CHAPTER – IV

GROWTH AND DEVELOPMENT OF TECHNICAL EDUCATION
IN INDIA WITH SPECIAL REFERENCE TO MUMBAI

4.0 Introduction

Technical education in India contributes a major share to the overall education system and plays a vital role in social and economic development of the nation and also in human resource development of the country by creating and providing skilled manpower, enhancing industrial productivity and improving the quality of life of its people. In India, technical education is imparted at various levels such as: craftsmanship, diploma, and degree, post-graduate and research in specialized fields, catering to various aspects of technological development and economic progress.

Modern and developed societies are technology-based and the quality of life of the people is directly related to the quality and level of technical education in vogue. Technology is a term which is used nowadays in almost all walks of life from the making of a pin to the manufacture of an artificial satellite. In this fast changing world, technology is the pivot round which the human needs and services revolve (Ahmad & Satija, 2005). Technical education is a basic and essential input for growth and development of nation and for strengthening of the industry, economy and ultimately improving the quality of life of the people. It has made a significant contribution to India’s economic development. Technically Skilled workforce is the best resource of the nation.

As per Banerjee & Muley (2010), initially, the focus of the engineering education system in India was to produce engineering graduates to implement operate and manage the growing industry that mainly relied on imported technology. Subsequently as the
economy grew, there emerged a need for technology development and then for research and development. The engineering institutions that were primarily set up for undergraduate teaching started emphasising research and evolved Master’s and doctoral programmes.

According to Dr. Anil Kakodkar Committee Report (2011), engineers and technologists are required for practically every aspect of the nation-building activity, and management of infrastructure and new products that improve the quality of life. They are involved in activities that generate technologies and wealth and make the nation more competitive and powerful. In this new era of knowledge economy, there is a need to emphasize on creating an ecosystem that promotes innovation in our higher engineering and technological institutions.

4.1 Technical Education in India

In India, technical education was initially based on the British model and emphasised the importance of engineering professional practice. After Independence it has been constantly influenced by the American educational system in its contents. The beginning of formal Technical Education in India can be dated back to the mid 19th Century. The major policy initiatives in the pre-independence period included appointment of the Indian Universities Commission in 1902, issue of the Indian Education policy resolution in 1904 and the Governor General’s policy statement of 1913 stressing the importance of Technical Education, the establishment of IISc in Bangalore, Institute for Sugar, Textile and Leather Technology in Kanpur, N.C.E. in Bengal in 1905 and Industrial schools in several provinces (http://www.aicte-india.org/).

Setting up the five Indian Institutes of Technology (IITs) (followed by 20 Regional Engineering Colleges; RECs) soon after gaining political independence was a game-changing investment. It paid off by providing world-class undergraduate (UG)
engineering education, with their graduates proving to be as good as or better than engineering graduates anywhere. If pursued with a sharp focus, the present young generation with high-quality advanced engineering education through their publications, patents, innovations and entrepreneurship will take India to the centre stage of global knowledge economy (Subbarao, 2013).

4.1.1 Pre-Independence Period

If we examine the historical development of technical education, it will be discovered that the foundation of technical education in India was laid almost at the same time as in Europe. 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. But technical education growth in India was very restrictive and slow till India became independent.

The Industrial Revolution of the 18th century laid the foundation of a technological civilization and gave rise to a new system of learning process which is known as technical education. The Technical Education system brought out the concept of establishment of training institutions in order to meet the challenges of fast changing technological environment and skilled work force demand for industrial growth in different sectors at all levels.

The impulse for creation of centres of technical training came from the British rulers of India and it arose out of the necessity for the training of overseers for construction and maintenance of public buildings, roads, canals and ports and for the training of artisans and craftsmen for the use of instruments and apparatus needed for the army, the navy and the survey department. The superintending engineers were mostly recruited from Britain from the Cooper's Hill College and lower grades- craftsmen, artisans and sub-overseers who were recruited locally. The necessity to make them more
efficient by giving them elementary lessons in reading, writing, arithmetic, geometry and mechanics, led to the establishment of industrial schools attached to Ordnance Factories and other engineering establishments (http://mhrd.gov.in/).

Soon, after the battle of Plessey in 1754, the status of presence of the Britishers was changed from traders to colonizers. Therefore, to rule the country, it was essential that they should have an intimate knowledge of the country’s topography through physical survey of the land. For achieving this object, the English traders established a survey school in Madras (Chennai) in 1794 to train Indian personnel in land survey to assist British Surveyors (Awale, 1996).

The first engineering college was established at Roorkee in 1847 for training Civil engineering personnel at various levels for the public works of the country, which made use of the large workshops and public buildings that were erected for the Upper Ganges Canal. The Roorkee College (Thomason Engineering College) started functioning under the principal ship of Lt. Col. R. Mac lagan from January 1848 and it was never affiliated to any university but gave diplomas considered to be equivalent to degrees.

In 1854 the “Wood’s Despatch” recommended the creation of a separate department for the administration of education in each province and establishment of universities in the three Presidency towns of Calcutta, Bombay and Madras. The universities were to be modelled after the London University. It is said that the Despatch was written by the famous thinker John Stuart Mill, a clerk of the company at that time. On the basis of the recommendations of the Wood’s Despatch, new educational policies were formed.

In pursuance of the Government educational 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 in 1856; the name was changed to
Bengal Engineering College. It was affiliated to the Calcutta University. Later, it was shifted to Sibpur, on the premises and buildings belonging to the Bishop's College. Proposals for having an Engineering College at Bombay city having failed for some reasons, the overseers' school at Poona eventually became the Poona College of Engineering and affiliated to the Bombay University in 1858. In the Madras Presidency, the industrial school attached to the Gun Carriage Factory became ultimately the Guindy College of Engineering and affiliated to the Madras University (1858). They all had licentiate courses in civil engineering up to 1880. After 1880, the demand for mechanical and electrical engineering was felt; but the three Engineering Colleges started only apprenticeship classes in these subjects. The Victoria Jubilee Technical Institute, which was started at Bombay in 1887, had as its objective of the training of licentiates in Electrical, Mechanical and Textile Engineering (http://mhrd.gov.in/).

During the British rule the Royal Engineers in the Army in India played the most imperative role in influencing, the fortune of the Roorkee College and the three other colleges in Bombay, Calcutta and Madras. The Military engineers were the only type of engineers that came to India with the East India Company. As the Company assumed greater power for governing the country, all technical jobs in engineering and science were entrusted to the military engineers. Almost all the PWD officers came from this tribe and the engineering education came under their purview.

