Chapter 2

History of Development of Technical Education in India

"Study the past if you would define the future." — Confucius

Section 2.1: Introduction

The purpose and objective of this investigation and the research methodology being adopted having been discussed in the previous introductory chapter, we now proceed for a formal beginning of the subject by focusing on the course of development of technical education in India since pre-independence period. The growth of technical education institutes has been rather restricted even during the post-independence period. It is only after 1991, the growth rate has been phenomenal.

Section 2.2 depicts the pre-independence development of technical education. Section 2.3 highlights on the various measures suggested by the different Commissions and Committees set up by the Government of India for the development of technical education in India. The development of technical education in the post-independence period has been captured in Section 2.4. In Section 2.5, we have paid special attention to the development in four major states where the growth of technical education institutes has been quite phenomenal. Section 2.6 briefly touches upon the legislative initiatives undertaken by the Government of India during the recent past for bringing in changes in higher education, in general, and technical education, in particular. A new phenomenon that private engineering colleges have started winding up their courses because of lack of demand has been highlighted in Section 2.7. Various quality improvement programmes like TEQIP, AICTE-INDEST Consortium, NPTEL, EETP and NEEM have been discussed in Section 2.8.

Section 2.2: Pre-independence development

Technical education is comparatively a newcomer in the field of learning system. The new system was born by marrying academic education with skill training to meet the occupational needs of an industrial age. The industrial revolution which took place in the eighteenth century introduced a new method of machine-based production. Various scientific and technological inventions and innovations during this period had not only increased productivity but also made the production process more complex. It started with the mechanization of textile industries, the development of

iron-making techniques and the increased use of refined coal. It gave birth to the technology of the mass production, quality products at affordable prices. Many manufacturing units came up which required unskilled as well as skilled labour. The old system of training artisans through passing knowledge and skills from generation to generation of craftsmen and artificers by words of mouths 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 first technical institution, which came into existence in 1790, was founded by Dr. John Anderson, a medical surgeon in Glasgow, as a school for general education of craftsmen and artisans. 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.[8]

The nineteenth century witnessed the birth of many branches of engineering and technology in addition to classical, civil, and mechanical engineering, thus introducing a new dimension and challenge to technical education. The oldest surviving technical institute in the world, still surviving with its name, is perhaps the Rensselear Polytechnic Institute of Troy (New York State) in USA which was founded in 1823 and started giving degree in civil engineering in 1835.[9] Since then engineering and technical education is constantly developing and changing at a rapid pace.

[8] Sen Biman, 1989, Development of Technical Education in India and State Policy—A Historical Perspective, Indian Journal of History of Science, 24(4): 224-248 (1989).
[9] ibid

Table 2.1: Pioneering Technical Schools and Colleges in Europe, USA and Germany

Year	Place	School/College	Branch	New Name
1790	Glasgow	School of Apprenticeship	Craftsman and Artisans	Royal Technical College
1794	France	Ecol Des Trevenx Publique	Technical Civil Service Training Schools	Ecol. Polytechnique
1823	Maine, USA	Bowdolin College		Discontinued
1823	New York	Rensseluer Polytechnique	Civil Engineering	Rensselaer Polytechnique Institute
1879	Berlin	Technische Hoceule		Discontinued
1890	Massachusetts Institute of Technology USA	MIT	Electrical Engineering	Massachusetts Institute of Technology USA
1805	London	Imperial College of Science and Technology	Civil and Mechanical Engineering	Imperial College, London

(Source: http://en.wikipedia.org/wiki/Imperial College London accessed on 22.08.2014)

The foundation of technical education was laid in India almost at the same time as in Europe but its growth was stunted till India become independent. When Britain captured the political power and became the ruler of this country, the British traders established a Survey School at Madras in 1794, to train Indian personnel in modern land survey and to assist British surveyors.[10] Thus, the first effort in setting up of technical institution in India came only out of the necessity of the British rulers for training middle level technical personnel required for construction and maintenance of public buildings, roads, canals, ports and railways, as well as for training artisans and craftsmen in the maintenance of instruments and equipments needed for army, navy and other technical establishment.

As the British moved to the north, a school of surveying was also established in 1806 at Saharanpur which later became Roorkee College in 1847 and subsequently, Thompson College of Engineering in 1854, at Roorkee. In 1948, the Roorkee University Act was passed and in 1949, the status of this college was further enhanced and the Roorkee Engineering College became first Technical University of India. After

[10] Sen, Biman.(1989). Technical education in India 1921-80. In *Studies in educational reforms in India*. P.R. Panchamukhi. Ed. vol. 3 part-2. Bombay, Himalaya. p.189.

completion of 150th year of existence, the Institute has been given the status of Indian Institute of Technology (IIT) in 2001.[11]

In pursuance of the British Government policy, three Engineering Colleges were opened by about 1856 in the three Presidencies. In Bengal, a College called the Calcutta College of Civil Engineering was opened at the Writers' Buildings in November 1856; the name was changed to Bengal Engineering College in 1857, and it, was affiliated to the Calcutta University. It gave a licentiate course in Civil Engineering. In 1865 it was amalgamated with the Presidency College. Later, in 1880, it was detached from the Presidency College and shifted to its present quarters at Sibpur, occupy in the premises and buildings belonging to the Bishop's College. The institute was renamed as Bengal Engineering College in 1920, subsequently was converted to a full university called Bengal Engineering and Science University (BESU), Shibpur and in 2014, it was renamed as Indian Institute of Engineering, Science and Technology (IIEST), Shibpur.[12]

Proposals for having an Engineering College at Bombay city having failed for some reasons, the Poona Engineering Class and Mechanical School was opened in July 1854, with an aim to provide suitable learning to the subordinate officers in the Public Works Department. This school eventually became the The Poona Civil Engineering College and was affiliated to the Bombay University in 1866. Subsequently in the year 1911, the nomenclature was changed to the "College of Engineering, Poona" and was later affiliated to the University of Pune.[13]

The early development of Collegiate Technical Education witnessed the establishment of some more technical institutes like Guindy College of Engineering, Madras in 1859, Tata Institute, now known as Indian Institute of Science in 1909, Delhi Polytechnic in 1941, later known as Delhi College of Engineering and subsequently, in 2009 as Delhi Technological University, Jabalpur Engineering College in 1947. The 13 Regional Engineering Colleges and the 5 IITs were later added in the late 1950's and early 1960's to strengthen India's higher technical education. Phenomenal growth of technical education has however, been witnessed in the post liberalisation era which began from 1991 onwards with an upsurge of private initiatives in technical education. Table 2.2 gives the growth profile of technical education in India prior to the

[11] http://www.iitr.ac.in/institute/pages/Heritage.html (accessed on 14.04.2015)
[12] http://www.becs.ac.in/index.php/iiest-institute/about (accessed on 14.04.2015)
[13] http://www.coep.org.in/about/history (accessed on 14.04.2015)

liberalisation era and Table 2.3 depicts the growth of technical education in the post-liberalisation era.

