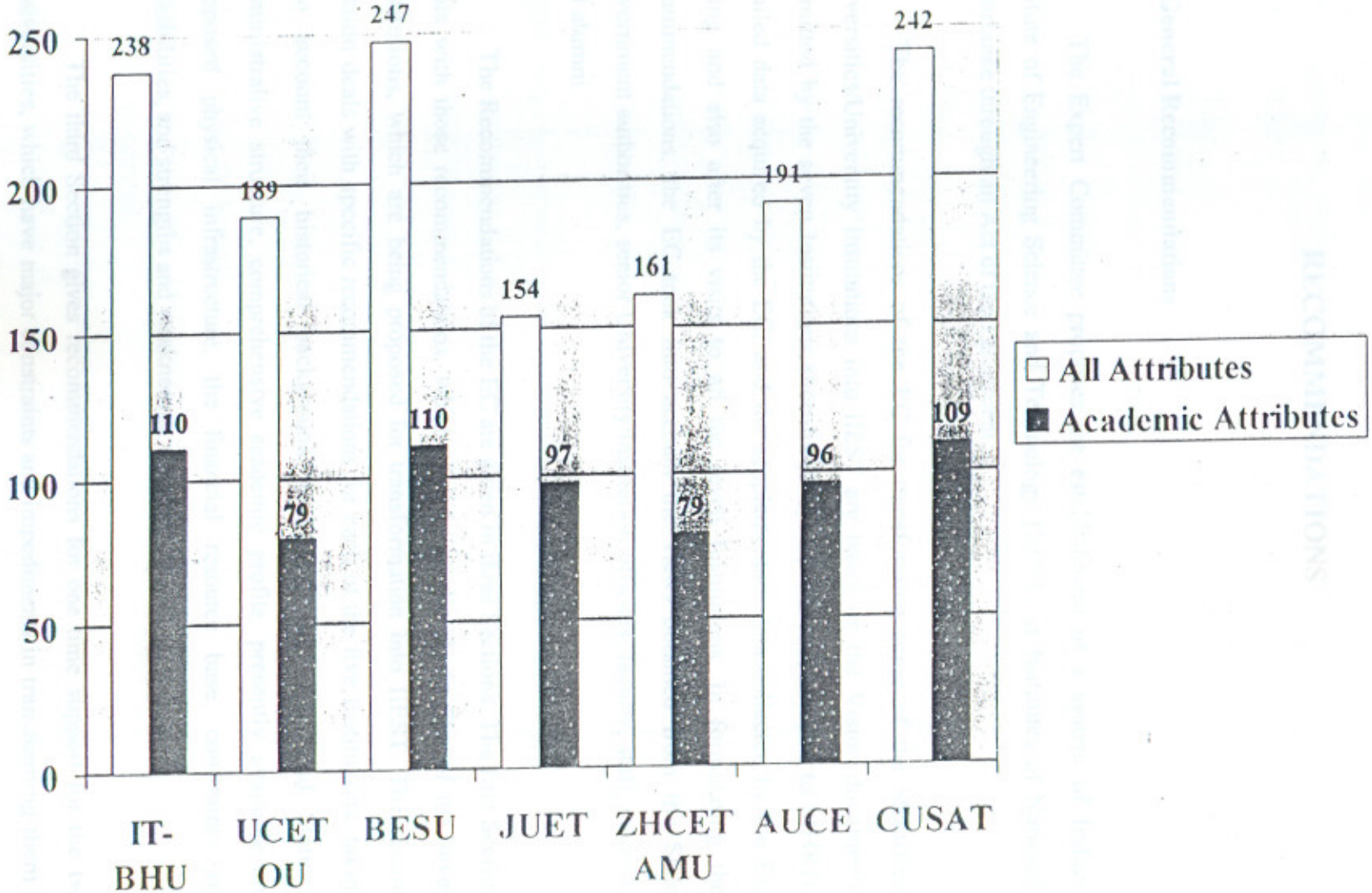
Table 5.2

Relative Score for Attributes

Attributes \ Institution		IT-BHU	UCET-OU	BESU	JUET	ZHCET-AMU	AUCE	CUSAT
1. Academic	(a). Relative PG intake/total intake	9.65	10.69	11.56	8.3	9.95	12.12	9.05
	(b). Faculty qualification (Ph.D.)	32.2	23.85	29.5	28.6	28.3	30	27.91
	(c). Research publications in five years/faculty	20	10	20	20	5	10	20
	(d). Sponsored research and consultancy in five years/faculty	18.8	8.37	20	8.69	8.96	8.4	20
	(e). Student:Teacher Ratio	8	3.5	8	8	8	3.1	8
	(f). M. Tech. output/faculty in five years	9.67	12.98	11.92	11.22	7.53	20	11.9
	(g). Ph.D. output (total) in five years	12	9.66	8.58	12	11.1	12	12
2. Infrastructure	(a). Campus area	40	40	40	10	28.9	40	40
	(b). Student accommodation	20	19.33	25.63	5	20	19	12.85
	(c). Faculty accommodation	8	2	8	2	3.5	2	6.05
	(d). Central Library (Eng. & Tech)	20	17.8	10	20	14.17	13.33	20
3. Governance		20	20	40	10	10	10	40
4. Student admission		12	3	6	6	3	3	6
5. Preference of academic community		8	8	8	4	3	8	8
Total score		238.32	189.18	247.19	153.79	161.41	190.95	**241.76**
Score based on academic performance		110.32	79.05	109.56	96.81	78.84	95.62	**108.86**

Figure 5.1

Relative Scores of Attributes



Chapter 6

RECOMMENDATIONS

6.1 General Recommendations

The Expert Committee proposes the establishment of a system of Indian Institute of Engineering Science and Technology (IIEST) as Institutes of National Importance through an Act of the Parliament.

The recommendations of the EC for transforming some of the identified Universities/University Institutions into IIEST are based on the Vision documents submitted by the seven Institutions short-listed by the Joshi Committee to MHRD, detailed data acquired by the EC, and the supplementary data collected by the EC during and also after its visits to all the seven Institutions. In formulating the recommendations, the EC took into account the views obtained from the State Government authorities, senior University/Institution officials, faculty, staff, students and alumni.

The Recommendations of the EC are given in three Sections. The first Section deals with those recommendations, which shall be applicable to five of the seven Institutions, which are being proposed for transformation into IIEST. The second Section deals with specific recommendations for each of the five Institutions, taking into account their historical background, traditions, their Acts and Statutes, administrative structure, comprehensive academic profile, presently available and proposed physical infrastructure, the financial resource base, constraints and flexibilities, and strengths and weaknesses.

The third Section gives recommendations for one time support for the two Universities, which have major constraints and impediments in transforming them to autonomous and unitary IIEST.

Five Universities/University Institutions are being recommended for transformation into IIEST on the assumption that there will be no difficulties in reaching agreements among all concerned regarding the proposed conceptual framework of IIEST.

The EC is fully aware of the complexity involved in quantifying the relative ranking of these five Institutions. Nevertheless, in view of substantial information available to the EC, ranking has been quantified taking into account the attributes mentioned in Chapter 5 and the feasibility of transformation into unitary and autonomous institutions. These Universities/University Institutions are ranked as indicated below:

- Bengal Engineering & Science University
- Institute of Technology, Banaras Hindu University
- Cochin University of Science and Technology
- Andhra University, College of Engineering
- Osmania University College of Engineering and University College of Technology

The following two Universities are recommended for one time support.

1. Engineering & Technology Faculty of Jadavpur University.
2. Zakir Hussain College of Engineering & Technology, Aligarh Muslim University.

6.1.1 Governance

- An Act of the Parliament should declare the transformation of five recommended Universities/University Institutions into IIEST as autonomous Institutes of National Importance.
- The President of India shall be the Visitor of all IIESTs.
- These five Institutions should function as a consortium with an IIEST Council, which will be an Advisory Body for major common policy decisions. The Minister HRD, Government of India shall be the ex-officio Chairman of the IIEST Council.

- Each IIEST shall have a Board of Governors chaired by an eminent academic/engineer/scientist/industrialist. The Board of Governors shall be the highest decision making authority of the Institute. The visitor shall appoint the Chairman of the Board.
- The chief executive of each Institute shall be designated as the President of the Institute who will be appointed by the Visitor.
- Each Institute shall have an Executive Council and an Academic Council. both to be chaired by the President of the Institute.
- Each Institute shall have an individual Statute providing for other institutional authorities and offices, their responsibilities and power.

6.1.2 Academic System

- IIESTs shall be predominantly postgraduate institutions offering five-year integrated dual degree (B.Tech-M.Tech), two-year M.Tech. two-year M.Arch, five year integrated M.Sc, two-year M.Sc. as well as Ph.D., and other postgraduate programmes and five year B.Arch programme, as decided by Institute authorities.
- They shall make conscious and deliberate efforts to attract foreign students to the two-year Masters and Doctoral programme in substantial proportion.
- The foreign students enrolled in these Institutes shall be entitled to the same privileges as those of Indian students.
- These Institutes shall make conducive provisions to enable outstanding teachers from other reputed institutions in India and abroad to serve as visiting faculty members for extended periods of time.
- They shall implement other academic objectives indicated in the conceptual model for IIESTs.
- All IIESTs shall preserve their all-India Character in their student population through national level admission tests, either by adopting the Joint Entrance Examination (JEE) system of the IITs or the All India Engineering Entrance Examination (AIEEE) or by developing a joint common entrance test of IIEST for the 5-year integrated dual degree programmes as approved by the IIEST Council.
- For admission to two-year Postgraduate and Ph.D. programmes all institutes shall prescribe common all-India level tests such as GATE, for Indian students.