The Swadeshi (of our own country) movement which started sweeping the whole country in the early 20th century led to an urge for Swadeshi education too. Many national educational institutions, free from Government control, were established at various places, some of which also imparted technical education. Prominent among the institutions established with private initiatives were the Indian Institute of Science, Bangalore by Sir Jamshedji Tata, an industrialist and a devout nationalist, which started a
certificate and an associate ship course at the degree level in electrical engineering and the Banaras Hindu University in which a College of Engineering was started. In 1917, the Banaras Hindu University started the first comprehensive degree course in electrical, mechanical engineering and metallurgy. Then with an increased realization of the importance of technical education in India, another engineering college was established at Jadavpur, West Bengal under the National Council of Education which started a diploma course in Mechanical engineering in 1908, which was followed by a chemical engineering course in 1921.

One of the reasons cited from the recommendations of the Indian Industrial Commission (1915), under the Chairmanship of Sir Thomas (Holland) against the introduction of electrical engineering courses, is given in the following quotation from their report: "We have not specifically referred to the training of electrical engineers, because electrical manufactures have not yet been started in India, and there is only scope for the employment of men to do simple repair work, to take charge of the running of electrical machinery, and to manage and control hydroelectric and steam-operated stations (http://mhrd.gov.in/).

The Indian Industrial Commission (1916) and the Calcutta University Commission (1917), led to the developments in technical education in the subsequent years. With the Government becoming more responsive to public demand, the technical education profile began to slowly improve. Prior to 1919, the number of higher or university level technical or engineering institutions was only five. This rose to 21 in 1939 and the number of diploma schools increased from eight to 23.

Nationalist will, private enterprise and Government assistance all played their parts in this change. To mention a few of the institutions which were established are the Harcourt Butler Technological Institute, Kanpur (1920), Indian School of Mines,
Dhanbad (1926), Maclagan College of Engineering, Lahore (1930), University Department of Chemical Technology, Bombay (1934), Engineering College in Aligarh Muslim University (1935), Delhi Polytechnic (1941), Laxminarayan Institute of Technology, Nagpur (1943), Alagappa Chettiar College of Technology, Guindy (1944), Department of Engineering in Annamalai University (1945) and three other colleges in Madras Province in Coimbatore (1945), Kakinada and Anantapur (1946). One of the steps was the thinking of technical education in a big way to provide facilities all over India for higher education in science, engineering and technology comparable to anywhere in the world. The overseas scholarship scheme of 1944 was pursued more vigorously. In 1936-37, the total enrolment for technical education in India was 0.126 million which rose to 0.201 million at the time of Independence (INSA, 2001).

The Government of India realized that it was necessary for the centre to support, coordinate and promote research in technical education. Crucial decision for the technical education was reflected through the most comprehensive plans for the organization of technical education on an All-India basis. Significant developments include constitution of the Technical Education Committee of the Central Advisory Board of Education (CABE) in 1943 and preparation of the Sergeant Report in 1944. A crucial recommendation of CABE was the constitution of a central agency to ensure an all India coordinated and integrated growth and spread of technical education. In 1945 the Government of India, thus, established the All India Council for Technical Education (AICTE) to supervise all technical education above the high school stage.

In 1945, the committee was appointed to propose options for advanced technical education in India under the chairmanship of Sir Nalini Ranjan Sarkar. The Sarkar committee recommended the establishment of higher technical institutes on the lines of Massachusetts Institute of Technology, USA in the four regions (Eastern, Western,
Northern and Southern regions) of the country to meet India's post war need for high
grade engineers, technologists, etc.

4.1.2 Post-Independence Period

‘The scientific approach has changed the world completely. I think that if the world is to
solve its problems, it will inevitably have to be through the means of science. The world
will ultimately be saved, if it is to be saved, by the method and approach of science.’

– Jawaharlal Nehru

Soon after becoming independent, the Government of India realised the
importance of developing sound technical and engineering education in the country,
ultimately to build its infrastructure like roads, water reservoirs, communications
systems, power and energy etc. and the development of industrial sector. The
Government implemented many schemes and recommendations of committee on
engineering education by which the country could develop in every sector.

The Government of India recognized that the future economic and industrial
growth of the country entirely depended 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 the independence, the first three years, until 1950, were the years of planning and
thereafter, the government started establishment of national, state or regional and
divisional engineering institutions mainly for graduate courses. Slowly over a decade,
transformation for post graduate engineering education set in.

With the advent of India’s independence from British rule, there has been a
significant increase in the number of engineering institutions and in student output. It is
due to the realisation that India has to become a great industrial country and would
require a far larger number of engineers than could be supplied by the older institutions.
Engineering became a preferred career choice for a large number of students at the 10 + 2 level.

In 1948, the Govt. of India setup a University Education Commission under the chairmanship of S. Radhakrishnan to examine the Indian University education including technical education and to suggest improvements and extensions that was desirable both for the present and the future requirements of the country. The Commission in its report recommended the need of the 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 (University Education Commission report). These recommendations led to several developments in the succeeding years Curricula were revised to include general education and basic physical and engineering sciences.

As per the Sarkar committee recommendations five Indian Institutes of Technology were set up between 1951 and 1961, have established a great reputation for undergraduate engineering education, as good as and, in fact, better than most institutions in the world. Fourteen Regional Engineering Colleges (now NITs) set up between 1959 and 1965 as joint and co-operative ventures of the Central and State Governments, soon after gaining political independence was a game-changing investment. It paid off by providing world-class undergraduate (UG) engineering education, with their graduates proving to be as good as or better than engineering graduates anywhere.
In pursuance of recommendations of the National Development Council in 1958, the working group on technical education and vocational training was appointed in 1959 under the Chairmanship of Prof. M.S. Thacker, the then Secretary, Ministry of Scientific Research and Cultural Affairs. It made an intensive study of the existing facilities for technical education and training in India, and made far reaching recommendations for the qualitative as well as quantitative improvement of technical education and training facilities in the country. Many of the recommendations of the working group were subsequently implemented for the development of technical education in the third and subsequent Plans.

In 1964, Education Commission on Education and National Development was appointed, under the chairmanship of Prof. D. S. Kothari. The Commission recommended good vocational schools, the junior technical schools, the industrial training institutes, polytechnics, etc should be established. And also recommended that technical education, practical training in industry should form an integral part of such education. Technical education and research should be related closely to industry, encouraging the flow of personnel both ways and providing for continuous cooperation in the provision, design and periodical review of training programmes and facilities (Education Commission report, 1964-66).

Then, there are a large number of Central autonomous institutions and State Government Engineering Colleges, often affiliated to a University and having a limited or no autonomy about curriculum, examinations, degree granting, etc. The great demand for engineering and technical education has led to the mushrooming of the large number of private engineering colleges, many started by politicians.

The Indian Government has taken fresh initiatives to increase the number of Indian Institutes of Information Technology (IIITs), Indian Institutes of Science
Education and Research (IISERs) and enable government departments such as Department of Atomic Energy, Indian Space Research Organization and Council of Scientific and Industrial Research to train people at the postgraduate level and award their own degrees (Subbarao, 2013).

