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HISTORY OF TECHNICAL EDUCATION

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Abstract

This paper presents an overview of the salient features of today's technical education and the growth and development of technical education in India from the eighteenth century. The nineteenth century has witnessed the birth many branches of engineering and technology in addition to the classical one of civil and mechanical. It also provides and insight into the Technical Education before independence from Vedic period. A detailed survey of growth of technical education and development of technical institutions has been made various commissions and committees on Technical Education have been briefly explaining and their recommendations. After independence Government has appointed various committees to suggest the growth and development, has also been discussed. National Policy on technical education challenges of Technical Education, Quality improvement and industry-Institution collaboration in Technical Education, Research and development, scientific and Industrial development as well as the National Policy of Education (NPE) and other vital facets has also been discussed. AICTE framed rules, regulations and guidelines in all India level in Engineering have been reviewed. At the end of the paper National Knowledge Commission has been discussed. The paper also enumerates various recommendations of committees appointed by central Government.

Introduction

The eighteenth century should be considered as a major watershed in human history. Machines came into existence to help man to increase productivity in all spheres of human activities. It brought about a revolution known as 'Industrial distribution 'Industrial Revolution' which introduced a new element in the concept of production and distribution, and laid the foundation of a technological civilization. Industrial revolution also became a forerunner of agricultural revolution through use of machinery and new techniques. It revolutionized the occupational pattern in the countries swayed by industrial revolution. The benefit of industrial revolution had been confined to the Western world for a long time. Consequently, a new economic order came into existence dividing countries into groups - industrial society and its colony, which gave birth to a new political order and concept of capitalism, and as a result, imperialism and colonialism came into existence. It introduced a new system of learning process to satisfy the growing needs of an industrial society. "The new learning system is known as technical education".

Technical education is thus comparatively newcomer in the field of learning system of training to meet the occupational needs of an industrial age. The new system was born by marrying academic education with skill training especially tailor-made, to meet challenges of new situations. Since the old system of training artisans

through passing knowledge and skills from generation to generation of craftsmen and artificers by words of mouth and long exposures to work could no more meet the challenges of fast changing technological environment, a new system of training institutions came into existence, which are today known as technical institutions distinct from normal academic institutions.

The fires technical institution came into existence in 1790. It was founded by Dr. John Anderson, a medical surgeon in Glasgow, as a school for general education of craftsmen and artisans and for teaching apprentices the use of machinery. It was soon followed by France with the starting of her first technical institution in 1794, named as Ecole des Traveaux Publique, later renamed as Ecole Polytechnique. [1]

The nineteenth century has witnessed the birth of many branches of engineering and technology in addition to the classical ones of civil and mechanical. The range of development in engineering and technology gave rise to list of separate engineering fields, which are recognized and in which four/ five years of under-graduate courses leading to a degree are offered in American universities and colleges. Within each one of the fields, there are further sub- divisions and specialization, each being the subject of special postgraduate study and research.

The 20th century witnessed tremendous progress and incredible developments took place in the field of engineering education. Technical education system is to produce trained manpower in adequate number for the economic and technological development of the country and to run its industries. It plays an important role for the economic and industrial growth, national developments and international competitiveness. It imparts technical knowledge, study, and research and facilitates technological transfer. Also another equally older stream of engineering, Automotive engineering dates from the time of the discovery of the internal combustion engine by Otto in 1870. Rudiments of chemical engineering were known in earlier metallurgical practices, but the great discoveries in organic, physical and inorganic chemistry subsequent to 1880, led to more and larger scale chemical industries. Chemical engineering courses began to be introduced about 1890, almost simultaneously in the German Technische Hoschschules and in great American Technical Colleges like the Massaschusetts Institute of Technology (M.I.T.). The first courses were introduced in England in the Imperial College of Science and Technology in 1911 .[2]

Technical Education before Independence

Our great saints and seers have been showing the entire world the path of enlightenment leading to the ultimate truth since the dawn of civilization. Even during the Vedic period (100-800BC) India had some of the prominent institutions of higher education, which attracted scholars from different parts of the world to come to India in pursuit of knowledge. Universities of Takshashila and Nalanda survived till the end of the fifth and twelfth century AD respectively. The other Vedic centers of education were located at Vallabhi, Vikramshila, Kashi, Nadia, Ujjain and Kanchi. The high quality of the manufactured articles available during the medieval period is proof of the excellent system of vocational training. People took great interest in vocational education on account of which trained workmen of every trade were available in abundance during that period.