- Admission of foreign students to IIESTs shall be made on the basis of recognized international tests such as GRE, as approved by the IIEST-Council.
- Each IIEST will establish two to three major R&D Centers of Excellence in frontier areas of science and technology based on expert assessments of the available talent, emerging demands and overall institutional growth pattern.
- Each institute shall establish at least two to three positions of Chair Professors along with research associates to attract distinguished researchers in priority areas of research. These positions should normally be filled up by experts drawn from outside.
- While transforming their existing programmes, care must be taken to rationalize them to eliminate proliferation of degree nomenclatures for programmes of similar nature.
- Sub-critical size of classes should be avoided.
- The recommended normal intake capacities for the various programmes of the IIESTs are as follows:

Sno.	Programme	Duration	Intake	
			Min	Max
1.	Dual degree B. Tech-M. Tech	5 yrs	30	60
2.	Integrated M. Sc	5 yrs	30	60
3.	M. Tech/M. Sc/M.Arch/M.A./MBA	2 yrs	10	30
4.	B. Arch.	5 yrs	30	50
5.	Ph. D.	Expected yearly output 150		

- Total intake for the 5-year Integrated Programme in Engineering, Science and Architecture for the Institute as a whole should be restricted to 700.
- Total intake for the 2-year postgraduate programmes in Engineering, Science, Arts, Architecture, and Management should be restricted to 500 for the Institute as a whole.
- *Total number of institutional Ph.D. scholarships should normally be limited to 600.
- *Total enrolment of students including Ph.D. scholars should not exceed 5000.
- *The faculty strength should eventually be determined on the basis of a student-teacher ratio of about 8:1

* (*These recommendations are with reference to the matured state of the Institute. The transition period should be planned accordingly*)

6.1.3 Infrastructure

Academic Facilities

- The IIESTs shall ensure that the academic and the physical infrastructure in their campuses are of high standards in conformity with their objectives to be predominantly post-graduate Institutes of substantially international character.
- For an orderly growth of the Institutes and proper phasing of their programmes depending on human and financial resources, a long term Master Plan should be prepared utilizing the expert services of professional consultants.
- Every IIEST shall have a modern Central Library facility using state-of-the-art technologies and learning resources with good spatial planning and layout to provide efficient library services to the users. The Library should be networked internally and externally with adequate connectivity and bandwidth to optimize the use of its resources.
- Each Institute must develop a well-equipped Central Computer Facility primarily for high-end computing which is not likely to be available in Departments/Centers. This facility should also be available for other services requiring specialized or high-volume processing. This facility will be valuable for high-skill training to keep pace with technology changes.
- Each Institute should have an Education Technology Centre associated with the Central Computer Facility primarily for development of courseware and educational software tools and servicing virtual laboratories, virtual classrooms and teleconferencing.
- Each Institute shall establish a Central Research Facility housing sophisticated and major equipment and systems (e.g., NMR, EPR, SEM, TEM, AFM, XRD, etc.) to cater to the needs of a large number of postgraduate students, research scholars and faculty.
- Each Institute shall establish a modern Central Fabrication Facility for precision work to provide institution-wide services.
- A modern lecture hall complex with adequate number of lecture theatres of varying capacities and equipped with audio-visual facilities, network connectivity, multimedia presentation and virtual class-rooms, should be created in each IIEST to optimize the space utilization and to minimize the need for addition of class-rooms in the Departments/Centers.

- Each Institute should have a Convention Centre with two modern auditoria (one large and one of medium capacity), seminar halls, exhibition space and service spaces (like reception, office, storage, etc.).

Student Facilities

- Each Institute should develop high quality Halls of Residence by renovating the existing Hostels and constructing new ones to provide accommodation to all full-time students. The quality and design of accommodation should conform to the international character of the Institute.
- The boarding and lodging services (dinning, lounge, toilets, laundry facilities, etc.) in the Halls of Residence should be compatible to the international character of the Institute.
- Good quality furnished accommodations with adequate space should be provided to married students and Research Scholars as well as Scientists and Engineers employed in Institute Projects.
- Each Institute should provide good quality sports complex, students community centre, cultural and recreation facilities by modernizing the existing facilities and supplementing them with new construction.

Faculty Facilities

- To attract faculty of all India character, it will be desirable to provide good quality residential accommodation with adequate space to the entire faculty. However, taking into account the local conditions and preferences, the number of faculty accommodations may be appropriately reduced.
- For the distinguished visiting faculty from India and abroad staying in the Institute for an extended period, adequate number of fully furnished, decent and comfortable accommodations should be available, as for example in IIT Kanpur.
- A good faculty club for social, cultural and recreational activities should be provided by renovating the existing facilities and, if necessary, supplementing with additional facility.

Staff Facilities

- Each Institute should consider providing appropriate residential accommodation for 50% of the non-teaching staff, along with a building for staff club for social, cultural and recreational activities.

Campus-wide Facilities

- In order to fully contribute to the image and reputation of the Institute, each IIEST should pay particular attention to the following campus-wide facilities and amenities:
    - + Reliable water supply
    - + Uninterrupted power supply
    - + Well-maintained and lighted roads with proper sineages and sidewalks.
    - + Green areas (landscaping for development of lawns, parks and gardens, along with supporting horticultural nursery.)
    - + Efficient maintenance and repair service
    - + Campus Security
    - + Prevention of encroachment and trespassing
- Each Institute should have modern guest house facilities of adequate capacity with a high quality by renovating the existing ones and/or constructing new ones.
- Each Institute should upgrade its existing health centre by renovation of the existing facility and addition of necessary equipment and staff to provide emergency and diagnostic care and referral services with an appropriate number of hospital beds.
- Each Institute must have a modern telephone exchange of adequate capacity, connecting all the offices of faculty and administration, laboratories, faculty and senior staff residences, student's hostels, hospitals, and all other essential locations. Similarly Internet connectivity with sufficient bandwidth should be provided at these locations.
- Each Institute may consider establishing a Community Centre for social and other functions if the demand justifies it.
- The existing facilities such as Bank, Post-Office, and Shopping Centers may be provided where they do not exist and there is a sufficient demand.

Some Imperatives

- Obsolescence results from ageing of equipment and infrastructure facilities and rapid advancements of technology. On transformation of the Institutions, there will be a major diffusion of new and modern equipment. The Institutions must have a time bound programme to quickly dispose off the obsolete equipment and facilities which have fallen into disuse to minimize clutter and release valuable space. This exercise should be given a high priority.

  The existing and the newly created facilities must have liberal accessibility to ensure their optimum utilization. The life of equipment remains same whether or not they are used. Therefore, equipment involving huge investments should be put to extensive use.

- The issue of industry-institute interaction is an oft-debated subject but remains elusive. Specific action-oriented strategies should be evolved by these Institutions to realise the goals of industry-institute interaction. Each IIEST should articulate its goals in accordance with its strength and faculty expertise, design programmes and prepare an action plan to achieve them and sustain them.

- It is essential that curricula should be designed to respond to the new trends of technology requirements by changing existing courses and introducing new ones in a timely and purposeful manner.

6.2 Institutional Profiles and Recommendations

While considering the proposal of the identified Institutions for transformation and their feasibility for effective implementation without undue delay, it is also necessary to take into account the history and traditions of the Institutions besides their ongoing programmes which need to be restructured and the renovation of existing infrastructure and development of new facilities. Based on the data available and discussions held during the visits, the prospects of individual Institutions are outlined below.

6.2.1 Bengal Engineering and Science University

Historical Background

The Civil Engineering College, Calcutta was established in 1856 and was originally housed in Writers' Building. It was affiliated to Calcutta University in 1857. The objective of the College was to train manpower for Public Works and Survey Departments and also for companies engaged in the development of railways in India. In 1865, the college was integrated with the Presidency College and designated as "Presidency College Civil Engineering Department". In 1880, it was moved to a 121-acre campus in Shibpur under the name of "Government Engineering College, Howrah" and was affiliated to Calcutta University. Later in 1887, it was re-named as "Civil Engineering College Shibpur". In 1920, it was given another new name "Bengal Engineering College", and become known as B.E. College, Shibpur. During the Second World War period, the facilities of the College were used by the Defense Department for training of technicians in large numbers.

In the ensuing years after Independence, technical education expanded with investments primarily made by the Central and State Governments. In 1953, postgraduate courses leading to Master of Engineering Degrees in Civil, Electrical, Mechanical and Metallurgical engineering were started in B.E.College, Shibpur, and subsequently doctoral programmes were also introduced.

The College was made a Deemed-to-be-University in 1992, which brought institutional autonomy to the college. The college was later converted into a State University and acquired its present name. "Bengal Engineering and Science University, Shibpur" (BESU).

Academic Programmes

BESU has programmes leading to undergraduate engineering and architecture degrees in nine disciplines, and a 6-year part-time programme (started in 2005) in Civil Engineering. It also has a 3-year full-time programme leading to BBA degree and a 2-year MBA degree programme. The University offers full-time postgraduate programmes leading to Master's degrees in eleven disciplines. For working engineers the University offers part-time M.E. degree programmes of three-year duration in four

disciplines. The Science Departments offer four M.Sc. degree programmes. The University has four Schools for multidisciplinary research. Some of the University Departments have four other Schools attached to them as multi-disciplinary Centers. The University has Ph.D. programmes for which it has only ten institutional fellowships. This is a major constraint, which inhibits the growth and development of doctoral research.

Earlier the predecessor College of BESU was fully residential for all students and a majority of faculty and other staff. With the increased strength of students, the constraint of available accommodation makes it difficult to maintain the fully residential character of the campus. The University has many old buildings, which are reminders of its history and inheritance. Several of those buildings are not used or fully utilized. They need to be restored to preserve the character and history of the University and be utilized for the University activities.

The Bengal Engineering and Science University offers eight 4-year B.Tech programmes in engineering besides a 5-year Architecture programme. The total intake capacity in the engineering B.Tech programmes is 450 besides 24 in Architecture. The actual admission is close to intake capacities and the out-turn is satisfactory.