4.1.2.1 Indian Institutes of Technology (IITs)

Implementing the Sarkar Committee recommendations, the government established the five Indian Institutes of Technology (IITs) and now the number has increased to sixteen. The Indian Institutes of Technology are apex institutions for engineering education and research. The main objective of IITs is to impart world class education in engineering and technology; to conduct research in the relevant fields, and to further advancement of learning and dissemination of knowledge. These Institutes are also contributing significantly to education and research in basic sciences and humanities.

The first Indian Institute of Technology (IIT) was established in 1951 at Kharagpur (West Bengal), with the support from the United Nations Educational, Scientific, and Cultural Organization (UNESCO), based on the MIT model. The second IIT came into existence at Bombay (now Mumbai) in 1958, with the assistance from the Soviet Union through UNESCO. In 1959, IIT Madras (now Chennai) was established with assistance from Germany and in 1960 IIT Kanpur with the help from a consortium of U.S. universities. The British industry and the U.K. government supported the establishment of IIT Delhi in 1961.

After a gap of over three decades, the sixth IIT was established at Guwahati in 1994 totally through indigenous efforts and the Engineering College at Roorkee was first made a University and then as the seventh IIT (2001). Then between 2008 – 2012, nine more IITs were established in different states of the country making a total of 16 IITs.
Table 4.1: List of Indian Institute of Technology (IITs)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of IIT</th>
<th>State</th>
<th>Year of Establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indian Institute of Technology Kharagpur</td>
<td>West Bengal</td>
<td>1951</td>
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<tr>
<td>2</td>
<td>Indian Institute of Technology Bombay</td>
<td>Maharashtra</td>
<td>1958</td>
</tr>
<tr>
<td>3</td>
<td>Indian Institute of Technology Madras</td>
<td>Tamil Nadu</td>
<td>1959</td>
</tr>
<tr>
<td>4</td>
<td>Indian Institute of Technology Kanpur</td>
<td>Uttar Pradesh</td>
<td>1960</td>
</tr>
<tr>
<td>5</td>
<td>Indian Institute of Technology Delhi</td>
<td>Delhi</td>
<td>1961</td>
</tr>
<tr>
<td>6</td>
<td>Indian Institute of Technology Guwahati</td>
<td>Assam</td>
<td>1994</td>
</tr>
<tr>
<td>7</td>
<td>Indian Institute of Technology Roorkee</td>
<td>Uttarakhand</td>
<td>2001</td>
</tr>
<tr>
<td>8</td>
<td>Indian Institute of Technology Gandhinagar</td>
<td>Gujarat</td>
<td>2008</td>
</tr>
<tr>
<td>9</td>
<td>Indian Institute of Technology Hyderabad</td>
<td>Telangana</td>
<td>2008</td>
</tr>
<tr>
<td>10</td>
<td>Indian Institute of Technology Jodhpur</td>
<td>Rajasthan</td>
<td>2008</td>
</tr>
<tr>
<td>11</td>
<td>Indian Institute of Technology Patna</td>
<td>Bihar</td>
<td>2008</td>
</tr>
<tr>
<td>12</td>
<td>Indian Institute of Technology Roorkee</td>
<td>Punjab</td>
<td>2009</td>
</tr>
<tr>
<td>13</td>
<td>Indian Institute of Technology Bhubaneswar</td>
<td>Orissa</td>
<td>2009</td>
</tr>
<tr>
<td>14</td>
<td>Indian Institute of Technology Mandi</td>
<td>Himachal Pradesh</td>
<td>2009</td>
</tr>
<tr>
<td>15</td>
<td>Indian Institute of Technology Indore</td>
<td>Madhya Pradesh</td>
<td>2009</td>
</tr>
<tr>
<td>16</td>
<td>Indian Institute of Technology (Banaras Hindu University), Varanasi</td>
<td>Uttar Pradesh</td>
<td>2012</td>
</tr>
</tbody>
</table>

(Source: https://www.iitsystem.ac.in/)

While taking advantage of experience and best practices in industrial countries, India ensured that the “institutions represented India’s urges and India’s future in making” (Prime Minister Nehru, 1956). The Indian Parliament designated the IITs as “Institutes of National Importance,” publicly funded institutions enjoying maximum academic and managerial freedom, offering programs of high quality and relevance in engineering, technology, applied sciences, and management at the undergraduate, master’s, and doctorate levels and offering their own degrees.

4.1.2.2 National Institutes of Technology (NITs) (Erstwhile Regional Engineering Colleges (RECs))

The main aim of setting up these RECs was to create the required technical manpower by providing undergraduate education and training in different branches of engineering & technology. Further, the RECs were also envisaged to function as pace
setters and to provide academic leadership to the technical institutions in their respective regions. On the recommendations of the Engineering Personnel Committee (EPC) set up by the Planning Commission in 1955, eight Regional Engineering Colleges (RECs) (two in each regions - east, west, north & south) were set up in early sixties as joint and co- operative ventures of the Central and State Governments concerned with a view to provide the required technical manpower for the industrial projects being contemplated during the 2nd Five-Year Plan (1956-61). Gradually Seventeen Regional Engineering Colleges (RECs) were established.