Table 2.2: Pioneering Technical Institutes in India

Year	Name of the Institute	Place	Branch	New Name of the Institute
1847	Thompson College of Engineering	Roorkee	Civil	Indian Institute of Technology, Roorkee
1854	Poona Engineering Class and Mechanical School	Poona	Civil	College of Engineering, Poona
1856	Calcutta College of Civil Engineering	Writers' Buildings, Calcutta	Civil	Institute of Engineering, Science and Technology (IIEST), Shibpur
1858	Civil Engineering School	Madras	Civil	College of Engineering, Guindy (CEG)
1887	Victoria Jubilee Technical Institute	Bombay	Electrical, Mechanical, Textile	Veermata Jijabai Technological Institute
1906	Bengal Technical Institute	Calcutta	Mechanical, Chemical	Jadavpur University
1909	Tata Institute	Bangalore	Electrical, Chemical	Indian Institute of Science (IISc)
1919	Benaras Hindu University	Benaras	Mechanical, Electrical, Metallurgy	Indian Institute of Technology (IIT—BHU)
1941	Delhi Polytechnic	Delhi	Chemical, Architecture	Delhi Technological University
1947	Government Engineering College	Jabalpur	Telecommunication	Jabalpur Engineering College
1959	Regional Engineering Colleges	17 states	Various disciplines	National Institutes of Technology (NITs)

(Source: http://shodhganga.inflibnet.ac.in/bitstream/10603/7053/7/07_chapter%202.pdf , accessed on 14.04.2015)

Section 2.3: Commissions and Committees on Technical Education and their recommendations

Different Commissions and Committees have been set up by the Government of India to suggest measures for the development of technical education in India. These Commissions and Committees were also asked to review the progress achieved and make recommendations for further reform in this sector. We discuss below the major recommendations of these Commissions and Committees.

2.3.1: Sarkar Committee (1945 - 1949)

The Government of India appointed a Committee, under the Chairmanship of the late Sri Nalini Ranjan Sarkar in 1945 to make recommendations in respect of Post-

War Reconstruction of Technical Education in India. The Sarkar Committee recommended that four higher technical institutions in the pattern of Massachusetts Institute of Technology may be established in the North, South, East (in or near Kolkata) and West (in or near Bombay). As a consequence, five IITs were established at Kharagpur, Bombay, Kanpur, Madras and Delhi between 1951 and 1963. The IITs were created with foreign technical collaboration and UNDP assistance[14].

2.3.2: S. S. Bhatnagar Committee (1947)

A Scientific Manpower Committee was appointed under the chairmanship of Dr. Santi Swarup Bhatnagar, Secretary, Ministry of Education and Educational Adviser to Government, in 1947 to assess requirements of scientists, technologists, engineers and doctors for meeting the needs of economic and industrial development after independence. The committee made the first-ever systematic assessment of the scientific manpower needs of the country.

2.3.3: Thacker Committee (1959 – 1961)

In 1959, a committee was formed under the chairmanship of Professor M.S. Thacker, which made a comprehensive study of postgraduate engineering education and research. The Committee submitted their report in 1961. The major recommendations of the Committee were:

i) Quality and standard should be the watch-word of post-graduate courses in engineering institutes.

ii) Urgent measures should be taken to improve the staff position at all technical institutions. The teachers teaching in the degree level colleges should possess post-graduate qualifications in order to be eligible for appointment.

iii) For a vigorous growth of technology, institutions and industry should come closer and establish cooperative relationships between themselves. The cooperative courses may be conducted in association with industry whereby the technical and other facilities available in industry are utilised to the maximum extent possible in the post-graduate development.

[14] Saha Samir Kumar and Sangita Ghosh, 2012, Commissions & Committees on Technical Education in Independent India: An Appraisal, *Indian Journal of History of Science,* 47.1 (2012) 109-138

Growth and development of postgraduate education and research in the country in the 1960's and 1970's was significantly influenced by the recommendation of the Thacker Committee.[15]

2.3.4: Damodaran Committee (1970)

The Government of India appointed a high powered committee in 1970 under the Chairmanship of G.R. Damodaran to examine the unemployment problems of technicians and to suggest some solutions. The Committee examined the entire gamut of polytechnic education, so as to prepare a blueprint for future development. This report is considered the bedrock of polytechnic system and helped to revamp the polytechnic education in India.

2.3.5: L.S. Chandrakant Committee (1971)

A Committee was set up in 1971 under the Chairmanship of Dr. L.S. Chandrakant, the then Educational Advisor to Government of India to make an appraisal of the postgraduate education and research programmes. The Committee recommended a revision of post-graduate curricula with a view to reducing over-emphasis on theory and increasing, emphasis on laboratory and project work. It was in favour of giving institutions freedom to initiate new programmes.[16]

2.3.6: Nayudamma Committee (1978 – 1980)

A Review Committee on Post-Graduate Education and Research in Engineering and Technology was set up under the Chairmanship of Dr. Y. Nayudamma in 1978. The Committee recommended that

i) Course of study should ensure participation of industry and be need-based.

ii) Tax rebate may be offered to industry on contributions to postgraduate education and research in engineering and technology.

iii) AICTE should be made a statutory body through an act of parliament.

2.3.7: National Policy on Education (1986)

The National Policy on Education (NPE), 1986 and its Programme of Action (POA) as updated in 1992 are based on review of the entire educational system in the country. The major recommendations include:

[15] ibid
[16] ibid

i) The All India Council for Technical Education (AICTE) would be responsible for planning, formulation and the maintenance of norms and standards, accreditation, funding of priority areas, monitoring and evaluation etc.

ii) Technical Manpower Information System should be developed and strengthened to improve the situation regarding manpower information.

iii) The engineering curriculum should be prepared according to the needs of industry and it should be continuously updated to phase out obsolescence and introduce new technologies.

According to the recommendation of the National Policy on Education 1986, the AICTE was made a statutory body through an Act of Parliament, in December, 1987.

2.3.8: Nayudamma Committee (1986)

The Government of India constituted a Review Committee under the chairmanship of Dr Y. Nayudamma to review the functioning of the five IITs at Kharagpur, Bombay, Madras, Kanpur and Delhi. Its main recommendations were:

(i) Instead of starting new IITs, support to Departments/Engineering Colleges/Centres who have performed well was recommended.

(ii) UG & PG Programmes should be reviewed periodically and updated to match the developments in Science & Technology

(iii) Institutions like the Regional Engineering Colleges (later renamed as NITs) should be given additional funds and should be upgraded so as to improve upon their quality.

2.3.9: P Rama Rao Committee (1995 – 1999)

A Committee headed by P. Rama Rao was constituted in 1995 (its report submitted in 1999) to review the Post-Graduate education and research in engineering and technology. The recommendations of this Committee were:

(i) Attractive fellowship and contingency grant should be given to attract motivated and meritorious scholars.

(ii) To meet the shortage of faculty certain programmes e.g. Early Faculty Induction Programme and Quality Improvement Programme should be expanded.

(iii) Manpower Information System should be build.

2.3.10: Mashelkar Committee (1996 - 1998)

A high powered Committee under the Chairmanship of Dr. Raghunath Anant Mashelkar was constituted in 1996 to review the progress and achievements of the Regional Engineering Colleges and suggest the future role of R.E.Cs in building a high quality Technological Education base in the country. The committee came out with recommendations on governance structure, academic matters, faculty issues and staff development and funding issues. The Mashelkar Committee report was fully accepted and recommendations were implemented by the government. As a result, 17 Regional Engineering Colleges were converted to National Institutes of Technology (NIT), changing the entire pattern of funding and governance and the control was shifted from state to centre[17].

2.3.11: U.R. Rao Committee (2002 - 2003)

A review Committee was set up in 2002 under the chairmanship of Prof. U.R.Rao, former Chairman of ISRO, to review the functioning of the AICTE and to redefine its role in view of the emerging changes and to suggest steps for further improvement. Major recommendations of the Committee include:

i) The number of institutions and the intake of students should be controlled more rigorously. Institutes not having enough faculty or infrastructure must be ruthlessly stopped.

ii) Right type of salary should be paid to the employees.

iii) Industry should also bear the cost of Technical Education.

iv) Further expansion of UG technical institutions should not be allowed and approvals for new institution should be stopped for at least 5 years in states where the UG student intake exceeds the national average of 350 per million population.

2.3.12: P Rama Rao Committee (2002 - 2004)

A Committee under the chairmanship of Dr. P. Rama Rao was constituted in 2002 (its report submitted in 2004) to review working of the IITs. Some of the recommendations of this Committee were:

i) The faculty members are to be given incentives for their outstanding performances.