The development of new technological activities growing out of scientific research in Europe led to the concept that practical skills be taught in special schools in India by the British. Schools were set up for imparting

skills which needed sound knowledge of mathematics, science and use of scientific instru-ments. Land Surveying was given high priority to train surveyors for government works.

The first Survey School on the Indian soil was opened in May 1794 in Madras, now Chennai. Later on, technical education spread to other parts of the country. The Madras Survey School trained only English boys. The native Indians were left out because of political and military implications of survey work. The East India Company feared that survey maps could fall into the hands of their French and Dutch rivals. Civil surveying was a well-established branch of knowledge in India as it served revenue purposes. Land revenue maps were in vogue much before the British came in. [3]

A technical institute known as the Victoria Jubilee Technical Institute was established in Bombay in 1887 to commemorate the diamond jubilee of Queen Victoria's reign. The main objective of VJTI was train licentiates in electrical, mechanical, and textile engineering and technology. Since the industrial progress in India in the nineteenth century was painfully slow, development of technical education and training was practically marginal. This was due to the economic policies followed by British in India in order to keep Indian economy subservient to British economy and to sustain the power structure of a colonial government.

In the beginning of the twentieth century, there had been a renewed realization in some quarters of the importance of technical education for development of the country. Consequently, some leading nationalist leaders who were fighting for independence of the country, started a college of engineering at Jadavpur, Bengal diploma course in mechanical engineering in 1908 followed by a chemical engineering course in 1921. A devout nationalist leader and industrialist, Sir Jamshedji Tata, also established the Indian Institute of Science at Bangalore in 1909, against the wishes of the British Raj.

Indian Institute of Science started a certificate and an associateship course and the degree level in electrical engineering against the opposition of the British Government. Although civil engineering degree course was started in the nineteenth century, as late as in 1917, the Calcutta University Commission debated the pros and cons for the introduction of degree courses in mechanical and electrical engineering. In this context, the Commission took shelter under the recommendation of the Indian Industrial Commission (1915-17) headed by Sir Thomas Holland. The Commission was against the introduction of electrical courses, as there was hardly any scope for employment of such persons except in the field of repair and maintenance of electrical machinery, for which facilities were already available.[4] But in spite of the objection of the Commission, Pandit Madan Mohan Malviya, the founder of the Banaras Hindu University started a comprehensive degree course in electrical and mechanical engineering in 1917, after having been convinced of its potentialities for the development of Indian economy.

After World War I (1914-18), in 1920s and 1930s, under the pressure for national movement and with rise of the Indian capitalist class, the Government of India was forced to grant some concession to Indian industries. However, the organized industrial units were mainly engaged in cotton spinning and weaving, jute spinning and weaving, other textile goods manufacturing, chemical and allied industries, but were to a very limited extent interested in engineering and metal works. There was hardly any heavy and capital goods industry without which

rapid and independent development of industries and economy cannot be envisaged. India lacked basic industries like heavy chemicals, machine tools, metallurgy, etc. India also lagged behind in development of electrical power which is essential for large scale economic and industrial development. The largest number of employment in technical occupations was limited to textile and allied industries and construction industries. Therefore, there was hardly any major reform in technical education and training during those periods so that its growth was painfully slow. Till the end of 1930s, there were only ten institutions offering engineering courses mainly in civil engineering with very limited facilities in electrical, mechanical, metallurgical and chemical engineering and technology. There were not affiliated to any university but mostly managed by the Department of Industry in selected provinces.