In 2003, the Seventeen erstwhile Regional Engineering Colleges (RECs) were rechristened as National Institute of Technology (NITs) and taken over as fully funded institutes of the Central Government and granted deemed university status. In addition, the Central Government has also taken over 3 other Institutes namely the Bihar Engineering Colleges, Patna, the Government Engineering College, Raipur and the Tripura Engineering Colleges, Agartala, and converted them into National Institute of Technology (NITs) in 2004, 2005 and 2006 respectively. These institutes are expected to be at par with other national level technical institutes and be able to fulfil the demand of high quality undergraduate and postgraduate level of education in engineering and technology. The National Institute of Technology Act, 2007 has since been enacted by Parliament so as to provide a common statutory framework for all NIT. During the 11th five year plan ten more NITs were established, bringing the current total NITs to 30 (Salmi, 2009).
### Table 4.2: List of National Institute of Technology (NITs)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of NIT</th>
<th>State</th>
<th>Year of Estb.</th>
<th>Upgraded as NIT</th>
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<tbody>
<tr>
<td>1</td>
<td>National Institute of Technology, Agartala</td>
<td>Tripura</td>
<td>1965</td>
<td>2006</td>
</tr>
<tr>
<td>2</td>
<td>Motilal Nehru National Institute of Technology, Allahabad</td>
<td>Uttar Pradesh</td>
<td>1961</td>
<td>2002</td>
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<tr>
<td>3</td>
<td>Maulana Azad National Institute of Technology, Bhopal</td>
<td>Madhya Pradesh</td>
<td>1960</td>
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<tr>
<td>4</td>
<td>National Institute of Technology, Calicut</td>
<td>Kerala</td>
<td>1961</td>
<td>2002</td>
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<tr>
<td>5</td>
<td>National Institute of Technology, Durgapur</td>
<td>West Bengal</td>
<td>1960</td>
<td>2003</td>
</tr>
<tr>
<td>6</td>
<td>National Institute of Technology, Hamirpur</td>
<td>Himachal Pradesh</td>
<td>1985</td>
<td>2002</td>
</tr>
<tr>
<td>7</td>
<td>Malaviya National Institute of Technology, Jaipur</td>
<td>Rajasthan</td>
<td>1963</td>
<td>2002</td>
</tr>
<tr>
<td>8</td>
<td>Dr. B.R. Ambedkar National Institute of Technology, Jalandhar</td>
<td>Punjab</td>
<td>1986</td>
<td>2002</td>
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<tr>
<td>9</td>
<td>National Institute of Technology, Jamshedpur</td>
<td>Jharkhand</td>
<td>1960</td>
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<td>10</td>
<td>National Institute of Technology, Kurukshetra</td>
<td>Haryana</td>
<td>1963</td>
<td>2002</td>
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<td>Visvesvaraya National Institute of Technology, Nagpur</td>
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<td>1960</td>
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<td>1886</td>
<td>2004</td>
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<td>13</td>
<td>National Institute of Technology, Raipur</td>
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<td>2005</td>
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<td>National Institute of Technology, Rourkela</td>
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<td>2002</td>
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<td>National Institute of Technology, Silchar</td>
<td>Assam</td>
<td>1976</td>
<td>2002</td>
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<td>Sardar Vallabhbhai National Institute of Technology, Surat</td>
<td>Gujarat</td>
<td>1961</td>
<td>2002</td>
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<td>National Institute of Technology, Surathkal</td>
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<td>1960</td>
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<td>19</td>
<td>National Institute of Technology, Tiruchirapalli</td>
<td>Tamil Nadu</td>
<td>1964</td>
<td>2003</td>
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**New NITs**

<table>
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<tr>
<th>Sr. No.</th>
<th>Name of NIT</th>
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<th>Year of Estb.</th>
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</tr>
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<td>22</td>
<td>National Institute of Technology, Delhi</td>
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<td>2010</td>
<td>2010</td>
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<td>23</td>
<td>National Institute of Technology, Goa</td>
<td>Goa</td>
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<td>2010</td>
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<tr>
<td>24</td>
<td>National Institute of Technology, Manipur</td>
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<td>2010</td>
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<td>National Institute of Technology, Meghalaya</td>
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<td>2010</td>
<td>2010</td>
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<tr>
<td>No.</td>
<td>Institute Name</td>
<td>Location</td>
<td>Year 1</td>
<td>Year 2</td>
</tr>
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</tr>
<tr>
<td>26</td>
<td>National Institute of Technology, Mizoram</td>
<td>Mizoram</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>27</td>
<td>National Institute of Technology, Nagaland</td>
<td>Nagaland</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>28</td>
<td>National Institute of Technology, Puducherry</td>
<td>Puducherry</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>29</td>
<td>National Institute of Technology, Sikkim</td>
<td>Sikkim</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>30</td>
<td>National Institute of Technology, Uttarakhand</td>
<td>Uttarakhand</td>
<td>2010</td>
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</tr>
</tbody>
</table>

(Source: http://mhrd.gov.in/nit)

4.1.2.3 Indian Institutes of Information Technology (IIITs)

Information Technology is an important tool for the development of different areas of knowledge economy. There has been a steady rise of software and IT sector in India since 1990’s. As the IT industry is expanding rapidly, manpower requirement is growing exponentially. In order to develop manpower for different areas of the knowledge economy, education and training of information technology is a core prerequisite. The Central Government has established four IIITs: the Indian Institute of Information Technology, Allahabad (1999), the Atal Bihari Vajpayee – Indian Institute of Information Technology (ABV- IIITM), Gwalior (1996), Pandit Dwarka Prasad Mishra Indian Institute of Information, Technology, Design and Manufacturing (IIITDM), Jabalpur (2005) and the Indian Institute of Information Technology, Design and Manufacturing (IIITD & M), Kanchipuram (2007). These institutions are meant to provide undergraduate as well as postgraduate education. The 11th Five Year Plan also envisages the establishment of 20 more IIITs in the country in the Public Private Partnership (PPP) mode.

Further the School of Planning and Architecture, New Delhi in 1955 came into existence and two more SPAs at Bhopal & Vijayawada were established in 2008. The National Institute of Technology and Industrial Engineering (NITIE) at Bombay in 1963, and the National Institute Foundry and Forge Technology at Ranchi in 1966 were set up.
Central Institute of Technology, Kokrajhar, Assam in 2006, the Sant Longowal Institute of Engineering & Technology (SLIET), Longowal, Punjab in 1989 and the North Eastern Regional Institute of Science & Technology (NERIST), Itanagar 1985 were also established by the government apart from IITs, IISc, and NITs etc (http://mhrd.gov.in/).

For continuous improvement, the technical education has been examined by the top notch committees, chaired by Y. Nayudamma, P. Rama Rao, U. R. Rao, R. A. Mashelkar and A. Kakodkar. Each of them made an in-depth analysis, identified the strengths and weaknesses, and made valuable suggestions for overcoming the shortcomings and make progress in the quality of education. The Committees and their recommendations are as follows;

- The Committee on post-graduate engineering education and research was appointed under the chairmanship of Prof. M.S. Thacker (1959-61) and the committee recommended funding for 100 Ph.Ds annually.

- The Nayudamma Committee (1979-80) was set up to look into the PG Education in Engineering and Technology recommended PG is the minimum qualification for Industry and R&D etc.

- In 1986 the Nayudamma Committee was appointed to review the working of the IITs and recommended greater flexibility in academic programme, focus on Engineering Research and Faculty Mobility.

- In 1995 P. Rama Rao committee was set-up to study Reshaping PG Education in Engineering and Technology and recommended 21 Months M.Tech, increased scholarship amount, assured employment for M.Techs and National Doctoral Programme.

- R.A. Mashelkar Committee (1998) was set up to draw a Strategic Road Map for Academic Excellence of Future Regional Engineering Colleges and recommended
conversion of RECs into NITs with status of a Deemed to be University and structural changes in governance.

- U. R. Rao Committee (2003) was set up for revitalizing the Technical Education and the committee recommended regional inquiry to be removed, faculty shortage to be addressed, need for planning and coordination in the working of the AICTE.
- P. Rama Rao Committee (2004) was also set up to IIT Review in India and the committee recommended to increase UG output of IITs, fund infrastructure increase, and add new IITs but maintain quality.
- In 2010 Dr. Anil Kakodkar Committee was constituted by the Ministry of Human Resource Development (MHRD) to suggest a roadmap for the autonomy and future of the Indian Institutes of Technology (IITs) as world-class institutions for research and higher learning.