[17] ibid

ii) Collaborative project works are to be encouraged with the foreign institutions.

iii) Alliances with other national laboratories and funding agencies are to be promoted. Industries are to be encouraged to invest in major joint research projects with IITs.

2.3.13: National Knowledge Commission Report on Technical Education (2005 - 2008)

The National Knowledge Commission was constituted in 2005 by the Prime Minister of India, Dr. Manmohan Singh to help frame a policy that might sharpen India's comparative advantage in the knowledge-intensive service sectors. NKC proposed the following set of initiatives:

i) Regulatory Framework to be reformed by establishing an Independent Regulatory Authority for Higher Education (IRAHE) to cover all streams. An autonomous Standing Committee for Engineering Education should be established under proposed Independent Regulatory Authority of Higher Education.

ii) Professionals from industry and research laboratories should be invited to participate in the teaching process.

iii) In order to meet the increasing demand, more institutes of excellence need to be established. Public private partnership could be explored for the same purpose.

Many of the recommendations of the NKC have been implemented by the Government. These include:

1) The Government has undertaken a massive expansion programme and is in the process of setting up eight Indian Institutes of Technology (IITs), 10 National Institutes of Technology (NIT), 20 Indian Institutes of Information Technology (IIITs) as far as possible in the Public-Private Partnership mode.

2) The Committee for Rejuvenation and Renovation of Higher Education, set up for the review of UGC/AICTE has submitted its report.

3) The Science and Engineering Research Board Bill 2008 have been introduced in the Parliament.

2.3.14: The Yashpal Committee (2008 - 2009)

"The Committee to Advice on Renovation and Rejuvenation of Higher Education in India", headed by scientist Yashpal was constituted in 2008 to review the functioning of the UGC and the AICTE and critically assess their role and preparedness in providing institutional leadership to the emerging demands of access, equity, relevance and quality of higher education/technical education and the university system. Major recommendations of the Committee include:

i) Universities to be made responsible regarding the academic content of professional courses;

ii) Abolition of multiple regulatory system consisting of UGC, AICTE, NCTE etc. and creation of a single regulator namely, National Commission for Higher Education and Research (NCHER) at the national level.

iii) Institutions of excellence like the IITs to be converted into full-fledged universities.

2.3.15: Dr Anil Kakodkar Committee (2010 - 2011)

A Committee was constituted by the Ministry of Human Resource Development (MHRD) in 2010 under the Chairmanship of Dr Anil Kakodkar to suggest a roadmap for strengthening the financial, administrative and academic autonomy of the IITs. Major recommendations were as follows:

i) IITs to be made independent of non-plan (operational) support from the Government for their operational expenditure while at the same time seeking greater plan (capital) support to enhance research in a comprehensive manner.

ii) The curriculum system needs to adopt greater flexibility to provide greater choice to students so that they are better prepared for a chosen career option.

iii) At least 100,000 quality engineering graduates per year through Central government-funded institutions alone should be produced.

2.3.16: Technical Teachers' Training

Training of teachers working in engineering colleges is very important for ensuring quality in teaching. In India, several committees had stressed on the importance of training of technical teachers. Although these committees were

primarily focussed on polytechnic education, some of their recommendations had ramification for engineering education also.

2.3.17: Kelkar Committee (1976)

The Committee under the Chairmanship of Dr. P.K.Kelkar, Ex-Director, IIT, Bombay, while evaluating in 1976 to what extent the aims and objectives of the TTTIs had been fulfilled, recommended introduction of Modular Training Programme and Short Term Training Programme at the TTTIs.

2.3.18: Amitabha Bhattacharya Review Committee (1991)

The Amitabha Bhattacharya Committee was appointed to review the progress made by the Technical Teachers' Training Institutes (TTTIs) in fulfilment of their objectives. Its major recommendations were:

i) The status of the TTTI should be raised from regional to national level. It may also be accorded the deemed university status.

ii) Teacher training programmes should have a strong focus on emerging technology.

iii) Innovative research and development activities should be undertaken to improve the quality of technician education.

2.3.19: P.V. Indiresan Review Committee (2000)

In 2000, a review committee under the Chairmanship of Professor P V Indiresan was formed to review the programmes and activities of TTTIs, to study the major problems and to give directions for future development of TTTIs. The Indiresan Committee in its report made following recommendations:

(i) Extension of reach of the Institute over the entire gamut of the Technical Education.

(ii) Emphasis on Educational Technology including Distance Education & web based learning.

(iii) To change its thrust, the TTTIs may be upgraded to national institute and be renamed as 'National Institutes of Technical Education and Research' (NITER).

TTTIs were later upgraded and renamed as National Institute of Technical Teachers' Training & Research (NITTTR) in 2003 with an objective to play larger role for the improvement of Technical Education in the country.

Section 2.4: Post-independence development

Total number of engineering institutes was 50 in 1950-51 with a student capacity of 3700 only. Intake per institution was 74. The number of engineering institutes increased to 337 in 1990-91 and 776 in 2000-01 with student intake increasing to 66600 in 1990-91 and 185758 in 2000-01. Intake per institution also increased to 198 in 1990-91 and 240 in 2000-01. Since 2000-01, there have been a quantum jump in both the number of engineering institutes and their intakes, with the former increasing to 1668 in 2007-08 and further to 3384 in 2013-14, while the latter registering a corresponding rise to 653290 and 1634596 in the respective years. Intake per institution also shot up to 392 in 2007-08 and 483 in 2013-14. (Table: 2.3).

Table 2.3: Growth of Technical Education in the country (Undergraduate)

Year	Number of Engineering Institutes	Students Intake	Intake per Institution (average)
1950-51	50	3700	74
1960-61	110	16000	145
1970-71	145	18200	125
1980-81	158	28500	180
1990-91	337	66600	198
2000-01	776	185758	240
2003-04	1208	359721	298
2004-05	1265	404800	320
2005-06	1346	452260	336
2006-07	1511	550986	364
2007-08	1668	653290	392
2006-07	1511	659717	437
2007-08	1668	701214	420
2008-09	2388	753910	316
2009-10	2972	1093380	368
2010-11	3222	1219347	378
2011-12	3286	1386083	422
2012-13	3369	1565722	465
2013-14	3384	1634596	483

(Source: Self-compiled from the Annual Reports of the AICTE of various years.)

Annual rate of growth of the number of engineering institutes was 12 per cent in 1960-61. It came down to only 0.9 per cent in 1980-81 but shot up to 11.33 in 1990-91 and further to 18.37 in 2003-04. Annual growth rate, however, dropped sharply to

0.47 per cent in 2004-05 and subsequently even became negative (-0.94 per cent) in 2006-07. This rate slightly picked up to 4.32 per cent in 2008-09 to get moderated again since 2010-11 at a level just a shade above zero (Figure 2.1).