The Abbot-Wood Report, 1936-37

Two expert advisors, Messrs. A. Abbot, formerly Chief Inspector of Technical Schools, Board of Education, England and S. H. Wood, Director of Intelligence, Board of Education, England, were invited to advise the government on certain problems of educational reorganization and particularly on problems of vocational and technical education. One of the basic reasons for instituting the enquiry was because of the fact that a large number of university graduates were unable to secure employment of a kind for which they received education. The report of Messer's Abbot and Wood recommended major reforms in the educational system by suggesting a complete hierarchy of vocational and technical institutions parallel to that of institutions imparting general education.[5] On the basis of their recommendations, a new type of technical institutions called "Polytechnics" came into existence for training of middle level technical personnel[6]

Delhi Polytechnic (**1941**) which has now been converted into an Engineering College was the first in the chain of such polytechnics. **In 1941-42**, only 264 students were studying in graduate courses of technical education and 22 students in chemical technology respectively[7]

The Laxmi Narayan Institute of Technology was founded in Nagpur in 1943 as a sequel to the will of Rao B.D. Laxmi Narayan according to which the annual income of his state was bequeathed to the Nagpur University for the purpose. The Institute started with two year BSc (Technology) degree course in chemical engineering and oil technology.[8]

Engineering Education:

Establishment of an Engineering college at Roorkee:

The establishment of an Engineering college at Roorkee was originally suggested in 1846 to the Hon'ble Mr. James Thomson, Lt. Governor of the then North-West Province (which was later known as United Province of Agra and Avadh and now consists of Uttaranchal & Uttar Pradesh) by Sir Proby Cautley of the Bengal Artillery, the famous designer and builder of the Ganges Canal, to train officers and subordinates for meeting the immediate needs of constructing this canal. But for the construction of the Ganges Canal, this famous college would not have come into existence and so it may be said that that the college owes its birth to the waters of the Holy Ganges. This project of building a College of Engineering at Roorkee received the total support of the then Governor-General in India as the engineers were needed for carrying out the extensive works of drainage, irrigation, road making, railways,

buildings, etc., around Delhi and practically all over India. The college was thus established in 1847 with Lt. Col. Robert Mac lagan as its first Principal. The classes stared in January 1848. Since then, the college has grown steadily from the humblest beginning to its present proud position of being one of the leading seats of learning and technical knowledge. The design of the College was entrusted to Lt. Gorge Price of the First Bengal Fusiliers in 1851 and the work of construction of its buildings was started in 1852 under the supervision of the same officer. Lt. Gorge Price, with his remarkable foresight and judgment, designed and constructed the grand edifice of the Thomson College which was built in the Renaissance style of architecture and stands majestically facing north across the plains towards the snowy peaks of the Himalayas. The construction was completed by 1856. The Court of Directors of the East India Company ordered by notification that the Roorkee college should be called the "Thomson College of Civil Engineering", by which name it was known till October 1946.

The Roorkee University Bill for converting this college into a Technical University was passed by both Houses of the Provincial Legislature and consequently the University of Roorkee came into existence in 1949. The University, after having a glorious history of progress in higher technical education for over a century, was converted into the Indian Institute of Technology in September 21, 2001 by an Act of Parliament. [9]

Commissions and Committees on Technical Education

The Hunter Commission of 1882

In 1882 an education commission, known as the Hunter Commission, was appointed by the Government to report on the whole question of education in the country. The following instructions regarding Secondary education were given: "The Commission was directed to enquire into the quality and character of the instructions Imparted in schools of this class. The great majority of those who prosecute beyond the primary stage will never go beyond the curriculum of the middle, or at farthest of the high schools. It is therefore of the utmost importance that the education they received should be as thorough and sound as possible. There are grounds for doubting whether there is 'not, in some provinces at any rate, much room for improvement in this respect."