4.1.3 MHRD funded Technical Institutions

The technical education system in the country can be broadly classified into three categories – Central Government funded institutions, State Government/State-funded institutions & Self-financed institutions. The Centrally funded institutions of technical and science education are as under;

At present 82 centrally funded technical institutions are there; IITs (16), IIMs (13), IISc, Bangalore (1), NITs (30), IIITs (04), NITTTRs (04), IISERs (5), and others (09 -SPA, ISMU, NERIST, SLIET, NITIE & NIFFT, CIT).

4.1.4 Private Initiatives in Engineering Education

The 1980’s saw a phenomenal growth of private engineering institutions in a few southern states such as Andhra Pradesh, Karnataka, and Tamil Nadu along with Maharashtra. The fast growth in the private sector is on account of the fact that during the Sixth Five Year Plan (1980-85), when the central and state governments were finding
it difficult to expand technical education in the country, a few state governments, especially the governments of Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra took a bold decision to permit private registered societies and trusts to establish and run technical institutions on a self-financing basis. These are technical institutions of a new generation unlike the previous set of private institutions started under the charity motives. As a result, a large number of private self-financing technical institutions came into existence in the above four states.

Then, there was an increase of large number of State Government Engineering Colleges, often affiliated to a University and having a limited or no autonomy about curriculum, examinations, degree granting, etc. During the last two decades, the growing demand for expansion of technical education and the inability of the Government (which traditionally has been establishing and running technical institutions), to meet the social aspirations, has resulted in private initiative to provide the alternatives. In recent years, the private registered societies and trusts have established a phenomenally large number of technical institutions. The self financing technical institutions now account for more than two-third of the admissions to engineering colleges and nearly half in polytechnics. The great demand for engineering and technical education has led to the mushrooming of the large number of private engineering colleges, many started by politicians or as money-making ventures (Banerjee & Muley, 2010).  

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>Government</th>
<th>Govt aided</th>
<th>Unaided - Private</th>
<th>University Managed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Diploma &amp; Post Dip. Institutes</td>
<td>827</td>
<td>197</td>
<td>2492</td>
<td>8</td>
<td>3524</td>
</tr>
<tr>
<td></td>
<td>23.47</td>
<td>5.59</td>
<td>70.72</td>
<td>0.23</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source: AICTE Approval Process Hand Book- 2013-14)
4.1.5 **Expansion of Engineering Education**

Technical education has always been and continues to be one of the more preferred areas of study with expectations for better career opportunities. As a result of the efforts stated above by the Central Government and initiation by the Governments of respective states after creation of new states, particularly after independence and increased demand for more trained technical manpower, the number of engineering colleges increased enormously. There has been a phenomenal growth in the number of engineering institutions in the country after independence. Since early eighties, due to rapid industrialization and economic growth and change in Govt. policies, engineering education has been developing very fast.

**Table 4.4: Number of engineering colleges and intake**

<table>
<thead>
<tr>
<th>Year</th>
<th>College</th>
<th>Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977–78</td>
<td>562</td>
<td>1,34,894</td>
</tr>
<tr>
<td>2006–07</td>
<td>1511</td>
<td>550,986</td>
</tr>
<tr>
<td>2012–13</td>
<td>3498</td>
<td>17,61,976</td>
</tr>
</tbody>
</table>
Today, there are 8,598 Technical education institutions with an intake of 22,36,743 in the country offering various programmes in Engineering, Management, Pharmacy and Architecture etc.

The growth of technical institutions for the past six years, during 2006-07 there were 1511 engineering institutions in India. The number increased to 1668 during 2007-08, and in year 2008-2009, it was 2388 institutions. There were 2972 engineering colleges in 2009-2010, and as on 2010-11 there were 3222 institutions. During 2011-2012, the number increased to 3393 engineering institutions and at present (2012-13) there are 3498 engineering institutions, in the country.

**Figure 4.2: Growth of Engineering Institutions in India**

(Source: AICTE Website)

4.1.6 System of Governance for Technical & Engineering Education

Higher education, and in particular technical and engineering education, is critical to India’s aspirations of strengthening its reputation as a major competitive player in the global knowledge economy. The system is huge and complex, and there is a consensus that reforms are imperative. Issues of fair access and affordable participation in higher education are critical if India is to empower its people with educational
opportunities that allow individual potential to be fulfilled, and allow more Indian graduates opportunities for employment and to compete in an international arena.

There are approximately 3498 technical/engineering institutions across India’s 30 states, of which less than 8 percent of public institutions are autonomous. There has been a phenomenal growth in the number of private colleges across India in the last 20 years. Private colleges now deliver 85 percent of all technical and engineering education. The significant changes in supply and demand make it increasingly important to ensure that tertiary education systems and institutions are effectively and efficiently governed and managed to meet the needs of industry and society (Biswas. et al. (2010).

4.1.7 All India Council for Technical Education (AICTE)

The aim of any country’s higher education system is sustainable development and achieving higher growth rates. It is enabled through creation, transmission and dissemination of knowledge. The All India Council for Technical Education (AICTE) has been in existence since November 1945 as a national level Apex Advisory Body with its mission of developing and promoting quality technical education in the country in a coordinated and integrated manner. The Council’s constant endeavour is to encourage a meaningful association between the technical education system and research and development activities in a concerted effort aimed at nation-building. The Council believes in providing a proper impetus to Institutions in generating competent engineers, pharmacists, managers, architects and scientists and encourages them to think beyond the curriculum while imparting training for the advancement of knowledge.

The general higher education is regulated by the UGC; engineering institutions are regulated by the AICTE. The AICTE regulates technical education institutions involved in education in engineering and technology, architecture and town planning, management, pharmacy, applied arts and crafts, and hotel management and catering
technology. The AICTE established the National Board of Accreditation (NBA) to evaluate technical education institutions. Currently, accreditation is voluntary, and it lasts three to five years, depending on a satisfactory assessment outcome.

The Council has put in place several initiatives in the last three years to bring about changes in the Approval Process by introducing greater transparency and accountability through the e-governance. The emphasis this year is to put in place simplified procedures and greater ease in the approval process. “Access to Quality” and “Education to All” will be the slogans for the year 2013-14 to give more impetus to quality in technical education and to be the best in the world. The role of AICTE as a regulator will be further geared up to weed out the Institutions not fulfilling the norms and standards (http://www.aicte-india.org).

4.2 Technical Education in Maharashtra State

4.2.1 About Maharashtra State

Maharashtra was a part and parcel of the erstwhile Bombay state along with Gujarat. It was popularly known as Bombay Presidency, which was created by the British when they became undisputed power of the Western part of India. Maharashtra is one of India’s biggest commercial and industrial centres, and it has played a significant role in the country’s social, economic and political life. It is also a leader among Indian states in terms of agricultural and industrial production, trade and transport, and education.