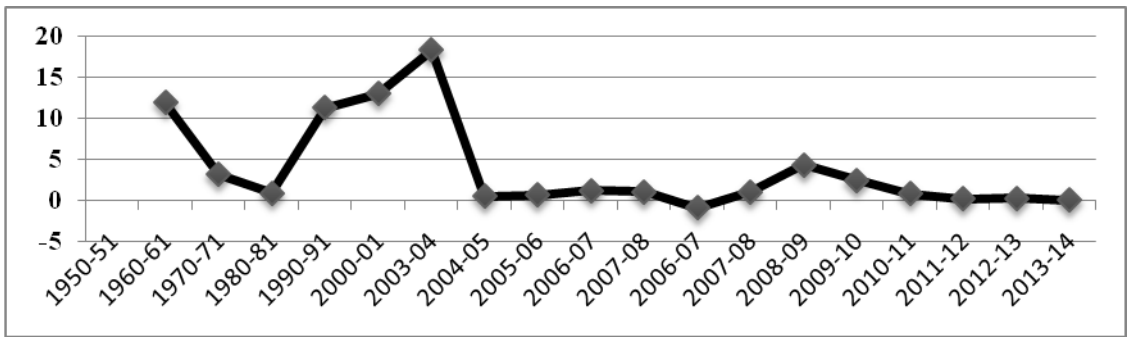

Figure 2.1: Average Annual Growth Rate of the Number of Engineering Institutes during 1950-2014[18]

Although aggregate student intake in engineering colleges increased continuously since 1950-51 (Figure: 2.2), average intake per institution, however, fluctuated once between 1950-51 and 2013-14. Average intake per institution increased steadily from 1950-51 (74) to 2006-07 (437), it fell for two successive years 2007-08 (420) and 2008-09 (316), then went on rising steadily again (Figure: 2.3). There has also been wide divergence between annual growth of intake and annual growth of population, with the former well surpassing the later after 1970-71 (Figure: 2.4). Annual growth of intake, although fluctuated frequently, remained well above the annual growth rate of net national income. After 1980-81, the former fell below the latter only once in 2013-14 (Figure: 2.5).

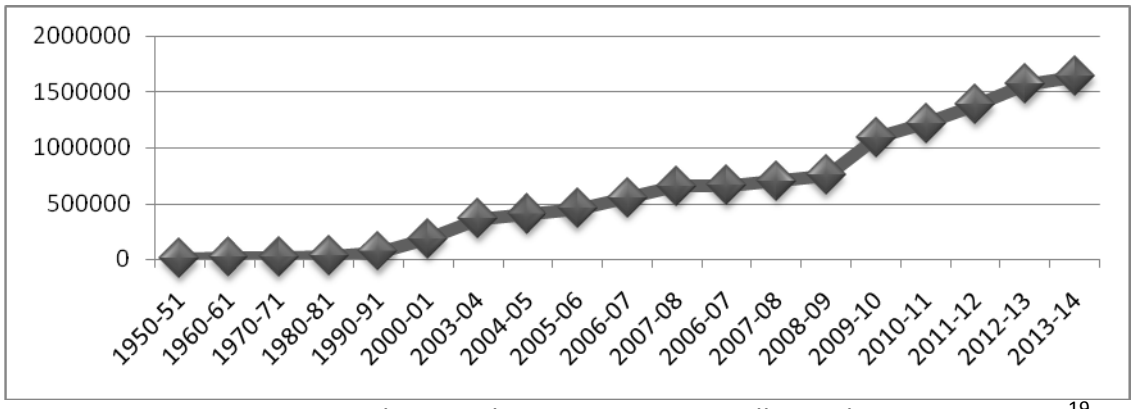

Figure 2.2: Aggregate Student Intake in Engineering Colleges during 1950-2014[19]

[18] Self-compiled from the Annual Reports of the AICTE of various years.
[19] ibid

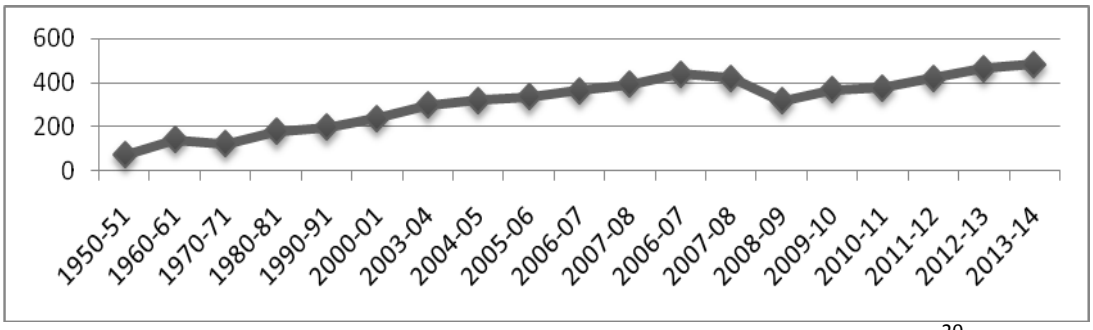

Figure 2.3: Average Intake per Institution during 1950-2014[20]

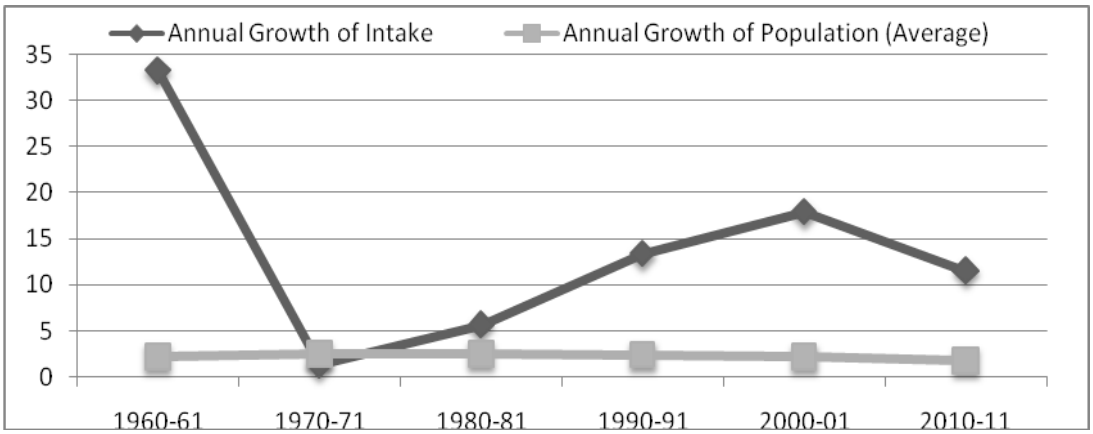

Figure 2.4: Average Annual Growth of Intake vis-a-vis Average Annual Growth of Population[21]

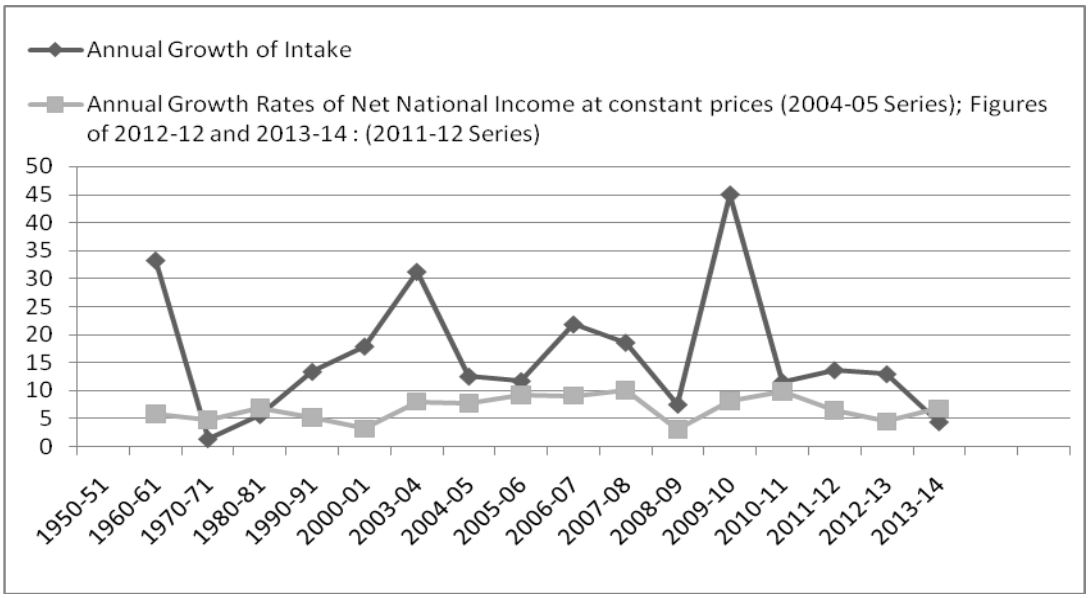

Figure 2.5: Annual Growth of Intake vis-a-vis Annual Growth of Net National Income[22]

[20] ibid

[21] Self-compiled from the Annual Reports of AICTE and Census data of various years.