BESU offers 2-year M.Tech programmes in 10 disciplines with an intake capacity of 224 and the out-turn is only about 50% of the capacity. During the last five years, the aggregate output of 2-year M.Tech in the engineering disciplines is 436 with an average of 87 per year. The University offers four 2-year M.Sc programme in Applied Sciences with an intake capacity of 80 with admission and output closer to intake. It also offers a 2-year MBA programme with an intake capacity of 60 and MCA with intake capacity of 30 with satisfactory admission and output levels.

The number of Ph.Ds produced by the engineering departments in the last five years is 24 and by the science departments is only 6, averaging 6 per year for the University as a whole.

The total number of regular faculty in all the departments of the University is 212 of whom 136 have Ph.D. degree. There are no contract or ad-hoc faculty except in the department of Architecture. The faculty have published during the last five years 575 papers in international refereed journals and 264 in national refereed journals, averaging 168 per year.

The University has generated about Rs.15 crores through sanctioned projects over a five-year period, averaging about 3 crores per year.

On transformation as IIEST the University should devote greater attention to the development of R&D programmes considering the large number of highly qualified faculty and very small output of Ph.Ds.

The University on transformation as an IIEST should offer 5-year integrated dual degrees B.Tech-M.Tech programmes and also 5-year integrated M.Sc programmes. This should be rationalized in a manner to offer greater flexibility for interdisciplinary programmes with good scope for research output.

Initially the University may be given 100 Ph.D. institutional fellowships to be increased to 300 by the end of the 11th Plan period.

Currently the admission to the undergraduate programmes is through the West Bengal Joint Entrance test conducted on an all-India basis. On transformation to IIEST the admission has to be through either IIT JEE, or, AIEEE or a separate all-India level examination jointly conducted by the IIESTs.

6.2.2 Institute of Technology, Banaras Hindu University

Historical Background

Banaras Hindu University was created under the Parliamentary legislation, B.H.U. ACT, 1915 and was founded in 1916. The University campus has 1300 acres of contiguous area with a good road network and open spaces. The University is acquiring 2700 acres in Mirzapur district. The Varanasi campus comprises 3 Institutes, 14 Faculties, 124 Departments, 4 Interdisciplinary Centers and 3

Constituent Schools. The academic programmes of the University include a wide range of subjects, which cover branches of humanities, social sciences, sciences, technology, medicine, fine arts, and performing arts. The University has a total enrollment of over 15,000 students, a noticeable number of students from abroad, about 2000 teachers and nearly 5000 non-teaching staff. The University has a large hospital with more than 900 beds, a museum and good facilities for games and sports.

Three Colleges were established in BHU to impart education in engineering and technology by starting Banaras Engineering College in 1919, College of Mining & Metallurgy in 1923 and the College of Technology in 1932. These three engineering institutions were merged to form the Institute of Technology (IT-BHU). Presently IT-BHU comprises 13 Departments, 3 Interdisciplinary Schools, and 3 Centers of Advanced Studies and has a National Electron Microscopy Facility.

Academic Programmes

Ten engineering departments of IT-BHU offer four-year B.Tech programmes in 10 disciplines with an annual intake per discipline ranging from 38 to 77 in different disciplines. The admissions to these programmes are made through the Joint Entrance Examination (JEE) along with the IITs. The actual number of students admitted to these programmes is about 60 to 75 percent of the intake capacity.

The Institute offers two-year M.Tech programmes in twelve disciplines with 34 specializations. The annual intake capacity per discipline, ranges from 5 to 30 in various disciplines. The actual number of students admitted to different disciplines is generally up to the intake capacity: Since 2005-06, the Institute has started 5-year Integrated dual degree M. Tech programmes in some of the disciplines. Doctoral degree programmes are offered in all Engineering and Applied Sciences departments. During the past five years the Institute has produced 146 Ph.Ds.

It is observed that the drop-out rate in the B.Tech and M.Tech programmes is comparatively low. Most of the seats reserved for SC/ST students remain vacant. The total enrolment of students under all programmes is about 3000 comprising about 1950 UG and 1050 PG students.

It appears that the Institute would have no problem in implementing the 5-yr integrated dual degree programmes (and phase out the 4-yr B.Tech programmes) and the 2-year M.Tech programmes, as proposed for IIESTs. The institute would have to increase the intake capacity for M.Tech in some of the disciplines to a level of 10-30.

The M.Sc/MA programmes are now offered by the departments of the main University. The applied science departments of the IT offer 2-year M.Tech programmes only. These departments would require considerable strengthening to offer 5-yr integrated M.Sc programmes in sciences.

Approximately 50 scholars are enrolled in Ph.D programmes in all departments of the Institute. Most of them are part-time or self-supporting candidates. The faculty members of the Institute are capable of guiding much greater number of Research Scholars. Initially 100 institutional Fellowships may be provided, which can be increased to 300 in five years.

There are 229 faculty members in position. Of these, 170 have Ph.Ds. There are no contract or ad-hoc faculty members. The present Student Teacher Ratio of 13:1 in the Institute would need to be improved after its transformation as IIEST by inducting new faculty.

The total number of publications in five years in referred journals is 462 for all the faculty of the Institution. A total of Rs.22.5 crores has been obtained as research grants by the faculty during the last five years.

6.2.3 Cochin University of Science and Technology

Historical Background

The University of Cochin was established in 1971 and was later converted to Cochin University of Science and Technology (CUSAT) in 1986, which emphasizes the academic orientation and character of the University. The CUSAT campus has 180 acres. It has eight faculties, namely, Engineering, Technology, Science, Marine Sciences, Environmental Studies, Social Sciences, Humanities and Law.

The Faculty of Engineering has six Departments besides a University College of Engineering, Kuttanand (with six B.Tech programmes and a MCA programme) and has an approval for starting three new Departments recently granted by the University Syndicate. The Faculty of Technology has six Departments and a School on Photonics. The Faculty of Marine Science has five Departments and two Schools. The Faculty of Environment Studies has one School. The Faculty of Social Science has one Department and a School of Management Studies. The Faculty of Humanities has two Departments and the Faculty of Law has one School. In most of these units, there are a number of faculty vacancies.

CUSAT, apart from the usual disciplines, has a special feature with several disciplines of ocean and marine sciences. The University has B.Tech., M.Tech., M.Tech. (Part-time), M.E. (by Research), PG Diploma, M.Sc., (Integrated), M.Sc. (5-year), M.Phil., M.A., L.L.B. and L.L.M. programmes in various disciplines and Ph.D programmes.

Academic Programmes

The Cochin University of Science and Technology (CUSAT) offers academic programmes in Engineering and Technology in two campuses with the main campus located near Kochi at Trikkakara along with a small Lakeside campus in the city, and another campus in Kuttanad, 65 kms away from the main campus. At the Kuttanad campus only 4-year B.Tech programmes are offered in the self-financing mode. At the main campus eleven 4-year B.Tech programmes are offered, nine of which in the self-financing mode. In the Lakeside campus only the Faculty of Marine Sciences is located.

The intake capacity in the nine 4-year B.Tech programmes conducted on self-financing basis is 598, while the intake capacity in the two regular 4-year B.Tech programmes (Naval Architecture and Polymer Science and Rubber technology) is 56. The admission to all the programmes is close to the full capacity.

The admissions to the B.Tech programmes are based on an All India Entrance Examination conducted by the University with no special reservation other than statutory requirements under the state policy. The Post-Graduate admissions in engineering are based on GATE scores.

The University offers 2-year M.Tech programmes in 10 specializations in the regular mode and three 5-semester part-time M.Tech programmes in self-financing mode. It also offers a 6-semester MCA programme, a 4-semester MBA, a 4-semester MBE (Master of Business Economics), a 4-semester MIB (Master of International Business) and a 10-semester M.Sc software Engineering in self-financing mode. It admits a few students for M.E. by research also.

The Science Faculties of the University offer fourteen 4-semester M.Sc programmes in various specializations beside a 6-semester LLB and 4-semester LLM programmes. The intake capacity in the 2-year M.Sc programmes varies from 10 to 25 in different specializations. The intake capacity is 60 in LLB and 36 in LLM. These programmes are also filled up to the capacity with satisfactory out turn.

During the past five years the University has produced 47 Ph.Ds in the Engineering Department, 179 Ph.Ds in other departments totaling 226 and averaging about 45 per year for the University as a whole. The number of publications in refereed national journals in the past five years is about 500 and in refereed international journals about 660, totaling 1180 for all the faculty, averaging about 236 per year.

CUSAT has a total regular faculty strength of 206 of whom 151 have Ph.Ds. The funds generated through sponsored research projects during the period 2000-2005 amounts to Rs.18.5 crores in addition to Rs.0.8 crores earned through consultancy, averaging about 3.8 crores per year.

After transformation as an IIEST, the CUSAT should phase out all 4-year B.Tech programmes in favour of 5-year integrated dual degree B.Tech-M.Tech. The self-financing programmes will have to be discontinued after the existing batches graduate.

It is recommended that the Kuttanad Campus may become a separate college and affiliated to one of the State universities. The Lakeside campus may continue as a part of the IIEST.

The science departments may offer 5-year integrated M.Sc programmes besides 2-year M.Scs. Considering the present level of output of Ph.Ds at about 36 per year with 151 faculty members having Ph.D. degrees, there is considerable scope for improving the Ph.D. out-turn. It is recommended that 100 institutional Ph.D. fellowships may be made available initially on transformation as IIEST, increasing to about 300 by the end of the 11th Plan period.

The admissions to the Institute after transformation shall be based on all-India examinations, such as JEE or GATE or other tests common to all IIESTs as determined by the appropriate authorities.

6.2.4 College of Engineering, Andhra University

Historical Background

Andhra University was established in 1933. It has a campus of 500 acres. Among the Campus Colleges of the University are College of Arts and Commerce, College of Law, College of Science & Technology and College of Engineering. The University has 22 colleges affiliated to it and has 4 postgraduate off-campus Centers.