The report of the Hunter Commission of 1882 is a valuable document which not only gave an excellent survey of the position of secondary schools at that time, but made certain fundamental recommendations concerning the type of education to be given at this stage. It anticipated what has, come to be recognised later as diversified courses of instruction in the secondary stage of education. With regard to vocational and technical education, the commission recommended that in a particular class of high schools there should be two avenues, one leading to the entrance examination of the University and the other of a more practical character intended to fit the youth for commercial, vocational or non-literary pursuits. In spite of such specific recommendations, neither the public nor the Government seem to have appreciated the value of the suggestions, with the result that the recommendations were practically ignored. The Government recognized that the future economic and industrial growth of the country entirely depends on the quality of technical education imparted in our institutions and the type of practical training provided to enable the future generation of engineers to become competent innovators, designers and product manufacturers. After independence various educational commissions and committees were made to recommend

highly practical and research oriented recommendations and development plans for technical education in the country. In 1945, Sarkarcommittee was appointed by the AICTE under the chairmanship of Mr. N.R. Sarkar. This committee was recommended the establishment of higher technical education institutes known as IITs in order to meet post war needs of engineers of higher level. These institutes aimed at providing excellence in science and engineering education. [10]

The Government of India appointed a Commission under the chairmanship of S. Radhakrishnan in 1948-49 to examine the Indian University education -- including technical education -- and to suggest improvements and extensions. The Commission in its report emphasized the need of new types of engineering and technical institutions in India to produce men not only skilled in technology but who were well integrated individuals. It was emphasized that technical education must include elements of general education and engineering courses should have underlying scientific studies. The commission also advocated closer liaison between engineering colleges and universities so that the colleges would grow vigorously in an atmosphere of higher research in science. Wherever possible, the existing engineering and technical colleges should be upgraded for postgraduate training and research. The Commission further recommended to start, without delay, higher technological institutes to produce much needed engineer-scientists and design and development engineers. [11]

The Commission clearly advocated that engineering colleges be not controlled or dominated in their administration by the Government. These and other recommendations led to several developments in the succeeding years. The first year of all undergraduate degree courses were made common in all branches of engineering. Curricula were revised to include general education and basic physical and engineering sciences.[12] In pursuance of the Sarkar Committee recom- mendations, five Indian Institutes of Technology were gradually established between 1950 and 1961. **The Secondary Education Commission (1952)** worked under the chairmanship of Dr. A. Lakshman Swami Mudaliar. This commission made the following recommendations. “Technical schoos should be started in large number either separately or as part of multi-purpose schools. Central technical institutes should be established in large cities. Where ever possible these should be located in close proximity to appropriate industries. A small cess to be called the Industrial Education Cess should be levied on industries and the proceeds of this cess should be used for the furtherance of engineering education.” This commission supported the recommendations of the previous commission but it suggested a new method of collecting funds for the engineering education. [13]

• The Planning Commission, in September 1955, appointed the Engineering Personnel Committee, to undertake an overall assessment of the demand and supply position in respect of engineering personnel during Second Plan Period. The Government of India decided to implement the first part of EPC recommendations in 1957. Accordingly, it was decided to establish eight new colleges.[14]

In 1958, due to recommendations of National Development Council, the Planning Commission decided to appoint working groups on different subjects in order to consider the various issues relating to the third Five Year Plan.

In 1959 under the Chairmanship of Prof. M.S. Thacker, the then Secretary, Ministry of Scientific Research and Cultural Affairs. Many of the recommendations of the working group were subsequently implemented. [15]

The Apprentices Act of 1961 was approved by the Central Government in consultation with Central Apprenticeship Council.[16]

Under this Act, a voluntary scheme known as "Programme of Apprenticeship Training" was arranged by the Ministry of Education, GOI. The object of this scheme was to provide practical training facilities to unemployed engineers and diploma holders (Polytechnics) in order to furnish them for gainful employment in industry [17].