[22] Self-compiled from the Annual Reports of AICTE of various years and the Economic Survey of GOI, 2014-15.

Presently, there are various types of technical Institutions to cater to the needs of technical education.[23] The Indian Institutes of Technology (IITs) were set up to train scientist and engineers, with the aim to develop a skilled workforce to support the economic and social development of the country. Secondly, National Institute of Technology (NITs), formerly known as Regional Engineering Colleges (RECs) were set up to promote regional diversity and multi-cultural understanding in India.

To meet the demand of high skilled professional in IT Sector, centrally funded Indian Institute of Information Technology (IIITs) have been set up in Gwalior (1998), Allahabad (1999), Jabalpur (2005) and Kancheepuram (2007). Further, the steps are being taken to set up Technical Institutes at various levels on Public Private Partnership (PPP) mode.

The Sant Longowal Institute of Engineering and Technology, (Deemed-University), Longowal (SLIET) Punjab was set up in 1989 to provide Technical Education in emerging areas of Engineering & Technology. It caters to the technical manpower requirements at various levels by adopting a new concept of modular system and education with emphasis on practical training in industry.

The North Eastern Regional Institute of Science and Technology (NERIST), Itanagar, Arunachal Pradesh was established in the year 1986 as an Autonomous Institution to generate Technical and Skilled manpower in the field of Engineering and Technology as well as applied science streams mainly for the development of the North Eastern Region. The Institution is fully funded by the Central Government.

The National Institute of Industrial Engineering (NITIE) is a premier Indian institution, engaged in Industrial Engineering and Management education. The Institute was set up by the Government of India in 1963 with the assistance of the United Nations Development Programme (UNDP) through the International Labour Organization (ILO).

Central Institute of Technology (CIT), Kokrajhar is an autonomous Institute funded by the Ministry of Human Resource Development (HRD), Government of India. CIT started to function from December 06, 2006.

Ghani Khan Choudhury Institute of Engineering & Technology (GKCIET), Malda, West Bengal was established by Ministry of Human Resource Development in 2008.

[23] MHRD Annual Report 2014-15

The Asian Institute of Technology (AIT) was established in 1959 as the SEATO Graduate School of Engineering with the objective of meeting the advanced technical educational need of SEATO Member States. In 1967, SEATO relinquished its control and the institute was renamed Asian Institute of Technology and became an autonomous institute.

Besides these, there are numerous number of private engineering colleges, developed mostly after 1991. Karnataka pioneered reforms in technical education in India and it is one of the early states to embark upon expansion of technical education on large scale. Other states which followed Karnataka include Andhra Pradesh, Tamil Nadu, Maharashtra, Uttar Pradesh, West Bengal etc.

Section 2.5: Development of Technical Education in different states

In this section we shall discuss the development of technical education in different states in India. We shall also pay special attention to the development in four major states where the growth of technical education institutes has been quite phenomenal. These states include Karnataka, Andhra Pradesh, West Bengal and Kerala. Karnataka pioneered reforms in technical education in the 1960s and embarked upon expansion of technical education on a large scale. Andhra Pradesh (undivided) recorded tremendous growth in technical education during the last couple of decades and as on March 31, 2012, it had the largest number of undergraduate degree engineering institutes as well as intake of students to engineering courses in India. West Bengal was laggard in regard to growth of technical education. Two private self financing engineering colleges were established for the first time in 1996, but it was followed by sporadic exponential growth. Kerala liberalised its technical education sector only in 2001, but because of substantial growth thereafter, Kerala now has one of the largest number of seats for undergraduate courses in engineering, especially when it is related to its population

As on March 31, 2012, Andhra Pradesh (undivided) had the largest number of undergraduate degree engineering institutes (704) followed by Tamil Nadu (498), Maharashtra (350), Uttar Pradesh (329), Madhya Pradesh (227), Karnataka (188), Haryana (167), Kerala (148) etc. West Bengal had 88 engineering colleges as on that date. In terms of intake of students to engineering courses, Andhra Pradesh (340007) is the leader followed by Tamil Nadu (236417), Maharashtra (146116), Uttar Pradesh

(136417), Madhya Pradesh (96374), Karnataka (92376), Haryana (64298), Kerala (52211) etc. West Bengal had 34973 intake on that date.[24]

Some interesting facts about development of technical education in different states, as it appears from Appendix: 1 are given below:

- Andhra Pradesh with a 7 per cent share in country's total population had 21.04 per cent share in the aggregate number of institutes and 23.07 per cent share in aggregate intakes, intake per million population being 4019.95. Tamil Nadu, on the other hand, with 14.88 and 16.04 shares in number of institutes and aggregate intakes respectively had a population share of 5.97 per cent and intake of 3276.74 per million population. For these two states, institute shares and intake shares far exceed population shares.
- For states like Madhya Pradesh, Odisha, Maharashtra etc. these three shares are very close to one another.
- For states like West Bengal, Uttar Pradesh, Rajasthan etc. institute shares and intake shares fall short of population shares.

A comparison of average annual growth rates of intakes in different states in the pre-global recession (1990-91 to 2007-08) and post-global recession (2007-08 to 2011-12) gives the following results (Appendix: 2):

- Except Delhi, Punjab and Goa, for all other states average annual growth rates had shot up in the post-recession period.
- For states like Gujarat, Madhya Pradesh, Assam, Haryana, Himachal Pradesh, Rajasthan, Bihar and Maharashtra the later period had recorded a substantial rise in growth rates over those in the previous period.
- For states like Odisha, Jammu and Kashmir, Kerala, Puducherry and Tamil Nadu, the average annual growth rates of intakes remained more or less constant in the two time periods.

2.5.1: Karnataka

Karnataka pioneered reforms in technical education in the 1960s.[25] It is one of the early states to embark upon expansion of technical education on large scale. Today it has the largest pool of young talent in all disciplines. The number of AICTE approved

[24] Appendix Table 1

[25] Governance of Technical Education in India: Key Issues, Principles, and Case Studies, edited by Blom Andreas and Jannette Cheong, Working Paper No. 190, World Bank (2010)

Engineering Colleges where undergraduate courses are taught is 109 in 2014-15. Government of Karnataka, Ministry of Higher Education conducts qualifying exam in the form of Common Entrance Test for admission to institutions across the state, with separate quotas for rural students, women and tribals. Fees are fixed by the Government of Karnataka based on the recommendation of Fee Fixation Committee which studies the income expenditure statements of institutions over previous years to fix fees. State Technical University, the Visvesvaraya Technological University (VTU) takes care of academic matters for non autonomous institutions regarding curriculum, laboratory requirements, faculty qualifications and cadres and conduction of examinations. Quality and compliance monitoring is done by the All India Council for Technical Education (AICTE) through annual approval procedures, mandatory disclosures and visits of nominated expert committees. The National Board of Accreditation on voluntary basis assesses institutions on several criteria such as teaching-learning processes, governance, research, faculty and student quality and achievements etc. The VTU through its annual affiliation processes also assesses quality of teaching-learning process, compliance in terms of library, equipment, faculty and space. The Government of Karnataka assesses institutes through SPFU, and the Directorate of Technical Education through its various approval and audit processes. The VTU and AICTE looks after compliance to academic norms such as faculty positions and cadres, faculty-student ratios, library requirements, equipment requirements, facilities for faculty and students, procedures for assessment and evaluation of students on annual basis. The VTU and AICTE also ensures compliance to infrastructural norms such as built area for instructional purposes, administrative purposes, circulation, recreation, labs, utility purposes, equipment, library, computers etc. on annual basis.