The Government of composite Madras State sanctioned the Engineering College, Visakhapatnam in 1946. The College was temporarily located in Kakinada and later became a constituent unit of Jawaharlal Nehru Technological University. After the separation of the Andhra State in 1953, a separate Department of Engineering was started as a constituent of the Andhra University with Civil, Mechanical and Electrical Engineering sections housed in improvised war-sheds. In 1960, the Department of Engineering was shifted to the 167 acre North Campus of the University. The Department of Chemical Technology instituted in 1943 was also shifted to the North Campus in 1962. The restructuring of University Colleges in 1960 led to the inception of the College of Engineering as separate constituent of Andhra University. The Sections of Engineering Physics, Engineering Chemistry and Engineering Mathematics were constituted in 1964 and later were upgraded as the Departments of the College in 1979.

Academic Programmes

In the years that followed, the college of Engineering grew considerably. It presently has 15 Departments and offers 14 full-time undergraduate programmes and 28 postgraduate programmes. The College also offers 5 M.Phil programmes and doctoral programme to full-time as well as part-time research students. The college has started a number of self-financing programmes at the postgraduate level with a higher fee structure. In addition, the college offers 4-year part-time B.E. degree programmes for diploma holders in the Departments of Civil, Mechanical, Electrical and Electronics & Communication Engineering. The various Departments have seven Centers for carrying out research in specialized areas.

The College of Engineering of Andhra university consists of 9 departments of engineering and technology, one department of Architecture, one department of Geo-Engineering, three departments of Applied Sciences and one department of Humanities and Social Sciences.

The 9 departments of engineering and technology offer thirteen 4-year B.Tech programmes in various disciplines/sub-disciplines with a total intake capacity of 310. The intake capacity in Architecture is 25. The admissions to these programmes are to the full capacity with satisfactory out-turn. The admissions to individual programmes range from 10 to 60 per year. The admissions are based on the State level Common Entrance Test conducted by the Andhra Pradesh Government but restricted only to students from the region of Coastal Andhra Pradesh as per the Presidential Order of 1974

The College offers twenty-six 2-year M.Tech and M.Sc programmes in various disciplines and specialties with a total intake capacity of 442 besides an MCA programme with an intake of 40. The intake capacity of different specializations varies from 6 to 36 per year. The programmes are generally fully subscribed with satisfactory out-turns.

During the past five years the college has produced 945 M.Tech graduates in engineering and technology faculties. The number of Ph.Ds produced by all the

departments including science and humanities during the five-year period is 85, averaging about 17 per year.

The total number of regular faculty members in all departments of the college is 123 against a sanctioned strength of 263. The programmes are manned by 34 contract and ad-hoc faculty members.

Sixty-eight of the regular faculty members possess Ph.D. qualifications. The total number of publications in 2000-05 in refereed journals is 172, averaging about 34 per year.

The College has generated about Rs.2.3 crores through sponsored research and Rs.2.4 crores through consultancy during the past years, averaging about Rs.1 crore per year.

After transformation to IIEST the college would have to restructure the academic programmes leading to 5-year integrated dual degree (B.Tech-M.Tech) programmes by rationalizing the intake capacity to avoid programmes of sub-critical size. The admission to these programmes would have to be based on an all-India entrance test such as JEE IITs or similar tests for IIESTs.

On transformation, besides the 2-year M.Tech and M.Sc programmes, the Institute should consider offering 5-year integrated programmes in basic sciences with intake capacities in the range suggested in general guidelines.

Considering the inadequate number of present regular faculty, the number of programmes should be within manageable limit till the faculty strength can be increased.

The number of Ph.Ds produced is an average of 17 per year for the college. Their publication averages about 34 per year. One reason for the relatively low research output by the college with 68 Ph.D. qualified teachers is perhaps the large number of undergraduate programmes.

There is scope for strengthening the R&D programmes of the Institute. Initially 50 institutional Ph.D. fellowships may be given to the Institute raising the number to 150 in the subsequent years.

6.2.5 University Colleges of Engineering and Technology, Osmania University

Historical Background

The University College of Engineering is a constituent College of Osmania University that was established in 1918. The University College of Engineering (UCE) was established in 1929, eleven years later. UCE moved to its present permanent building in 1947. UCE is the biggest among the Campus Colleges of Osmania University. The University made UCE autonomous in the year 1994.

Academic Programmes

UCE offers B.E. degree programmes in six disciplines and at the postgraduate level, M.E., M.Tech and M.Sc. (by research) programmes and also doctoral programmes in various disciplines. UCE offers an MCA programme. In all UCE offers six B.E. programmes, nine M.E. programmes, one M.Tech programme, Two M.S. programmes (by Research), three PG diploma programmes, one MCA and one MSIT programme. UCE has a Biomedical Instrumentation Centre to support the Biomedical Engineering Department.

The University College of Engineering and The University College of Technology (UCET) of the Osmania University together comprise eight departments offering nine 4-year Bachelor degree programmes with a total intake capacity of 420. The number of students admitted is close to the available capacity with few dropouts. They also offer seven 2-year M.Tech programmes in 21 specializations with intake capacity of 257 on regular basis and 125 on self-financing basis. These courses are filled up to the intake capacity. The number of graduates produced during the past five years under the 2-year M.Tech programme is 623. The total number of Ph.Ds produced by the UCET during the past five years is 37 averaging about 7 per year.

The total number of regular faculty is 127 besides 65-contract/ad-hoc faculties. The number of Professors, Assistant Professors and Lecturers among the

regular faculty is 21, 32 and 71 respectively. Of these 9 Professors are over 55 years age.

Fifty seven of the regular faculty members possess Ph.D. degrees. The funds generated through research grants and consultancy during the past 5-years is about Rs.3 crores averaging about Rs. 0.6 crore per year. The number of papers published in refereed national and international journals during the past 5-years is 155, averaging about 31 per year.

At present the admission of students to the UCET is restricted to those from the Telengana region, as per the Presidential Order of 1974. For B.Tech programmes, the admission is based on the Common Entrance Test conducted by the State of Andhra Pradesh. On transformation into IIEST, the admissions should be on all-India basis through a national level test such as JEE, AIEEE or by the IIESTs as decided by the appropriate authorities.

The number of contract and ad-hoc faculty, mostly at the starting and middle level positions is nearly half of those in regular position. As IIESTs, all faculty positions will have to be on regular basis. No programme can be offered on self-financing basis.

The introduction of 5-year integrated dual degree B.Tech-M.Tech programme and phasing out the 4-year B.Tech programme should be initiated from the first year of new status as IIEST. The intake capacities to the various programmes should be normally in the indicated range in the general recommendations.

Presently the science and humanities departments of the University offer the necessary courses for the engineering and technology students. As IIESTs it will be necessary to establish sufficiently viable science and humanities departments, and allowing them to offer their own Masters' and Doctoral programmes, depending on the faculty strength in these departments.

The average number of Ph.Ds produced by all the departments is about 7 per year. Considering the number of faculty members with Ph.D., about 50 institutional

Ph.D. fellowships may be made available initially, increasing the number to 150 during the succeeding five years, provided sufficient number of guides would become available.

6.2.6 Jadavpur University

Historical Background

The National Council of Education, Bengal founded in 1906, was a unique institution imparting education. It became Jadavpur University in 1955. The University has two campuses; the main campus has 60 acres and the other in the Salt Lake area has 20 acres. Most of the academic programmes are housed in the main campus, which is nearly saturated with academic buildings. The University has three Faculties namely, Arts, Engineering & Technology, and Science. It also has sixteen Schools of Interdisciplinary Studies and Research. Ten of these Schools are in the area of engineering and technology and allied areas such as Industrial Pollution Control Engineering; Bioscience Engineering; Education Technology; Energy Studies; Environmental Science; Illumination Science, Engineering & Design; Laser Science & Engineering; Material Science & Technology; Oceanographic Studies; and Water Resource Engineering. The University also has twenty seven Centers. Eleven of them have engineering and technology context such as Computer Aided Design; Distributed Computing; IC Design and Fabrication; Knowledge-Based System, Microprocessor Application; Quality Construction; Quality Management Systems; Surface Science; Transport Studies; Welding Technology; Thermal Power and Process Management. Most of these are in established areas and are not newly emerging ones. The Faculty of Engineering & Technology offers programmes at Bachelor and Master's level in seventeen disciplines. Jadavpur University has collaborative programmes with several foreign Universities, primarily for exchange visits of faculty and research. The industry-oriented activities of the University include Entrepreneurship Development Programme, technology development and consultancy, testing, manpower training and extension.

6.2.7 Zakir Hussain College of Engineering and Technology, AMU

Historical Background

The Aligrah Muslim University has its origin in the Mohammedan Anglo Oriented College which was established in 1875. The college was upgraded to a Central University in 1920 by an Act of the Central Legislator. The University has a campus of 1059 acres and has 12 Facilities with more than 100 Departments, 4 Centers of Excellence and 9 Centers. The University has five constituent Colleges, Zakir Hussain College of Engineering as one of them.

The University maintains two senior secondary schools, one for girls and the other for boys, and five High Schools, including one for girls and one for blind students.

The University has a predominantly residential character. It has 15 Halls of Residence, including 3 for women and a facility for day scholars..

Zakir Hussain College of Engineering & Technology was established in 1940. It started with programmes in Electrical Engineering and Mechanical Engineering (1940–41) and Civil Engineering (1941–42). Five more disciplines including Architecture were added during the period 1978-97. All the Engineering Departments have M.Tech and Ph.D programmes. AMU admits students from all over the country and also abroad. Admission in all the Faculties is made on the basis of rules framed by the Academic Council. Presently the University follows a system of reservations for minority community.

6.3 Transformation and One-time Grant

The EC has conceptualized the academic and governance structure of a new category of technical institutions which will enable them to distinguish themselves and be comparable to some of the best institutions internationally. Detailed recommendations for transforming five Universities/University Institutions with

regards to their academic programmes, governance and funding are given in Chapters 7 and 8.