• The next important landmark in the development of technical education in India was the appointment of the Education Commission in July 1964 under the Chairmanship of Prof. D.S. Kothari. It has been considered a mile stone because its suggestions were scientific, more wide spread and more practicable besides taking into consideration the new environment of the country. The Kothari Commission Report of 1964 contains many recommendations on technical education, including the importance of practical training as an integral part of the courses and the need for industry-institute interaction. As a measure designed to provide each state with Regional Engineering College, seven more colleges were approved for establishment during the Third Plan Period.
In 1968, the document on "National Policy on Education", which was published by the Government of India, mostly reiterated the recommendations of the Committee of Members of Parliament on Education [18] .

In the last four decades since Independence, there was a phenomenal expansion of technical education in India at the Polytechnic Diploma level after the Independence of the country. In 1947, there were only 53 diploma level and 38 degree level courses in technical education and they could admit only 3,670 students each year[19].

• Fifteen Regional Engineering Colleges were thus established, one in each of the major states by 1972. Two colleges were subsequently established at Hamirpur in Himachal Pradesh (1985) and Jallandhar in Punjab (1989), raising the total number to 17.
• Consolidation and quality improvement in the field of technical education was given importance during the period 1967 – 1980. The Indian Society for Technical Education (ISTE) and four Technical Teachers' Training Institutes contributed sizeably towards this goal.
• The ISTE was registered in 1967 as a national professional society of teachers and administrators of engineering colleges and polytechnics with the main objective of advancing the cause of technological education in the country. As a strategic partner of AICTE, ISTE has been organizing summer and winter schools for the teachers of degree engineering colleges and polytechnics every year since 1965. About 3100 programs have been arranged in which over 75,000 teachers have been participated till date.
• On the recommendation of AICTE, the government established four Regional Technical Teachers' Training Institutes at Bhopal, Calcutta, Chandigarh and Madras in 1967, to meet the requirements of developing polytechnic education in their respective regions.
In 1970-71**,** however, there was widespread criticism of the system of Polytechnic education prevailing in the country. It was felt that the diploma courses in our polytechnics were "mostly theoretical with very little practical bias". So, to make polytechnic education more practical, Govt. of India on the advice of AICTE, constituted a "Special Committee for Re-organisation and Development of Polytechnic Education" under the Chairmanship of Prof. G.R. Damodaran popularly known as Damodaran Committee[20].

•The Apprentices Act of 1961 which sought to regulate and control the training of apprentices in trades was amended in 1973 with view to bring the training of engineering graduates and diploma holders within its purview.[21]

• The Central Government formulated a program named "Direct Central Assistance" was started to selected Engineering Colleges and Polytechnics in order to bring about qualitative improvement for improving the standard and quality of technical education with particular reference to developing the faculty of engineering colleges and polytechnics. This scheme was approved by AICTE in 1969. [22]

Ministry of Education and Social Welfare, Government of India, established a Working Group on Technical Education in November 1977,. This group made an in depth study of the Technical Manpower, Research and Development, Diversification and Redesigning of the existing programmes, Quality Improvement and Industry-Institutional Collaboration in Technical Education.[23] This Working Group also emphasized need for continually reviewing the system of technical education for "Harnessing Science and Technology to profitable and productive processes of economic growth and social well being".

• In 1979, the Government of India published a new draft of national policy on education-1979, which advocated the need for creation of a machinery for dissemination of information relating to manpower needs in the field of technical education. [24]

In order to assess the impact of foreign technical assistance on the development of technical education, The Ministry of Education, GOI appointed a Review Committee in June, 1978 under the Chairmanship of Dr. A. Rama Chandaran, the then Secretary, Department of Science & Technology.