2.5.2: Andhra Pradesh

In Andhra Pradesh, the Commissionerate of Technical Education deals with the engineering education.[26]. As on March 31, 2012, Andhra Pradesh (undivided) had the largest number of undergraduate degree engineering institutes (704) as well as intake of students to engineering courses (340007) in India[27]. Andhra Pradesh with a 7 per

[26] ibid
[27] Appendix Table 1

cent share in country's total population had 21.04 per cent share in the aggregate number of institutes and 23.07 per cent share in aggregate intakes, intake per million population being 4020. During the last couple of decades, tremendous growth has been observed in engineering institutions in the state. This growth has occurred primarily in the private sector. The density of these institutions is more in urban and semi-urban areas. The intake in these undergraduate degree engineering institutes increased from 8070 in 1990-91 to 82970 in 2007-08 at an average annual growth rate of 54.6 per cent. The growth rate of intake increased further to 77.45 per cent after 2007-8 with intake rising to 340007 by 2011-12.

The lone technological university in the state, the Jawaharlal Nehru Technological University has been split into four universities namely, Jawaharlal Nehru Technological University Hyderabad, Jawaharlal Nehru Technological University, Anantapur, Jawaharlal Nehru Technological University, Kakinada and Jawaharlal Nehru Architecture and Fine Arts University by the Jawaharlal Nehru Technological Universities Act, 2008. These universities affiliate engineering, technology, pharmacy, architecture, and management institutions in Andhra Pradesh.

The Andhra Pradesh (Regulation of Admissions, and Prohibition of Capitation Fee) Act 1983 governs the admissions into professional colleges. Admissions into the professional colleges are through common entrance tests (EAMCET, ECET, APICET etc.) conducted under the aegis of the Andhra Pradesh State Council of Higher Education (APSCHE). The tuition fee is fixed by the Admission and Fee Regulatory Committee (AFRC). The private institutions are funded by student tuition fees. The state government permits the establishment of new self financing private engineering colleges after the approval given by the central regulatory agency AICTE. Jawaharlal Nehru Technological University affiliates private self financing institutions, provide them curriculum for approved courses, conduct exams, award degrees, and conduct academic audits. Private engineering institutes seek approvals from AICTE and affiliation from university and run only approved courses. No regular government grants are given, except those in special circumstances like TEQIP, and from AICTE for research and other activities. These engineering institutes are accountable in the matters of collection of fees, academic works, quality issues, and all other regulatory requirements. Increased concern on

quality among the affiliated colleges has resulted in more number of NBA accredited institutions in Andhra Pradesh[28].

2.5.3: West Bengal

Until the late 1990s higher technical education was primarily confined within a few government controlled engineering institutions and very old state universities in West Bengal. The first reformation took place after the late nineties when the state government allowed private participation in the growth of higher technical education. As a result two private self financing engineering colleges were established first in the year 1996, followed by sporadic exponential growth thereafter. West Bengal University of Technology (WBUT) was established in 2001. WBUT now affiliates all government and private engineering colleges in West Bengal. Admissions to engineering colleges are made on the basis of the results of the West Bengal Joint Entrance Examination.

The second reformation took place when the state government decided to make a significant change in the evaluation process of State Joint Entrance Examination from subjective to objective assessment along with many other tangible modifications since the year 2005–06. The third reformation was the mandate given by the state government to constitute the governing body in each and every engineering college as per the AICTE guidelines and laid down detail procedures[29].

All private engineering colleges have the uniform fee structure as recommended by the Fee Structure Committee, set up by the Department of Higher Education, Government of West Bengal. F**or the students admitted in First Year Engineering Courses in the Academic Year 2015-2016, m**aximum tuition fee would vary between Rs. 75,000 – Rs. 80,000 during first to fourth years. *No separate Development Fee can be charged by the Colleges*[30].

The performance of private self-financing colleges is monitored regularly in West Bengal. In order to improve quality of teaching a continuous thrust has been given to apply for NBA accreditation for each college. The state government has activated the governing bodies to ensure introduction of at least two core disciplines in

[28] ibid

[29] http://info.worldbank.org/etools/docs/library/252191/WEST%20BENGAL%20Case%20Study.pdf (accessed on 28.04.2015)

[30] Notification No- 306 - Edn(T)/10M - 04/2004(Part IV) Dated: Kolkata, 3rd July, 2015 of Department of Higher Education, Technical Branch, Government of West Bengal

each institution. One of the most remarkable reformation measures is the sincere drives of the private self-financing engineering colleges to institutionalize merit cum means scholarship for academically good but economically poor students in lien admission against management quota.

Significant institutional reforms, both academic and non-academic, were introduced from 2005 to 2009 through implementation of TEQIP. Practice of autonomy with accountability by the institutes has also been ensured. WBUT granted autonomy to the TEQIP institutes to introduce elective subjects at the undergraduate level as per market demand as well as full autonomy to the PG Courses except conducting examination and awarding degree[31]. Evaluation of teachers by students and teacher's counseling; encouraging institutes to develop synergic networking with institutes of repute through sharing of physical and human resources; granting incentive to the faculty, and staff to conduct continuing education scheme, sponsored research programs, and so forth have been introduced. Qualification and skill up gradation of faculty and staff has been undertaken as a continuous program.

All recognized engineering institutions in the state are AICTE approved and university affiliated. All institutions have their own board of management/governing body, on which stakeholders have representation. All institutions are under the academic control of the WBUT.

2.5.4: Kerala

Engineering education in the state of Kerala was essentially public funded. Most of the engineering institutes were government owned, although there existed a small number of government aided private engineering colleges. The technical education sector in Kerala was liberalised in 2001, which dramatically increased the number of engineering colleges in the state. Kerala has one of the largest number of seats for undergraduate courses in engineering, especially when it is related to its population: Kerala's share in the total intake for undergraduate engineering studies account for about 5 per cent, and this intake in 2008-09 has increased by about 5 times the intake two decades earlier in 1990-91(See Annexure 1).

[31] Governance of Technical Education in India: Key Issues, Principles, and Case Studies, edited by Blom Andreas and Jannette Cheong, Working Paper No. 190, World Bank (2010)

Another interesting fact is that although sanctioned intake and actual intake were moving in tandem until 2001 or so, the two started diverging from each other from around 2002 onwards until 2006 or so with actual intake being considerably less than the sanctioned one. Once again, since 2006 onwards the two have started moving in tandem. Intake has increased at an annual average rate of 17 per cent, while the outturn has increased only at 15 per cent per annum during the period 1995 through 2007.

Table 2. 4: Trends in number of engineering colleges, sanctioned and actual intake (in numbers) in Kerala

Year	Number of engineering colleges	Intake	
		Sanctioned	Actual
1991	9	2810	2795
1995	16	3930	4441
1996	17	4699	4657
1997	17	4871	4792
1998	17	4979	5122
1999	24	6668	6126
2000	33	8820	8739
2001	45	11293	11147
2002	74	18280	16143
2003	81	19889	16563
2004	87	23643	16837
2005	91	24526	21857
2006	91	26349	25471
2007	91	28578	27975
2008	94	30069	29635
2011	142	45147	NA

(Source: NTMIS Nodal Centre for Kerala (various issues), Kerala State Planning Board, 2012)

Privatisation of engineering education, although increasing enrolments, has actually led to deterioration in the quality of engineering education as indicated by lower outturns[32]. However, in all fairness, this deterioration has actually started in the

[32] Outturn rates, often used in literature, measure the actual supply of engineers. Given the fact that undergraduate degrees in engineering in universities in Kerala (which of course follow the All India Council for Technical Education pattern) is four years in duration, outturn rate in year 't' is obtained by dividing the outturn in year 't' by the intake in year 't-4'. In symbols:

$$OTR_t = \frac{OT_t}{IT_{t-4}} \times 100$$

Employing the above formula, the outturn rates have been worked out (Appendix Table 3). Given the four year time lag and the availability of data we are in a position to compute the outturn rates for the intakes in 1991 (graduating in 1995) through 2004 intake (graduating in 2008).