EC is of the view that because of systemic constraints, it will not be possible to transform JUET and ZHCET-AMU into the framework of the new category of Institutes, which have been conceptualized in terms of their unitary status and governance structure requiring their delinking and separation from their respective parent Universities. The EC nevertheless, is recommending (Chapter 7) one time financial support to these institutions to enable their engineering and technology departments to develop specific Centres of Excellence.

Chapter 7

BUDGET ESTIMATE (2007 – 2012)

7.1 The Rationale

Technical education is comparatively more expensive. The high quality technical education is primarily available in public funded institutions, such as IITs, NITs and some other good universities/institutions. The engineering graduates from the leading institutions in India, when they move to other professions or go abroad for good, represent a significant loss to the nation. The postgraduate education to bright young men and women would give them more maturity and a greater sense of purpose with reference to knowledge and skills they have acquired at a higher level in their fields of study. It is expected that about 5000 postgraduates will pass out from IIEST system every year beginning 2011, comprising about 1000 with Ph.D degree. They will be a highly qualified asset of a distinct human resource to fulfill in a large measure, the needs of industry for such high level functions as research, design, development and management, as well as the demands for competent faculty in the technical institutions in India and researchers in the national and corporate laboratories, notwithstanding the fact that some of them will also move to other careers or go abroad.

In arriving at the recommendations for the estimated allocation of recurring and non-recurring budgets to the IIESTs, the EC considered several alternate approaches. The approach finally adopted is based on the rationale that the funds should be made available for meeting the basic objectives of transformation, as outlined in Chapter 3 and should be related to the key attributes (Chapter 5) to be strengthened.

Since the main distinguishing features of the IIESTs are the integrated 5-year B.Tech-M.Tech dual degree programmes and large scale Ph.D. research activities, the primary determinants for funds will be the enrolled strength of students and the

number of well qualified faculty members. The estimates for the recurring budgets are, thus, calculated for each of the parameters linked to the faculty strengths.

Considering the importance of high quality academic and physical infrastructure, the non-recurring grant is estimated to provide for upgradation and creation of item wise infrastructural facilities. It is emphasized that the funds indicated against each item is normally not diverted to other items.

The procedure adopted for estimating the budgetary requirements for individual Institutions is outlined in the Appendix at the end of this chapter. The estimates for recurring and non-recurring budgets for individual Institutions are shown in the following Sections and their summary in Table 7.1

7.2 Budget Estimates for Individual Institutions

7.2.1 Proposed IIEST, Shibpur (BESU)

Recurring Grant		Rs. (in Crore)
1. Faculty Salary & Pension Bill	–	12.40
2. Staff Salary & Pension Bill	–	9.30
3. Ph.D Fellowships	–	2.72
4. M.Tech Fellowships	–	2.24
5. Operating Expense of Department & Institute	–	2.92
6. Electricity & Water	–	3.00
7. Books and Journals	–	4.00
8. Telephone/Postal/Internet	–	0.80
9. Maintenance (Campus + Institute)	–	3.18
10. Security	–	0.72
11. Travel		
(a) International	–	0.85
(b) Domestic	–	0.53
12. Transport (local)	–	0.25
13. Health Care + Med Reimbursement	–	2.12
14. Annual Maintenance of Equipment/Computer	–	0.50
15. Guest House Operation (50 rooms)	–	0.18
16. Startup Grant for New Faculty	–	0.80
17. Overall Contingency	–	0.80
Total	–	47.31

Total recurring grant = 5 × Rs 47.31cr = Rs 236.55cr

Non-recurring Grant

		Allocation Rs. cr
1.	Renovation of existing student accommodation and modernization of facilities. No. of existing students with accommodation ~1300 @ Rs.20,000	2.60
2.	Construction of new student accommodation No. of extra student accommodation needed ≈ 1700 @ Rs 8000 per m^2 ($15m^2$ /student)	20.40
3.	Renovation of existing faculty residence No. of existing faculty accommodation ~ 210 @ Rs 2,00,000	4.20
4.	Construction of new faculty accommodation No. of new accommodation required ~ 110@ Rs 25,00,000	27.50
5.	Renovation of existing staff accommodation No. of existing staff accommodation to be renovated ~100 (A substantial number are beyond renovation being 200 years old) @ Rs 75,000	0.75
6.	Construction of new staff accommodation No. of new staff accommodation ~ 150 @ Rs 10,00,000	15.00
7.	Married students' accommodation No. ~100 @ Rs 4,00,000	4.00
8.	Project staff hostel No. ~ 100 @ Rs 4,00,000	6.00
9.	Visiting faculty accommodation (furnished) No. of units-8 @ Rs35,00,000	2.80
10.	Campus development (a) Roads-street light-side walk (b) Parks, lawns, gardens, landscaping (c) shopping complex, Bank, P.O., etc (d) water, electrical, swears	25.00
11.	Upkeep and renovation of heritage structures	5.00
	Total	**113.25**

12. **Funds for the Growth of the Departments:** The total number of regular faculty after 5 years is expected to be about 1.5 x 212 ~ 320 and hence a total non-recurring budget of 320 x Rs.20,00,000/- ~ **Rs.64cr** is earmarked for the development and modernization of the departments and administrative facilities.

13. An amount of **Rs.20cr** may be earmarked for the establishment of 2 Centers of Excellence within IIEST, Shibpur. Considering the expertise available, ongoing R&D and other aspects the Committee recommends the establishment of a Centre of Excellence focusing on fuel cells, membrane technology, nanomaterial, catalysts, etc. Besides, one of the following areas may be chosen by the Institute for developing a centre of excellence:
    (i) VLSI design
    (ii) Mechatronics and Robotics

The Institute should submit detailed proposals for establishing the centers which can be examined by experts in the respective disciplines for a suitable decision.

7.2.2 Proposed IIEST, Varanasi (IT-BHU)

Recurring Grant			Rs. (in Crore)
1. Faculty Salary & Pension Bill		–	13.40
2. Staff Salary & Pension Bill		–	10.10
3. Ph.D Fellowships		–	3.10
4. M.Tech Fellowships		–	2.40
5. Operating Expense of Department & Institute		–	3.10
6. Electricity & Water		–	3.00
7. Books and Journals		–	4.30
8. Telephone/Postal/Internet	0.1 + 0.2 + 0.5	–	0.80
9. Maintenance (Campus + Institute)		–	3.44
10. Security		–	0.72
11. Travel			
(a) International		–	0.95
(b) Domestic		–	0.57
12. Transport (local)		–	0.25
13. Health Care + Med Reimbursement		–	2.38
14. Annual Maintenance of Equipment/Computer		–	0.50
15. Guest House Operation (50 rooms)		–	0.18
16. Startup Grant for New Faculty		–	0.86
17. Overall Contingency		–	0.90
	Total	–	50.95

Total recurring grant = 5 × Rs 50.95cr = Rs 254.75cr

Non-recurring Grant

		Allocation Rs. cr
1.	Renovation of existing student of accommodation and modernization of facilities No. of existing students = 1800 @ Rs 20,000/-	3.60
2.	Construction of new student accommodation No. of extra student accommodation needed ~ 1200 @ Rs. 8000/-per m^2 ($15m^2$ / student)	14.40
3.	Renovation of existing faculty residence No. of existing faculty houses ~ 190 @ Rs.20,000/	3.80
4.	Construction of new faculty accommodation No. of new accommodation required ~ 150 @ Rs.25,00,000	37.50
5.	Renovation of existing staff residence No. of existing staff accommodation ~180 @ Rs.75,000	1.35
6.	Construction of new staff accommodation No. of new staff accommodation ~190 @ Rs.10,00,000	19.00
7.	Married students' accommodation No. ~ 100 @ Rs.4,00,000	4.00
8.	Project staff hostel No. ~ 150 @ Rs.4,00,000	6.00
9.	Visiting faculty accommodation (furnished) No. of units-8 @ Rs.35,00,000	2.80
10.	Campus development (a) Roads-street light-side walk (b) Parks, lawns, gardens, landscaping (c) shopping complex, Bank, P.O., etc (d) water, electrical, swears	25.00
	Total	**117.45**

11. **Funds for the Growth of the Departments:** The total number of regular faculty after 5 years is expected to be about 1.5 x 229 ~ 340. A total non-recurring budget of 340 x Rs.20,00,000 ~ **Rs.68cr** is earmarked for the development and modernization of the departments and administrative facilities.