The modern state of Maharashtra came into existence on 1st May 1960. Under the Bombay Reorganization Act the states of Maharashtra and Gujarat were legally given the status of separate states on the basis of linguistic differences. The present Bombay city became the capital city of Maharashtra. It is bounded by the Indian states of Gujarat to the northwest, Madhya Pradesh to the north, Chhattisgarh to the east, Andhra Pradesh to
the southeast, Karnataka to the south, and Goa to the southwest and by the union territory of Dadra and Nagar Haveli and the Arabian Sea to the west. It covers almost 118,800 square miles (307,690 square km) area of the country with the population of 112,372,972 (http://www.britannica.com).

Maharashtra is one of the highly recognized states in India for the promotion of quality education. With numerous schools, colleges and other educational institutions operating in the state, Maharashtra is flocked by students from all over the country for pursuing a career in their own chosen field. The western region of the state is a hub for popular colleges and premier institutions. It is one of the States that are in the forefront in the matter of higher education. The State offers numerous graduate and post-graduate courses of study in the arts, science and commerce streams as well as in professional courses such as medicine, engineering and management.

Figure 4.3: Map of Maharashtra State
4.2.2 Growth and Development of Technical education in Maharashtra

Due to a change in the industrial growth and requirement of skilled manpower in different sectors at all levels, government has been putting continues effort in restructuring of education and quality maintenance in recent years, in education sector and particularly in technical education. Technical education contributes substantially to the Socio-economic development of the country as a whole. The development sustenance of the industrial sector is entirely dependent upon the availability of trained manpower to perform the multidimensional activities needed to keep the wheel of industry running.

Thus the Technical Education Department of Maharashtra state aims towards making available these trained technically qualified hands to serve the industry & society. Equality of educational opportunities and preparing highly skilled work force for enterprises widely with excellence is also objective of Technical Education. Technical Education system thus has to be flexible enough to adapt to rapid change. Thus precise aim of the system is to develop and transfer of technology to user systems.

4.2.2.1 Before Independence of India

The industrial revolution considered as a major turning point in human history. It introduced a new system of learning process to satisfy the growing needs of an industrial society, which is called technical education. The Technical Education system brought out the concept of establishment of training institutions in order to meet the challenges of fast changing technological environment. Creation of centres of technical training came from the British rulers of India and it arose out of the necessity for the training of overseers for construction and maintenance of public buildings, roads, canals and ports and for the training of artisans and craftsmen (http://mhrd.gov.in/). Govt. recruited lower grades- craftsmen, artisans and sub-overseers locally. The necessity to make them more
efficient by giving them training, led to the establishment of industrial schools. One of the schools was started in Western Presidency at Poona for training overseers.

The College of Engineering, Pune, established in the year 1854, is one of the oldest and premier engineering institutes in the Indian subcontinent. Initially it was started as the ‘Poona Engineering Class and Mechanical School’ to train subordinate officers for carrying out public works. Later on, the school became “Poona Civil Engineering College”, then changed to ‘College of Engineering, Poona’. The institution was initially affiliated to the University of Bombay for a degree of Licentiate in Civil Engineering known as LCE. Later on, the certificate course and the first batch of the B. E. (Civil) degree came out in the year 1911 (http://www.dtemaharashtra.gov.in/). For a long time, this was the only College of Engineering in the Western Presidency.

On the recommendation of the Court of Directors of the East India Company, the University of Bombay was established in 1857. It established faculties of arts, science and law, and engineering. The provincial engineering colleges were duly affiliated to the University of their Region. After 1880, the demand for mechanical and electrical engineering was felt, but engineering colleges started only apprenticeship classes in these subjects. The Victoria Jubilee Technical Institute, which was started at Bombay in 1887, had as its objective the training of licentiates in Electrical, Mechanical and Textile Engineering and technology. The Modern Education Society’s Cusrow Wadia Institute of Technology was started at Pune with setting up of Department of Applied Electricity in 1938.

Later on in 1933, the University Department of Chemical Technology in Bombay (Mumbai) and in 1943 Laxminarayan Institute of Technology in Nagpur were established. These were as a result of the reports of the Indian Industrial Commission (1916) and the Calcutta University Commission (1917) with private enterprise and Government assistance. These Institutions were the major contributing factors for the
development of technical education in the state in particularly western part of the state, Pune and Mumbai regions. These early initiatives created conducive environment for setting up of large number of educational Institutes including engineering and technical education in the other parts of the state.

4.2.2.2 After Independence of India

Between 1948 and 1960, the states of Maharashtra and Gujarat were clubbed together. An engineering college at Ahmadabad, a separate polytechnic at Pune and two model polytechnics, one at Bombay and another at Ahmadabad were started. To promote higher education in the region the University of Poona was established under the Poona University Act, passed by the Bombay Legislature on February, 1948.

The Sarkar Committee recommended for the establishment of four higher technical institutes, on the pattern of the MIT, USA to meet India's post war need for high grade engineers, technologists etc. As per the recommendations, Govt. of India established the first Indian Institute of Technology at Kharagpur in 1950 and the second Indian Institute of Technology came into existence at Bombay (now Mumbai) in 1958, with assistance from the Soviet Union through UNESCO. Further came into existence the National Institute of Technology and Industrial Engineering at Bombay in the year 1963,

To provide technical training to military & defence personnel and to promote higher engineering education & research in defence related areas, the Defence Institute of Advanced Technology, Pune was established in 1952. It was started as a military technical training school called the Institute of Armament Studies in the CME campus. In 1967, it was renamed as "Institute of Armament Technology, (IAT)". From the relatively narrow scope of Armament Studies alone in the fifties, the role of the Institute was significantly enlarged by the Defence R&D Council. With accreditation of the
AICTE, the Pune University recognised eight courses for the award of ME degree in 1980. In 2000, the Institute acquired the status of a Deemed University. IAT has been renamed as DIAT w.e.f. 1st April 2006 (www.diat.ac.in/).

On the recommendations of the Engineering Personnel Committee (EPC 1955), the Visvesvaraya Regional College of Engineering (VRCE) (now Visvesvaraya National Institute of Technology Nagpur) was established in the year 1960 under the scheme sponsored jointly by Govt. of India and Maharashtra. The college was started in June 1960 by amalgamating the State Govt. engineering college functioning at Nagpur (http://www.vnit.ac.in).

The formation of the State of Maharashtra in 1960 opened a new chapter in the development of technical education and the activities of the Directorate increased manifold. With industrial development, the need for skilled technical manpower grew to a large extent. The growth of technical institutes mainly can be attributed to industrial revolution in the state. In the beginning the growth in establishment of technical institutes in the state was mainly concentrated in the main cities like Pune, Mumbai, and Nagpur later. The Establishment of Maharashtra Industrial Development Corporation (MIDC) led to the industrial revolution in the state. The key progressive policy decisions taken by the State certainly changed the social economic scenario of the state as Industrial activities spread in the across the state.