1990s, when the provision of engineering education was still in the government sector. A major change occurred in the early 2000 when several new engineering institutes came into existence in Kerala. Almost all these new colleges are in the private sector and they are usually referred to as self-financing colleges as they do not receive any grant from the state but their main income is tuition fees and donations of various kinds. The arrival of these self-financing colleges although has increased the capacity of engineering education in the state, has also at the same time, brought to the fore, serious deficiencies in the higher education scene in Kerala.

The number of engineering colleges affiliated to the university started increasing after the liberalisation of engineering education in 2001. From 5 colleges in the pre liberalisation regime, the number of colleges increased to 16 by 2002. All the newly formed colleges have a self-financing model. 2009 also marks a sudden increase in engineering colleges affiliated to the university. Based on their financing model, colleges are grouped into Government funded, Government aided, and Self Financing. It can be seen that Government funded and Government aided colleges have better pass percentage than self-financing colleges over the last several years.

Section 2.6: Reforms in Higher Education

Several legislative initiatives have been taken by the Ministry wherein reforms are undertaken by means of policy changes/executive order as well as legislative initiatives. Presently, following legislative proposals for reforms in Higher Education have been initiated which are at various stage of finalization/consideration[33]:

2.6.1: Educational Tribunals Bill, 2010

The Bill aims to provide a mechanism for adjudication of disputes and to establish a two-tier structure of Educational Tribunals at the State and National level on the entire gamut of disputes arising in higher education.

2.6.2: The Universities for Research and Innovation Bill, 2012

The Bill provides for the establishment and incorporation of Universities for Research and Innovation which will be set up in the public mode, purely privately funded, as well as Universities in the PPP mode to promote synergies between

[33] Annual Report, 2013-14, Ministry of Human Resource Development. Government of India

teaching and research and to create institutions universally recognised for quality in teaching, learning and research.

2.6.3: The Foreign Educational Institutions (Regulation of Entry and Operations) Bill, 2010

The Bill seeks to regulate of entry and operation of Foreign Educational Institutions, including technical and medical institutions, imparting or intending to impart higher education in India.

2.6.4: Higher Education and Research Bill, 2011

The Bill provides for establishment of an over-arching authority called National Commission for Higher Education and Research for determining, maintaining and coordinating standards in Higher Education. The Bill was introduced in the Rajya Sabha on 28th December, 2011.

2.6.5: The National Accreditation Regulatory Authority for Higher Educational Institutions Bill, 2010

The Bill provides for mandatory accreditation of all higher educational institutions through accreditation agencies registered by a regulatory authority for registering and licensing these accreditation agencies and regulating the process of assessment and accreditation in the country. It is also proposed that higher educational institutions established by State Governments will apply to accreditation agencies owned and controlled by such State Governments only and imprisonment as punishment in certain cases has been removed.

2.6.6: Prohibition of Unfair practices in Technical Educational Institution, Medical Educational Institutions and Universities Bill, 2010

A Bill to prohibit and punish malpractices and adoption of unfair practices in technical and medical educational institutions and in the university system, to protect the interest of students and applicants seeking admission, has been introduced in the Lok Sabha on 3rd May, 2010. The amendments proposed in the Bill include renaming of the Bill as Prohibition of Unfair Practices in Higher Educational Institutions Bill 2011, to make disclosure of adherence to reservations provisions (in public funded institutions) and putting a policy framework in place (in private un-aided institutions) to account for addressing equity concerns, mandatory in the prospectus and to provide for punishments and penalties in case of non-adherence to the same. The institutions would be required to mandatorily publish the relevant information on its website in addition to publication of a printed prospectus.

2.6.7: National Academic Depository Bill 2011

A Bill called the National Academic Depository Bill, 2010 has been introduced in the Lok Sabha on 5th September, 2011 for creation of a National electronic database of Academic Awards and its maintenance by an authorized depository.

2.6.8: National Institute of Technology (Amendment) Act, 2012

To make National Institute of Technology (NIT) Act, 2007 more comprehensive and effective, necessary amendments were moved to incorporate 10 new NITs located in the States of Sikkim, Arunachal Pradesh, Manipur, Nagaland, Meghalaya, Mizoram, Uttarakhand, Delhi, Goa and Pondicherry as Institutions of National Importance. The NIT (Amendment) Act, 2012 received assent of the President of India on the 7th June, 2012 and since then the 10 new NITs and five IISERs are functioning under the ambit of the NITAct, 2007.

2.6.9: Indian Institute of Information Technology (IIIT) Bill, 2013

The Bill seeks to provide the four existing IIIT's founded by the Central Government independent statutory status and also to declare them as Institutions of National Importance. Likewise, the IIITs, proposed to be established through Public Private Partnership mode would also be incorporated as statutory bodies and declare as Institutions as National Importance.

Section 2.7: Recent developments

A new phenomenon which has started early this decade is that private engineering colleges have started winding up their courses because of lack of demand**.** As reported in the newspaper, **e**ngineering colleges have cut the number of seats by a staggering 1.3 lakh in the three years between 2013-14 and 2015-16.[34] The student intake has also declined in the same proportion. More than 23,000 of these seats were reduced because of shutting down of 71 engineering colleges while another 1,279 colleges decreased the number of courses offered for engineering (diploma/UG/PG). A state-wise analysis of the reduction of seats shows that erstwhile Andhra Pradesh (including Telangana), Tamil Nadu and Maharashtra accounted for 80,000 of these reduced seats. These states also account for the highest number of engineering colleges. Between 2012-13 and 2014-15, the number of approved seats have increased

[34] http://timesofindia.indiatimes.com/home/education/news/Engineering-colleges-have-cut-1-3-lakh-seats-since-2013-14/articleshow/50130710.cms (accessed on 26.11.2015)

from 16.5 lakh to over 18 lakh. This is despite the fact that there is a steady decline in the number of students actually joining these courses. From 10.1 lakh in 2012-13, the student intake dropped to 9.9 lakh in 2013-14 and 9.1 lakh in 2014-15, a decrease of about a lakh. The data also show that the student intake has gone down from 61% of approved seats in these colleges to 51% over the three years. Census data shows that in 2011 there were 121 lakh people who had technical degrees or diploma equal to graduation or post-graduation. Of these, 16 lakh were unemployed and seeking work, while another 3.1 lakh were working as marginal workers. Overall, there were 5.7 lakh marginal workers with technical degrees. Experts attribute this phenomenon to various reasons. Unlike other graduate degrees, engineering is a job oriented course and a sustained slowdown reflects on job opportunities and hence student intake.