12. An amount of **Rs.20cr** may be earmarked for the establishment of 2 Centers of Excellence within IIEST, Varanasi. Considering the expertise available and other aspects, the Committee recommends the establishment of a Centre of Excellence for Advanced and Smart Materials. So far as a second centre is concerned the Committee is unable to make a definite recommendation. The Institute may submit a proposal in a suitable area for evaluation by experts in the concerned area for a suitable decision

7.2.3 Proposed IIEST, Kochi (CUSAT)

Recurring Grant		Rs. (in Crore)
1. Faculty Salary & Pension Bill	–	12.05
2. Staff Salary & Pension Bill	–	9.04
3. Ph.D Fellowships	–	2.76
4. M.Tech Fellowships	–	2.15
5. Operating Expense of Department & Institute	–	2.83
6. Electricity & Water	–	3.00
7. Books and Journals	–	3.86
8. Telephone/Postal/Internet	–	0.80
9. Maintenance (Campus + Institute)	–	3.10
10. Security	–	0.72
11. Travel		
(a) International	–	0.86
(b) Domestic	–	0.52
12. Transport (local)	–	0.25
13. Health Care + Med Reimbursement	–	2.14
14. Annual Maintenance of Equipment/Computer	–	0.50
15. Guest House Operation (50 rooms)	–	0.18
16. Startup Grant for New Faculty	–	0.77
17. Overall Contingency	–	0.77
Total	–	46.30

Total recurring grant = 5 × Rs 46.30cr = Rs 231.5cr

Non-recurring Grant

		Allocation Rs. cr
1.	Renovation of existing student accommodation and modernization of facilities No. of existing students with accommodation ~1320 @ Rs 20,000/-	2.60
2.	Construction of new student accommodation No. of extra student accommodation needed ~ 1200 @ Rs 8000/-per m^2 ($15m^2$ / student)	14.40
3.	Renovation of existing faculty residence No. of existing faculty accommodation ~ 50 @ Rs 2,00,000/	1.00
4.	Construction of new faculty accommodation No. of faculty accommodation needed ~ 200 @ Rs 25,00,000	50.00
5.	Renovation of existing staff accommodation No. of staff residence to be renovated ~ 101 @ Rs 45,000	0.46
6.	Construction of new staff accommodation No. of new staff accommodation ~ 130 @ Rs 10,00,000	13.00
7.	Married students' accommodation No. ~100 @ Rs 4,00,000	4.00
8.	Project staff hostel No. ~ 150 @ Rs 4,00,000	6.00
9.	Visiting faculty accommodation (furnished) No. of units-8 @ Rs35,00,000	2.80
10.	Campus development (a) Roads-street light-side walk (b) Parks, lawns, gardens, landscaping (c) shopping complex, Bank, P.O., etc (d) water, electrical, swears	25.00
	Total	**119.56**

11. **Funds for the growth of the Department:** The total number of regular faculty at the end of the plan period is expected to be about 1.5 x 206 ~ 310. A total non-recurring budget of 310 x Rs 20,00,000 = **Rs.62cr** is earmarked for the development and modernization of the departments and administration.

12. An amount of **Rs.20cr** may be earmarked for the establishment of 2 Centers of Excellence within IIEST, Kochi (CUSAT). The University already has a Centre of Excellence in "Lasers and Optoelectronic Sciences" initially developed under the Dutch MHO programme and is currently funded by the UGC with a grant of Rs 5 cr. Further support from the earmarked fund, mentioned above, may be considered for this Centre of Excellence if requested by the Institute (after transformation) with necessary justification. In addition the Committee recommends that one of the following areas may be considered for developing into a Centre of Excellence on the basis of a detailed proposal from the Institute to be examined by experts in the concerned disciplines:

    (i) Marine Pharmacology

    (ii) Wireless and Mobile Computing

7.2.4 Proposed IIEST, Vishakhapatnam (AUCE)

Recurring Grant		Rs. (in Crore)
1. Faculty Salary & Pension Bill	–	7.20
2. Staff Salary & Pension Bill	–	5.40
3. Ph.D Fellowships	–	1.33
4. M.Tech Fellowships	–	1.57
5. Operating Expense of Department & Institute	–	1.69
6. Electricity & Water	–	3.00
7. Books and Journals	–	2.30
8. Telephone/Postal/Internet	–	0.80
9. Maintenance (Campus + Institute)	–	2.50
10. Security	–	0.72
11. Travel		
(a) International	–	0.51
(b) Domestic	–	0.31
12. Transport (local)	–	0.25
13. Health Care + Med Reimbursement	–	1.30
14. Annual Maintenance of Equipment/Computer	–	0.50
15. Guest House Operation (50 rooms)	–	0.18
16. Startup Grant for New Faculty	–	0.46
17. Overall Contingency	–	0.46
Total	–	30.48

Total recurring grant = 5 × Rs 30.48cr = Rs 152.4cr

Non-recurring Grant

		Allocation Rs. cr
1.	Renovation of existing student accommodation and modernization of facilities No. of existing students with accommodation ~930 @ Rs 20,000/-	1.86
2.	Construction of new student accommodation No. of extra student accommodation needed ~ 1570 @ Rs 8000/-per m^2 ($15m^2$ / student)	18.84
3.	Renovation of existing faculty accommodation No. of existing faculty accommodation ~ None	-
4.	Constructions of new faculty accommodation No. of faculty residences ~ 180 @ Rs 25,00,000	45.00
5.	Renovation of existing staff accommodation No. of existing staff accommodation ~ None	-
6.	Construction of new staff accommodation No. of new staff accommodation ~ 130 @ Rs 10,00,000	13.00
7.	Married students' accommodation No. of apartments ~50 @ Rs 4,00,000	2.00
8.	Project staff hostel No. of apartment ~ 75 @ Rs 4,00,000	3.00
9.	Visiting faculty accommodation (furnished) No. of units - 4 @ Rs35,00,000	1.40
10.	Campus development (a) Roads-Street light-side walk (b) Parks, lawns, gardens, landscaping (c) shopping complex, Bank, P.O., etc (d) water, electrical, swears	25.00
	Total	**110.00**

11. **Funds for Growth of Departments:** The total number of faculty after 5yr will be 1.5 x 123 ~ 200. A total non-recurring budget of 200 x Rs 20, 00,000 = **Rs.40cr** is earmarked for the development and modernization of the departments and administration.

12. Considering the capabilities of AUCE for establishing Centers of Excellence in one or two disciplines, in terms of the number of Ph.D's produced, the record of publication in referred national and international journals, funds generated through research grants and consultancy and the number of faculty with advanced qualification, the Committee is unable to specify any particular area, appropriate to the existing situation in the institute, to be developed into Centers of Excellence.

However, a sum of **Rs.20cr** may be earmarked and the Institute (after transformation) may be requested to submit proposals for two Centers of Excellence within 2-3 years which may be examined by the experts in the concerned areas for suitable decision.

7.2.5 Proposed IIEST, Hyderabad (UCET – OU)

Recurring Grant			Rs. (in Crore)
1. Faculty Salary & Pension Bill		–	7.43
2. Staff Salary & Pension Bill		–	5.57
3. Ph.D Fellowships		–	1.50
4. M.Tech Fellowships		–	1.60
5. Operating Expense of Department & Institute		–	1.75
6. Electricity & Water		–	3.00
7. Books and Journals		–	2.38
8. Telephone/Postal/Internet	0.1 + 0.2 + 0.5	–	0.80
9. Maintenance (Campus + Institute)		–	2.50
10. Security		–	0.72
11. Travel			
(a) International		–	0.53
(b) Domestic		–	0.32
12. Transport (local)		–	0.25
13. Health Care + Med Reimbursement		–	1.32
14. Annual Maintenance of Equipment/Computer		–	0.50
15. Guest House Operation (50 rooms)		–	0.18
16. Startup Grant for New Faculty		–	0.48
17. Overall Contingency		–	0.50
	Total	–	31.33

Total recurring grant = 5 × Rs 31.33cr = Rs 156.65cr

Non-recurring Grants

		Allocation Rs. cr
1.	Renovation of existing student accommodation and modernization of facilities No. of existing students with accommodation ~ 1050 @ Rs 20,000/-	2.10
2.	Construction of new student accommodation No. of extra student accommodation ~ 1500 @ Rs 8000/-per m^2 (15m^2 / student)	18.00
3.	Renovation of existing faculty residence No. of existing faculty accommodation ~ None	-
4.	Constructions of new faculty accommodation No. of faculty accommodation ~ 190 @ Rs 25,00,000	47.50
5.	Renovation of existing staff accommodation	-
6.	Construction of new staff accommodation No. of new staff accommodation ~ 140 @ Rs 10,00,000	14.00
7.	Married students' accommodation No. of apartments 50 @ Rs 4,00,000	2.00
8.	Project staff hostel No. of apartment 75 @ Rs 4,00,000	3.00
9.	Visiting faculty accommodation (furnished) No. of units - 4 @ Rs35,00,000	1.40
10.	Campus development (a) Roads-Street light-side walk (b) Parks, lawns, gardens, landscaping (c) shopping complex, Bank, P.O., etc (d) water, electrical, swears	25.00
	Total	**113.00**

11. **Funding for the growth of the departments:** The number of total regular faculty after 5 years is expected to be about 1.5 x 127 ~ 200. A total non-recurring budget of 200 x Rs 20, 00, 000/- = **Rs.40cr** is earmarked for developing and modernizing the departments and administrative facilities.

12. Considering the capabilities of CE-OU for establishing Centers of Excellence in one or two disciplines in terms of the number of Ph.D's produced, the record of publication in referred national and international journals, funds generated through research grants and consultancy and the number of faculty with advanced qualification, the Committee is unable to specify any particular area, appropriate to the existing situation in the University, to be developed into Centers of Excellence.

However, a sum of **Rs.20cr** may be earmarked and the Institute (after transformation) may be requested to submit proposals for two Centers of Excellence within 2-3 years which may be examined by the experts in the concerned areas for suitable decision.

7.3 Special Recommendations for JUET and ZHCET-AMU

As mentioned earlier, the Committee found total deliking of the two above institutions from their parent universities extremely difficult, if not impossible. Furthermore development of appropriate independent campus also poses formidable problems. Therefore, transformation into IIEST's is not recommended in the above two cases.

However, considering the academic standing of these two universities and their services to the domain of technical education in India the Committee is desirous of making the following special recommendation hoping that these may be very useful in the field of engineering R&D.

An one time grant of **Rs.50cr** maybe earmarked for Faculty of Engineering & Technology, Jadavpur University and Zakir Hussain College of Engineering, Aligarh Muslim University each, for the purpose indicated below:

Faculty of Engineering & Technology Jadavpur University:

(i) Establishment of one Center of Excellence in Educational Technology with a focus on Engineering and Technological education in terms of development of course material, training of personnel for courseware development, innovations in delivery mechanism using emerging technology, etc.

(ii) Modernizations and strengthening of the library to serve the needs of Engineering Education and Research.

Aligarh Muslim University, Z.H.College of Engineering:

A Center of Excellence in Biomedical Engineering may be considered as the University has a regular Medical College.

In the above two cases grants may be released based on the submission of appropriate proposals by the Universities and positive recommendations by experts in the concerned disciplines.