To cater to this need, new industrial training institutes, polytechnics and engineering colleges were started. These institutes produced skilled workers, technically qualified supervisors, and shop floor and design engineers. By 1978, the number of degree level institutes increased to 16, the diploma level institutes to 50. Also, post-graduate facilities were developed in nine institutions. Similarly, the ITIs and technical high schools were also increased in large numbers.
The fast growth in the private sector is on account of the fact that during the Sixth Five Year Plan (1980-85), when the central and state governments were finding it difficult to expand technical education in the country, a few state governments, especially the governments of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh took a bold decision to permit private registered societies and trusts to establish and run technical institutions on a self-financing basis (Geetha Rani, 2010).

In 1983 the government decided to grant permission to private educational societies to start the technical institutions. Being a place of Social reformers, saints, Educationists and having great tradition and rich heritage in the field of education many private registered societies and trusts came forward to start technical institutions on a self-financing basis. Around 175 Colleges were established and started offering technical education in the state. The number of institutions offering Technical Education grew exponentially in the last 20 years and the story still continues.

Later on in 1989, the Dr. Babasaheb Ambedkar Technological University (BATU), Lonere, was established by Government of Maharashtra under the Government of Maharashtra Act XXII of 1989. The University is located in the Raigad District of Konkan region of Maharashtra State and is the first autonomous Technological University of unitary status in the state. This University has been attracting students with excellent academic credentials from all over Maharashtra (http://www.dbatuonline.com/).

During the period of industrial growth many visionaries, Industrialist and educational leaders contributed for the development of the technical education in the state by helping in establishing number of technical institutions across the state. The reputations of VJTI, Mumbai and Pune Universities and IIT Bombay have made a mark in imparting technical education and training students in these regions to develop multi
dimensional skills required for the industry. These are all main factors responsible for the establishment of more number of engineering and technical institutions in Maharashtra State.

4.2.3 Present Status of Technical Education in Maharashtra

Engineering education in Maharashtra state has seen tremendous growth over the past decade, both in number of students and colleges. The recent growth in engineering education has been overwhelming due to privately funded educational institutions came forward to establish engineering colleges rather than public funded ones. The State of Maharashtra, which is a pioneer in technical education, contributes more than 50% to this educational achievement. Since the establishment of a School of Engineering in 1854 at Pune, the growth of engineering education has been amazing in Maharashtra state.

Quite a number of engineering colleges have been started since August 15, 1947. It is due to the realisation that India has to become a great industrial country and would require a far larger number of engineers than could be supplied by the older institutions. Today, there are 365 engineering colleges with an intake capacity of 1,54,827 in the state offering undergraduate and post graduate and Ph.D. programmes in various engineering and technological disciplines (http://www.dtemaharashtra.gov.in/).

The following are the oldest and premier autonomous technological institutions in the Maharashtra state;

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of Institutes</th>
<th>Year of establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Govt. Autonomous Institutes</td>
<td>1964</td>
</tr>
<tr>
<td>2</td>
<td>Government College of Engineering, Amravati</td>
<td>1960</td>
</tr>
<tr>
<td>3</td>
<td>College of Engineering, Pune</td>
<td>1854</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Govt. Aided Autonomous Institutes</th>
<th>Year of establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shri Guru Gobind Singhji Institute of Engineering &amp;</td>
<td>1981</td>
</tr>
</tbody>
</table>
The following tables give an idea about development of Engineering & Technology institutes in the state:

### Table 4.6: Growth of Engineering & Technology Institutes

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Institutes</td>
<td>16</td>
<td>76</td>
<td>94</td>
<td>129</td>
<td>154</td>
<td>309</td>
<td>365</td>
<td></td>
</tr>
<tr>
<td>Sanctioned Intake</td>
<td>2642</td>
<td>14275</td>
<td>22740</td>
<td>38939</td>
<td>46325</td>
<td>114268</td>
<td>154827</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Institutes</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>15</td>
<td>41</td>
<td>88</td>
<td>226</td>
<td></td>
</tr>
<tr>
<td>Sanctioned Intake</td>
<td>584</td>
<td>700</td>
<td>750</td>
<td>770</td>
<td>2789</td>
<td>6081</td>
<td>16714</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Institutes</td>
<td>28</td>
<td>127</td>
<td>160</td>
<td>170</td>
<td>174</td>
<td>387</td>
<td>483</td>
<td></td>
</tr>
<tr>
<td>Sanctioned Intake</td>
<td>5145</td>
<td>23436</td>
<td>30000</td>
<td>34295</td>
<td>68685</td>
<td>132632</td>
<td>173802</td>
<td></td>
</tr>
</tbody>
</table>

(Source: DTE Website)

### Table 4.7: Growth of Intake Seats (UG/PG/Diploma)

<table>
<thead>
<tr>
<th>Approved Intake (Year)</th>
<th>2008 - 2009</th>
<th>2009 - 2010</th>
<th>2010 - 2011</th>
<th>2011- 2012</th>
<th>2012- 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>All India</td>
<td>1700325</td>
<td>2200920</td>
<td>2790735</td>
<td>3164131</td>
<td>3449355</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>204297</td>
<td>257970</td>
<td>344803</td>
<td>395654</td>
<td>437739</td>
</tr>
</tbody>
</table>

(Source: DTE Website)
Table 4.8: No. of Institutes & Type of Institutes (2012-2013)

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>No. of Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>48</td>
</tr>
<tr>
<td>Govt. aided</td>
<td>40</td>
</tr>
<tr>
<td>University Managed</td>
<td>01</td>
</tr>
<tr>
<td>Unaided - Private</td>
<td>541</td>
</tr>
</tbody>
</table>

(AICTE Approval Process Handbook -2013 -14)

Figure 4.4: Type of Institutes

4.2.4 Department of Higher & Technical Education, Maharashtra State

The main functions of the Department of Higher & Technical Education are to implement The National Education Policy, to provide guidance to educational institutions and to increase standard of higher and technical education in the state. This department has the overall responsibility of strategic direction setting, administrative & financial matters and also responsible to develop & extend Technical Education, to provide grants to universities, local & other independent educational institutions. The Department governs following directorates of GoM;

1. Directorate of Higher Education
2. Directorate of Technical Education
3. Directorate of Vocational Education
4. Directorate of Vocational Education & Training
5. Directorate of Arts,
6. Directorate of Libraries
4.2.5 Directorate of Technical Education, Maharashtra State

After independence, with an increased stress on industrial development, a separate Directorate of Technical Education was set up by the Government in 1948 to organise and co-ordinate the technical education activities at all levels. The role of the Directorate is to maintain, enhance the standard, quality of technical education by laying the policies, establishing developing Govt. Institutions, guiding supervising the aided, private institutions, interacting with industry and national level institutions, co-ordinating with other departments of State Government, Government of India Statutory Organisations and to contribute to the development of industry society at large.