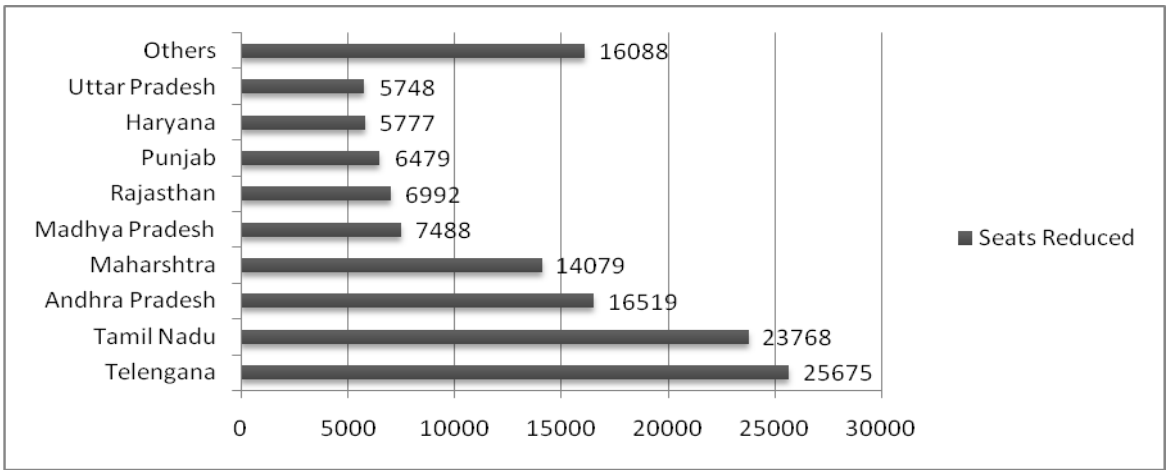

Figure 2.6: Seats in Engineering Colleges reduced because of closure / reduction of courses during 2013-14 to 2015-16[35]

Section 2.8: Technical Education Quality Improvement Programme (TEQIP)

The Ministry of Human Resource Development launched in December, 2002 the "Technical Education Quality Improvement Programme of Government of India (TEQIP)" which aims to upscale and support ongoing efforts in improving quality of technical education and enhancing existing capacities of the institutions to become dynamic, demand-driven, quality conscious, efficient and forward looking, responsive to rapid economic and technological developments occurring both at national and international levels. The Programme was conceived and designed as a long term project to be implemented in 10-12 years in 3 phases to support excellence and transformation in Technical Education in the country.

[35] ibid

2.8.1: TEQIP PHASE I

TEQIP Phase I was implemented with the assistance of World Bank as a Centrally co-ordinated Central and State Sector Project with a total cost of Rs. 1389 crore.[36] Out of this Rs.306 crore was Central Component and the remaining Rs. 1033 crore was State Component. The program became effective in March, 2003 and closed on 31st March, 2009. 127 Institutions participated in TEQIP, out of which 18 were Centrally Funded Institutions and 109 were State Institutions. The State Institutions were from 13 States namely, Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, Uttarakhand and West Bengal. The 18 Central institutions include 17 NITs and NIFFT, Ranchi. The 109 State Institutions include 90 Engineering Colleges and 19 Polytechnics. The cumulative expenditure by Centre for TEQIP Phase I was Rs. 132.80 crore which is 99% of the total Project allocation.

2.8.2: TEQIP PHASE II

Building upon the satisfactory completion of the TEQIP Phase-I, TEQIP Phase-II is presently being implemented as a Centrally Sponsored Scheme (CSS) with the assistance of the World Bank at a total cost of Rs. 2430 crore to improve quality of Technical Education through institutional and systemic reforms.[37] The Central contribution will be Rs. 1895.50 crore, out of which Rs. 1395.50 will be reimbursed by the World Bank. The State share will be Rs. 518.50 crore and the Share of Private unaided institutions will be Rs. 16 crore. The funding pattern will be 75:25 between the Centre and the participating States and for North Eastern States it will be 90:10. The TEQIP-II project is for the duration of 4 years covering 190 institutions based on competitive funding. The Programme is being implemented from 2010-11.

It follows the same principles as the first phase, while beefing up implementation with rigorous and detailed monitoring procedures and emphasis on policy reforms. The second phase boosts efforts to prepare more post-graduate students to reduce the shortage of qualified faculty, and to produce more R&D in collaboration with industry.

[36] http://mhrd.gov.in/technical-education-12 (accessed on 28.04.2015)
[37] ibid

The Project's objectives are to (i) Strengthening Institutions to produce high quality engineers for better employability; (ii) Scaling-up postgraduate education and demand-driven Research and Development and Innovation; (iii) Establishing Centers of Excellence for focused applicable research (iv) Training of faculty for effective Teaching, and (v) Enhancing Institutional and System Management effectiveness. A total of 190 institutions i.e. [26 Centrally Funded, 127 State Govt. funded and aided and 37 Private Unaided institutions] have been selected for participation in the Project.

2.8.3: TEQIP's Achievements

(i) Establishment of Knowledge Incubation Centres at IITs (Bombay, Delhi, Guwahati, Gandhinagar, Hyderabad, Kanpur, Kharagpur, Madras, & Roorkee). A total of 1373 faculty members have been trained under KIT programme.

(ii) Initiation of Phase –II of Quality Enhancement in Engineering Education (QEEE) Direct to Student programme for project institutions under TEQIP by IIT Madras. The programme has been launched in 82 project institutions.

(iii) Capacity Development programme with IIMs (Indore, Lucknow, Bangalore, Kozhikode, Trichy, Udaipur, Raipur) through which 931 faculty members have been trained.

(iv) Administrative Staff College of India (ASCI), Hyderabad was selected to conduct Project Evaluation Study in a sample of 30 project institutions. The study has been completed; however final report is to be submitted by ASCI.

(v) A Letter of Intent (LoI) has been signed with Mitacs, Canada for student mobility exchange programme in February, 2014. Action has been initiated to implement the same.

2.8.4: AICTE-INDEST Consortium

The “Indian National Digital Library in Engineering Sciences and Technology (INDEST) Consortium” was set-up in 2003 by the Ministry of Human Resource Development (MHRD).[38] The Ministry provides funds required for providing access to electronic resources to the core members through the consortium headquarters set-up at the IIT Delhi. The Consortium was renamed as INDEST-AICTE Consortium in

[38] http://paniit.iitd.ac.in/indest/index.php/about-us (accessed on 28.04.2015)

December 2005 with the AICTE playing a pivotal role in enrolling its approved engineering colleges and institutions as members of the Consortium for selected e-resources at much lower rates of subscription. The Consortium enrolls engineering and technological institutions as its members and subscribe to electronic resources for them at discounted rates of subscription and favourable terms and conditions. Membership of the consortium is now open to all private or Government-funded engineering institutions / universities for one or more electronic resources. The consortium charges an annual fee of Rs. 2,000.00 (Two Thousand) only. The total number of members in the Consortium has now grown to 1235.

2.8.5: National Programme on Technology Enhanced Learning (NPTEL)

The National Programme on Technology Enhanced Learning (NPTEL), a project funded by the Ministry of Human Resource Development (MHRD), provides e-learning through online Web and Video courses in Engineering, Sciences, Technology, Management and Humanities. [39]This is a joint initiative by seven IITs and IISc Bangalore. Other selected premier institutions also act as Associate Partner Institutions.

NPTEL is a curriculum building exercise and is directed towards providing learning materials in science and engineering by adhering to the syllabi of All India Council for Technical Education and the slightly modified curricula of major affiliating Universities. It has developed curriculum based video courses and web-based e-courses targeting students and faculty of institutions offering UG engineering programs.

2.8.6: Programme (EETP) under AICTE

To facilitate technical institutions to respond to the need of providing state of art Telecom equipment based operational Skill to engineering graduates to enhance their qualification, competence and employability by enhanced skill up-gradation, AICTE has signed an MoU with BSNL to use the training facilities and faculty of BSNL for the benefit of students in AICTE approved institutions under its Employability Enhancement Training Programme (EETP).

[39] https://en.wikipedia.org/wiki/National_Programme_on_Technology_Enhanced_Learning (accessed on 28.04.2015)

2.8.7: National Employability Enhancement Mission (NEEM)

The objective of National Employability Enhance Mission (NEEM) is to offer on the job practical training to enhance employability of a person either pursuing his or her graduation / diploma in any technical or nontechnical stream or have discontinued studies of degree or diploma course to increase their employability.

We shall now proceed to Chapter 3 where we put forward a theoretical perspective of technical education.