Table 7.1 Summary of Budgetary Recommendation for the Period 2007-2012

Sl. No.	Head / Institution	Total Recurring Grant for the 5year period (Rs. Cr)	Non Recurring Grant (Rs. Cr.)				Total Grant (Rs. Cr.)
			Common provision for Lecture Halls, Auditorium, Central Research Facility, Central Library, Student's Activity Centre, Computer Centre etc.	Institute Specific Grants			
				Residential & Institute Campus, Hostels, Quarters, Guest House etc.	Development of Academic Departments, Modernization of Labs etc.	Development of Centers of Excellence	
						1 2	
1.	IIEST, Shibpur (BESU, Shibpur)	236.55	85.75	113.25	64.00	20	519.55
2.	IIEST, Varanasi (IT-BHU)	254.75	85.75	117.45	68.00	20	545.95
3.	IIEST, Kochi (CUSAT, Cochin)	231.50	85.75	119.56	62.00	20	518.81
4.	IIEST, Vishakhapatnam (AUCE)	152.40	85.75	110.00	40.00	20	408.15
5.	IIEST, Hyderabad (UCET-OU)	156.65	85.75	113.00	40.00	20	415.40

Total – Rs.2407.86Cr

Procedure for Budget Estimation

The procedure for estimating the budgetary requirements for each Institution is described below:

Key Parameters

1. The number of departments = N
2. Total current regular faculty = F
3. Ratio of faculty with Ph.D. to total faculty = R
4. Ratio of retirement benefit to salary = B

Assumptions and Formulae

1. Student-Faculty ratio will be about 8
2. Staff-Faculty ratio will be about 1.5
3. Expected total faculty strength after 5 years will be about 1.5F
4. Expected total student strength after 5 years will be about 12F
5. Expected Ph.D. scholars after 5 years will be about 1.5F
6. Expected strength of students in final year integrated 5-year and in 2-year M.Tech programme = 50N+1.25F

Estimation of Recurring Budget

Yearly recurring budget is estimated based on the middle year of the 11th plan period, assuming a 10% growth per year. The results of calculation are in rupees.

1. (a) Faculty Salary = (F + 1.5F)/2 x Rs.30,000 x 12 = 4.50,000F
   (b) Retirement Benefits = B x 450000F
2. (a) Staff Salary = 1.5 (F + 1.5F)/2 x Rs.15,000 x 12 = Rs.3, 37,500F
   (b) Retirement Benefits = B x 3,37,500F
   (1. + 2. is limited to 25cr Only)
3. Ph.D Scholarship = (R x F+ 1.5F)/2 x Rs.10,000 x 12 = (R + 1.5) 60,000F

4. M.Tech Scholarship (final year of 5-year Int.M.Tech + 2-year M.Tech)
   = 50N x Rs.5000 x 12 + 1.25 F x Rs.5000 x 12
5. Operating Expense of Departments + Institute
   = [(F + 1.5F)/2] x Rs.1, 00,000 x 1.1
6. Electricity and Water = Rs.3cr
7. Books and Journals
   = (F + 1.5F)/2 x Rs.50, 000 + (F + 1.5F)/2 x Rs.1, 00.000
   (limited to Rs 4.5cr)
8. Telephone/Postal/Internet = 0.1cr + 0.2cr + 0.5cr = Rs. 0.8cr
9. Maintenance (Campus + Institute)
   = (F + 1.5F)/2 x Rs.1, 20,000 x {(factor) > 1} (limited to Rs. 3.5cr)
10. Security Expenses (with 120 persons for three shifts)
    = 120 x Rs.5000 x 12 = Rs. 0.72 crore
11. Travel
    (a) International = (F + 1.5F)/2 x 1/3 x Rs.1. 00.000 (limited to Rs.1cr)
    (b) National = (F + 1.5F)/2 x Rs.20, 000 (limited to Rs 0.75cr)
12. Healthcare/Medical Reimbursement
    = (2.5F + 1.5 x 2.5F)/2 x Rs.30, 000 +8 (F + 1.5F)/2x Rs.1000
    (limited to Rs. 2.5cr)
13. Annual Maintenance of Equipment = Rs. 0.5cr
14. Guest House Operation = No. of rooms x Rs.3,000 x 12
15. Startup Grant for New Faculty = 1.25 F x 0.1 x Rs.3,00,000
16. Contingency = (F + 1.5F)/2 x Rs.30,000 (limited to 1cr)

Estimation of Non-Recurring Budget

Basis for Allocation of Non-recurring Budget

The allocation for the non recurring budget can be divided into two major parts. The first part is common to all the five Institutes recommended for transformation into IIEST. The second part is institute specific.

Common Provisions

The following units are being recommended for each institute.

1. Lecture Hall Complex cum Auditorium cum convention centre consisting of the following major halls.
   (a) 1000 capacity auditorium = 1
   (b) 300 capacity lecture halls = 2
   (c) 150 capacity lecture halls = 4
   (d) 80 capacity lecture halls = 6
   (e) Associated offices and other facilities like toilets, lounge, stores etc. =Rs.20cr
2. Central library (centrally air-conditioned) with an approximate floor area of 10,000m^2 + Associated furniture. Approximate total cost = Rs 15cr
3. Central Research Facilities to house the major analytical equipment, like SEM, STEM, TEM, AFM, X-Ray, etc., the centrally air conditioned building and clean rooms need to have a total floor area of about 3500m^2.
   (a) Approximate Building and Furniture cost = Rs 5.25cr
   (b) Equipment cost = Rs 15.00cr
4. Central computer centre:
   (a) Approximate building cost = Rs 4.00cr
   (b) Approximate systems and associated cost = Rs 8.00cr
5. Communication Facilities consisting of a new 5000 line telephone exchange and internet network = Rs 8.00cr
6. Students Activity Centre = Rs 2.50cr
7. Cafeteria = Rs 0.50cr
8. Sports Facility creation = Rs 2.50cr
9. Guest House (50 rooms) Building + furniture = Rs 3.50cr
10. Community Centre = Rs 1.50cr

Total Rs 54.75cr (Building & Furniture) + Rs 31.00cr (Equipment) = Rs 85.75

The estimation of Institute specific non-recurring budget is based on the extent of renovations required for existing facilities, the need for additional facilities and all other infrastructure suggested in the Recommendations in Chapter 6.

(A) Residence / Students' Accommodation

1 Renovation of existing Student Hostels = No. of students x Rs.15,000

2 Construction of new Student Hostels (including all developments)
= No. of rooms x Rs.2, 00,000

3 Renovation of Existing Faculty Residence = No. of units x Rs.3,00,000

4 Construction of New Faculty Residence (including all developments)
= No. of units (flats) x Rs.25, 00,000

5 Renovation of Existing Staff Residence = No. of units x Rs.2,00,000

6 Construction of New Staff Residence (including all developments)
= No. of units (flats) x Rs.10, 00,000

7 Renovation/Expansion cum Construction of Guest House
= No. of rooms x Rs.6, 00,000

8 Married Students Accommodation = No. of apartments x Rs.4,00,000

9 Project Staff Hostel (for scientific persons and engineers)
= No. of apartments x Rs.8, 00,000

10 Visiting Faculty Accommodation (including furnishing and development)
= No. of units x Rs.35, 00,000

(B) Academic Facilities/Infrastructure

Renovation/expansion of Departmental Facilities (Seminar Room/Meeting Room/Faculty Offices/Laboratories) = 1.5F x Rs.20, 00,000/- (for the whole institute) to be divided as per needs. (10%can be added for upgradation of administrative facilities)

(C) Campus Development**

1. Roads, Street Light and Side walk = Total km length x Rs.100,000
2. Electrical Installations (Substations, Cables/lines) 4MW
3. Water Supply
4. Sewer Systems
5. Parks, Lawns, Gardens, Landscaping = Rs.3cr

6. Shopping Centre (optional), Bank, P.O., Telecom Centre, Travel Assistance = Rs.3cr
7. Schools (optional) , Clubs
8. Community Centre = Rs.1.50cr
9. Health Centre = Rs.3cr + Rs.3cr (furnishing, equipment, building)

(D) Student Amenities**

1. Sports Complex (outdoor) Hockey, Football = Rs.1cr
2. Students' Activity Centre = Rs.2.5cr
3. Cafeteria = Rs.0.50cr
4. Swimming Pool = Rs.2.00cr
5. Indoor Games = Rs.1.5cr

***** A total of Rs.25crore can be allocated per Institute for the campus development and student amenities.***

Chapter 8

SUGGESTIONS FOR IMPLEMENTATION

8.1 The Tasks

The tasks associated with the implementation process would require, to begin with, a policy addressing the urgent need in India for a larger number of higher technological institutions of World standard than are available at present. Some of them should function together as a distinct system, to collectively establish a high stature and a brand image of their own. Their visions and mission should be clearly defined. The intended characteristics and functions of the proposed five IIESTs are elaborated in Chapter 3. These include their all-India character with prominent international profile, predominant postgraduate and research orientation, availability of infrastructural facilities of international quality, emphasis on faculty with advanced qualifications and rich experience, and above all a governance system supportive of the necessary degree of autonomy, which ensures a creative atmosphere and nurtures excellence.

Since these are not new institutions and have been in existence for several decades and have earned a certain degree of recognition in technical education, the task of transformation would have to begin with the establishment of a governance system compatible with the mission and goals of the IIESTs. In view of the fact that each one of them at present has a different system of governance, new Statutory provisions would have to be negotiated to move towards the proposed system of governance. In some cases delinking of the institutions from the parent university would involve negotiations with the concerned university authorities beside the State governments.

Since major reorientation of academic programmes are intended, there should be discussions among the faculty and the associated academic bodies, to determine the nature of initiatives required on their part. In addition, the issues relating to the service

conditions of the existing faculty and staff after transformation would require in-depth consideration. Similarly, the ownership of certain assets and liabilities would require serious attention.