Prof. Nayundamma, former Director General of Council of Scientific and Industrial Research was appointed as Chairman of the Review Committee. It was suggested that this Committee should examine how the IIT's could offer technical assistance to academic institutions of lower formations such as engineering colleges.[25]

Another Committee was also appointed by the GOI in 1978 to review the progress so far made in the area of post graduate education and research in engineering and technology and to report on all aspects of its further development. Once again, Prof. Y. Nayudamma, distinguished Scientist and Former Director General, Council of Scientific and Industrial Research, was selected as a Chairperson of this review committee.[26]

• In June 1981, the Government of India published a guideline document on the scheme of community polytechnics in India, which was started during 1978 – 1979 on the recommendation of AICTE.

During the year 1982-83, two National Experts Committee selected 12 Engineering Colleges and 22 Polytechnics for grant of assistance involving a total expenditure of Rs. 111 Lakhs.[27]

• The National Policy of Education (NPE), 1986, was a major development in the field of education in India. For the first time in the country, a national debate was initiated by publishing a document titled **"Challenge of education"** which resulted in a blueprint for national policy on technical education.

• The national policy helped to focus attention of the public in general on the need to adopt innovative approaches to education, which resulted in the formulation of program of action in 1992.

• After 1990, the spirit of globalization was responsible for industrial growth and competition. Not only quantitative but qualitative demand of technical manpower received a boost. In order to meet these requirements, privatization of professional education is being promoted to supply skilled technical manpower in adequate number.

• **P.Rama Roa Committee (1995)** reported in its report entitled reassessing the technical education crisis that "There is a considerable distortion in the technical manpower generation. Infrastructure facilities available in a vast majority of the technical institutions are alarmingly inadequate. The quality of education in most of the institutions is poor. The teaching competencies is low'.

Mashelkar(1998) report was entitled, 'Strategic Road Map for Academic Excellence of future RECs'. As recommended by this report since 2002 the government has upgraded in phases, all the 17 REC to National Institutes of Technology. This upgradatin has been done on the lines of the prestigious IITs, after it was concluded that REC's have immense potential as proven by the success of their alumni and contributions in the field of technical education. Subsequently it is provided with more working autonomy and have been granted deemed to be university status to award their on degrees.

Birla-Ambani Report (2000), that was presented to the Prime Minister's Council of Trade and Industry stressed that engineering institutions should be organized by private enterprises, and NRIs may be permitted to open and run technical and engineering institutions at their behest. Those institutions that have been accredited higher by NAAC may be given independent status as deemed universities, so that they should be able to take independent initiatives for the development of engineering education as required by the new environment. In this connection it was also recommended that the status of Regional Engineering Colleges may be raised to that of Institutes of Excellence. These institutions would serve the nation with new innovations in the engineering education institutions in sufficient number. Moreover these institutions must be provided with funds required for excellent laboratories, libraries for the faculty to attract the most efficient and intelligent individuals from the national and foreign academic institutions.Around 2000, global demand and expansion in the Information technology led to exponential growth of IT and IT enabled services. This in turn resulted in establishment of IT specific courses throughout the State.[28]

U.R RAO COMMITTEE (2002) reviewed the performance of the AICTE and drew attention to the unsustainable expansion of technical education. The committee strongly recommended that quality in teaching must be maintained and desired fee levels may be stabilized in the engineering institutions. This report also revealed that there were not enough engineers with higher qualifications to teach in the institutions. [29]

Department Related Parliamentary Standing Committee regarding Human Resource Development (HRD's) report (2003) laid stress on government & private initiative in setting up engineering institutions in North East region. Moreover this committee also recommended that there should be uniformity in all India level for eligibility criteria for admission in engineering education. On the recommendations of the committee, AICTE had framed regulations in norms and guidelines for fees and admission in engineering institution. [In the year 2002-03 a Common Entrance Test for admission in engineering colleges (AIEEE) was started]. The committee also took many steps in respect of career advancement and modification of pay scales for the faculty of engineering colleges.

Beside this accreditation had been made mandatory to maintain the quality of all institutions. Another recommendation given by the committee was regarding giving grant and autonomy to engineering institutions possessing adequate infrastructure and competent faculty, etc. Another recommendations made by the committee

wasthat shortage of funds could be tackled through generation of resources by the institutions themselves through industry-institute contacts, generation of technology for the industry and renting of the labs etc.