On transformation, the IIESTs will require substantially higher levels of funding than what is currently available as well as for further development and growth. The grants available to them from the State Governments and the UGC will not be sufficient to sustain them as Institutes of National Importance.

At an early stage of the implementation process, the necessary financial provisions in the 11th Plan will be required. There should be a clear policy and commitment for continued support in subsequent Plan periods.

8.1.1 The Concurrences

The steps for implementation of the recommendations of the EC, would necessarily involve a review at the level of the Central Government. This process may be expedited through joint meetings between the Central and concerned State authorities. Once the necessary concurrence is obtained, a parliamentary Bill or an Ordinance would have to be prepared to declare the institutions as Institutes of National Importance, under the name of Indian Institute of Engineering Science and Technology (IIEST).

8.1.2 Statutes

Once the general concurrence is available from all concerned, the Institutions agreeing to the transformation into IIESTs would need to take steps to amend the relevant Acts and Statutes and prepare their new Statutes after the IIEST Ordinance or Act is passed. A model Statute which could be helpful to individual institutions to prepare their own draft Statutes, may be provided by the MHRD.

Following the declaration of the Statutory status of the five proposed Institutions as IIESTs, the States of Andhra Pradesh, Kerala and West Bengal would need to make amendments to the Acts concerning four of the Institutions. The UGC and the BHU-Syndicate may make necessary amendments to the BHU Act.

8.1.3 Consortium Council and Boards

After the declaration of their Statutory status as IIESTs, the Institutions should, take steps to constitute the Board of Governors of the individual Institutions and formation the Council of the IIESTs.

8.1.4 Academic Preparations

Concurrently the respective Institution may formulate the Rules & Regulations, the schemes for admissions, structuring of curriculum, budgets for renovations and new facilities and initiate steps for filling up the faculty positions and upgradation of qualifications of some of them.

8.2 The Task Schedule

The Task Schedule for the various steps is shown in Figure 8.1. Only the major tasks are indicated in the Figure. It will be necessary for each individual Institution to prepare its task schedules, elaborating upon the main tasks as well as specific time schedule for critical activities. As these steps are being pursued, adequate provisions may be made in the 11^{th} Plan for funding the formation of the IIEST.

Figure 8.1

Task Schedule

Major Task	Time Frame						Remark
	March 2006	August 2006	February 2007	March 2007	August 2007	February 2008	
1. Obtaining Concurrences of concerned authorities							To be expedited by a joint meeting with Vice Chancellors and State authorities.
2. Promulgation of Ordinance							Ordinances be promulgated if the Act cannot be passed in the Parliament in due time.
3. Preparation of Statutes							A model Statutes be given to the Institutions by MHRD to assist them in preparing their Statutes for approval.
4. Constitution of Consortium Council and Institutional authorities (Board of Governors, Academic Council, etc.)							
5. Framing of admission policies							The Consortium Council to finalize joint admission policies (should be over by March 2007)
6. Development of Curriculum							Initially adopt curricula similar to those in IITs and other reputed institutions
7. Initiating admissions							Should be jointly done by IIESTs
8. Renovation of facilities							To continue
9. Construction of New Facilities							To continue
10. Recruitment of Faculties							To continue

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Government of India
Ministry of Human Resource Development
Deptt. of Secondary & Higher Education
Technical Bureau (TS-I)
****

New Delhi, dt. 6.9.2005

OFFICE MEMORANDUM

Subject: **Appointment of an Expert Committee to examine the Vision Documents of the identified institutions and suggest the Plan of Action for their upgradation to the level of IITs.**

An Expert Committee was set up under the Chairmanship of Prof. S.K. Joshi vide O.M. dated 5th November, 2003. It had identified the following 7 academic institutions to be upgraded to the level of IITs:-

(1) Institute of Technology, Banaras Hindu University, Varanasi;
(2) University College of Engineering combined with the University College of Technology, both belonging to Osmania University, Hyderabad;
(3) Bengal Engineering College, Howrah;
(4) Jadavpur University's Engineering and Technology Departments;
(5) Zakir Hussain College of Engineering and Technology, Aligarh Muslim University, Aligarh;
(6) Andhra University College of Engineering, Vishkhapatnam; and,
(7) Cochin University of Science and Technology, Cochin.

These identified institutions have since submitted their Vision Documents for upgradation to the level of IIT's, which need further examination. For this purpose a Committee is constituted as follows:-

i)	Prof. M. Anand Krishnan, Former VC Anna University and Former Professor IIT, Kanpur.	-	Convener
ii)	Prof. A. Ghosh, Former Director, IIT Khargapur and Prof. Emeritus IIT, Kanpur.	-	Member
iii)	Prof. D.V. Singh, Former VC, Roorkee University and Vice President, Indian National Academy of Planning.	-	Member

The terms of reference of the Committee will be as follows:-

i) to examine the Vision Documents and give necessary suggestions to meet the goals
ii) to identify the gaps in resources and suggest measures to raise the additional fund requirement
iii) to suggest a Plan of Action for upgrading the identified institutions to the level of IITs.

The committee may invite other experts as special invitees if required, in its meetings and shall submit its report within two months. The Department of Secondary & Higher Education will service the Committee.

(RAVI MATHUR)
Joint Secretary to the Govt. of India
Tel: 23381097

Copy to:

1. Convener & Members of the Committee
2. PS to HRM
3. Sr. PPS to ES
4. PS to JS (T)
5. Guard File

Recommendations of the Joshi Committee*

12. The Committee looked at the 23 shortlisted institutes, colleges and universities in detail and eliminated 14 of them as explained in Section 11 above. Out of the remaining nine institutions, Punjab Engineering College, Chandigarh and the University College of Technology Kolkata were dropped from further consideration for upgradation for reasons given above in Section 11. To intercompare the remaining institutions in a quantitative manner is very risky and would be open to questions, but the Committee did attempt to order them in the following order of merit, taking into consideration all the parameters listed in 8(i) to 8(ix): -

1. Institute of Technology, Banaras Hindu University, Varanasi,
2. University College of Engineering combined with the University College of Technology, both belonging to Osmania University, Hyderabad,
3. Bengal Engineering College, Howarah,
4. Jadavpur University's Engineering and Technology Departments.
5. Zakir Hussain College of Engineering and Technology, Aligarh Muslim University, Aligarh,
6. Andhra University College of Engineering, Vishakhapatnam and,
7. Cochin University of Science and Technology, Cochin.

It would be pertinent to emphasize that all these institutions fall far below the level of existing IIT's in all criteria used for the

* *Extracted from the Report of The Expert Committee to identify Promising Academic Institutions to be upgraded into Indian Institutes of Technology*

shortlisting. The following table will make clear the nature of dilution adopted in comparison to IIT's in the selection process of these institutions: -

Academic feature	The Committee's Criterion	The IIT Level
Faculty	Majority of Professors and Readers should have Ph. D. degree	100% of Professors and Associate Professors have Ph. D.
Research Publications	More than 30 papers in refereed journals in a year	About 450 publications per year and growing
Patents	Due weightage for patents if any	20 patents a year and growing
Research Guidance	25 Ph. D's in the previous 3 years	About 70 Ph. D's in a year
Physical Infrastructure	About 100 acres of land	More than 500 acres of land
National Facilities	Not specified	At least 5 major facilities

In regard to library stock (the colleges have few tens of thousand volumes as against a few hundreds of thousand volumes in the IITs) and modern library infrastructure, so also in regard to sponsored and consultancy projects, the institutions recommended for upgradation stand substantially inferior to the IITs.

1. In the light of the substantial gap between the selected colleges and the IITs, the Committee is of the view that it would not be correct to position these colleges straightaway alongside the IITs. Such a step may even be seen to be to the detriment to the stature of the existing IITs. The Committee's suggestion therefore is that the selected institutions should be described as institutions possessing

the best potential among the Engineering and Technology Colleges in the country for upgradation to the level of IITs.

2. Before taking the final decision on the above recommendation, the Ministry may like to set up a small expert group. The group would need to visit the institutions listed in 12, to assess the suitability of institutions through such visits and also assess first hand the problems of transformation these institutions to IIT like institutes. This group can then also arrive at the quantum of one time financial support needed for managing such a transformation of the institutions in the event the government decides to upgrade any of them.

3. Once the govt. takes a decision to upgrade institutions after the visits by the above expert Group, it is imperative that the selected institutions should be enabled to reach the level of IITs in the shortest possible time. Some essential steps in such an exercise are mentioned below: -

a. First and foremost, out of the younger faculty, who do not possess a doctorate degree and are capable of doing advanced research, arrangements should be made for them to obtain a doctorate degree in advanced institutions within India or abroad.

b. Professors who have retired from IITs should be located and appointed to take up faculty positions for appropriate period of time in the institutions selected for upgradation.

c. The infrastructure requirements of these institutions being considered for upgradation into an IIT would have to be estimated. The quality of facilities including building, laboratory, library and computational facilities required, to be considerably improved and modernized. In an IIT like institution there would have to be 100% faculty housing, 100% hostel accommodation for students and about 50% staff accommodation. A broad band electronic connectivity would have to be provided.

d. It is imperative that the selected institutions are nurtured by linking them with an existing IIT in the neighborhood so that the growth to IIT levels happens with the academic support of that IIT. All the financial resources needed by the linked IIT for nurturing the institution recommended for upgradation should be provided by the Ministry of Human Resource Development.

e. It is obvious that when the government is taking a decision on upgradation of an institution, the upgraded institution should have

(i) Administrative structure identical to IIT's

(ii) The same norms of recruitment of faculty as in IIT's

(iii) The student admissions through JEE at the undergraduate level and GATE at PG level

(iv) The academic autonomy identical to IIT's.

f. It will be essential for all the colleges and institutes selected to be upgraded to become totally free from their present mother university. This will have to be made mandatory in order for the upgraded institution to adopt the governance structure of an IIT.