• After 2005, stabilization of Indian Economy and continuous growth of GDP (more than 8% per annum) resulted in huge expansion of Indian Industrial sector. This in turn, helped to gear up expansion of Technical Education in the State of Maharashtra. [30]

V. MOILY COMMITTEE (2006) gave its recommendations regarding reservations for OBCs in a phased manner in the institutions. Another suggestion made by this committee was that the cut-offs for admission should be somewhere between those for the SC and ST categories and the general category so that reservation does not compromise the quality of education. The implementation of the quota in the IITs should be left to their discretion. The new reservation process may cover all central and elite institutions like IITs and are to be accompanied with a 54% expansion of seats in order to ensure 27% quota for OBCs. Besides recommending a liberal financial package for the expansion of plan, the committee was also understood to have suggested liberalizing the retirement age of faculty & re-employment of retired faculty.[31]

The high powered committee headed by **Justice Rajinder Sachar** (2006) has investigated the social, economic and educational status of Muslims. The committee has recommended that it is necessary to increase the participation of Muslim community in engineering education, which is a minority in India.

NATIONAL KNOWLEDGE COMMISSION (2008) under the chairmanship of Mr. Sam Pitroda recommended that there was a need to establish an Independent Regulatory Authority for Higher Education (IRAHE) to overall streams. The role of the standing committee on Engineering Education under IRAHE would be to exercise due diligence at the point it approved entry for an institution to grant degrees/diplomas. The member of the committee should be comprised of eminent educationists, educational administrators and management specialists drawn from industry. The committee would follow transparent and uniform processes under the overall supervision of IRAHE. The committee would also determine the criteria and the processes of accreditation and license multiple agencies for the same. A mechanism for ranking of institutions to enable students to take informed decisions at the time of admissions by stipulating grading norms and nominating independent rating agencies was also recommended to be established. These initiatives would enable the AICTE to focus on important issues such as curriculum development, pedagogy, faculty development etc. Moreover it was also recommended that in order to encourage greater flexibility and autonomy, there was a need to progressively do away with the system of affiliation of engineering institution / colleges to the universities where feasible, they should be given full autonomy. To attain greater transparency and accountability, it should be made compulsory for all engineering institutions to display information about their building, labs, faculty, intake of students, performance of student, recognition status and placements on their websiters. Furthermore, it was also recommended that the current curriculum should be modified to provide greater flexibility, interdisciplinary perspective and choice of electives. The focus in the teaching/leaving process should be on integrating skills such as problem solving and logical reasoning process orientation, learning ability, English communication and programming fundamentals, industry participation to discuss real life case studies should be encouraged. Laboratory courses must be revamped to develop a healthy attitude towards experimental work environment must be created to encourage students to participate in co-curricular activities.

The NKC also gave detailed recommendations about integrating science and engineering education, encouraging research, industry-academic interactive, interaction, improving access and mentoring role to be played by NITs and RECs. February, 2009 meeting of **CABE** (Central Advisory Board on Education) noted that government had decided to setup eight new IITs in Andhra Pradesh, Bihar, Rajasthan, Orissa, Punjab, Gujarat, Madhya Pradesh (Indore) and Himachal Pradesh. Apart from there it was also noted that IISERs at Mohali, Pune, Kolkatta, Bhopal and Thiruvananthpuram had started functioning from temporary premises. Moreover to adverse the increasing skill challenges of the Indian IT industry and growth of the domestic IT market, the Ministry of Human Resources Development (MHRD), Government of India intended to establish twenty Indian Institute of Information Technology (IIITs) during the 11th Five Year Plan Period, on a Public Private Partnership (PPP) basis. The process of opening of nine NITs was also started. [32]

Yashpal Committee (2009) has recommended IITs should not be meant for the isolated study of engineering only, rather they should produce scholars in literature, linguistics and politics along with the engineering.

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