The Directorate of Technical Education was given the responsibility of degree and diploma level institutions in Engineering and Technology, Architecture, Pharmacy, Hotel Management and Catering Technology etc. The Directorate was also entrusted with the monitoring and control of management institutions imparting degree and diploma level training in various branches of management. At present there are 6 regional offices of Directorate of Technical Education in the state.

Main activities of Department of Technical Education are;

a. **Directorate of Industry-Institute Co-Ordination (DLLC):** The Directorate of Industry-institute Co-ordination was established in 1996, the MHRD World Bank Project has been started to look after the quality improvement of the faculty, staff as well as the students and the efficiency enhancement of Technical Education system (TES) in total. This is a separate Directorate to manage the externally funded projects for total quality management (TQM) of TES of Maharashtra.

b. **Staff Development Program:** Staff Development cells are established at six lead centre polytechnics in Maharashtra state. These cells have identified training need & training facilities and design need based training programmes for the teaching
faculties and supporting staff with the help of TTTI Bhopal, IIT Bombay and National Institute of Industrial Engg. Bombay. Foreign fellowship programmes are also being arranged for senior administrators and teachers engaged in teaching high-tech courses.

c. **Industry Institute Interaction**: With fast growing needs of the industries for man-power with specialisation in specific areas it became necessary to have proper interaction with the industry. Therefore, special 28 Industry Institute Interaction Cells have been established in Institutions. The main function of the cell is to promote interrelationship between industry & institution through training programmes, visiting faculty from industry, industrial visits & practical training etc.

d. **World Bank Assisted Project**: With the fast developments in technologies it was essential to revamp technician’s education the World Bank offered to finance the scheme of strengthening of Technician Education in 1992 and the project was completed in 1999.

e. **Book Bank and Training & Placement Services**: These schemes for the backward class students / Training and Placement Cell in the institutions were to facilitate the industry institute interaction and also help students in getting good jobs through campus interviews. The student counselling and guidance is extended to the student through these cells.

f. **Women in Technical Education**: The Govt. of Maharashtra established polytechnics exclusively for women. There are more than 8 polytechnics at different parts of the state. In Engineering colleges & polytechnics admissions 30% seats are reserved for women to pursue technical education and 30% seats are also reserved in employment for them.


**g. Scholarships:** The financial assistance is made available to the student from backward class community and economical backward classes. The merit scholarships are also made available to the meritorious students of both diploma and degree courses.

**h. Implementation of Information Technology in State:** Department of Higher & Technical Education has started the certificate & advance certificate course in information technology at all levels of higher, technical and vocational education through the 8 private training providers and a few government engineering colleges & polytechnics with a deemed status (http://www.dtemaharashtra.gov.in/).

**4.2.5.1 Maharashtra State Board of Technical Education (MSBTE)**

With an increase in the number of institutions, courses and students admitted to various diploma courses, a need to have a separate body to conduct the examinations of these courses was felt and thus in 1963; a separate Board of Technical Examinations for the state was established. Now this Board, named as the Maharashtra State Board of Technical Examination (MSBTE), has been given an autonomous status, since 1999-2000. A key responsibility of the board is to advise the government on matters of policy relating to the Diploma Level Technical Education in general and on the following matters in particular, namely: 1. Co-ordination between national policies and state policies in Diploma level Technical Education. 2. Co-ordination between Secondary, Higher Secondary, Degree Education & Diploma level Education 3. To promote Industry-Institute Interaction (MSBTE - http://www.tafnap.com/).
4.3 Engineering Education in Mumbai

4.3.1 About Mumbai

The City of Bombay, as it was then called came to light in the year 150 A.D. through the geographical work of a renowned geographer, Ptolemy. The city consisting of several islands were then ruled by kolis and agris, the native inhabitants of Mumbai.

These natives ruled the islands upto 1345 A.D. Thereafter, the rulers changed down the history till the Islamic rulers invaded India and conquered some of the islands in 1534 A.D. Subsequently, a Muslim ruler from Gujarat took over all the islands, which were then conquered by the Portuguese. In 1661 A.D., the island of Bombay was added to the Britishers as a part of Royal Dowry, on the occasion of the marriage of King Charles II of England with the Portuguese princess Infanta Catherine. The island of Bombay was then to remain the part of British Empire till 15th August, 1947, on which day our country saw the first dawn of independence from the foreign rule. Initially, the King entrusted the administration of Bombay to the East India Company. By a Royal Charter under the Regulation XIX of 1827, passed by the British Government, the Collector of Bombay was made the Chief Controlling Authority of the Revenue Administration of Bombay. The Collector of Bombay enjoyed vast authority under the Bombay Land Revenue Act 1876 which was repealed by the Maharashtra Land Revenue Code 1966 (http://www.mu.ac.in/).

Mumbai (formerly Bombay) is the capital city of Maharashtra state. It consists of two distinct regions: Mumbai City district and Mumbai Suburban district, which form two separate revenue districts of Maharashtra. The total area of Mumbai is 603.4 km² (233 sq mi). Of this, the island city spans 67.79 km² (26 sq mi), while the suburban district spans 370 km² (143 sq mi), together accounting for 437.71 km² (169 sq mi) under
the administration of Brihanmumbai Municipal Corporation (BMC) (http://www.britannica.com/).

**Figure 4.5: Map of Mumbai, Mumbai Suburban and Navi Mumbai**

![Map of Mumbai](http://en.wikipedia.org/)

Mumbai is an island city on the western coast, connected to the mainland by roads and railways. Mumbai is one of India's biggest commercial and industrial centres, and a land for finance, trade and entertainment. It has played a significant role in the country's social and political life. It displays a cosmopolitan character, which reflects in its cuisine, culture, inhabitants and language. The bustling city is the busiest ports of India and handles about 40 percent of India's Martine trade. The city which is a part of India's splendid coast has a natural harbour developed by the British. This was because
larger vessels and ships could easily dock, and found the islands of Bombay ideal for development and trade.

The most ambitious plan to decongest Mumbai was the one to create Navi Mumbai formerly known as New Bombay is a twin city of Mumbai, an alternative urban settlement on the mainland that would remain accessible to the island city. It was developed in 1972, and is the largest planned city of the world, with a total area of 344 km². Navi Mumbai lies on the mainland on the eastern seaboard of the Thane Creek. The city limits stretch from Airoli near Thane in the north, to Uran in the south. The length of the city is almost the same as that of Mumbai. Navi Mumbai is a part of the Mumbai Conurbation (http://www.frontline.in/ & http://www.cidco.maharashtra.gov.in/).

The progressive policies of the Government have encouraged huge industrial investments in the recent past and created job opportunities in multiple sectors like Engineering, ITES, Finance etc... Industrial growth stabilized the population base near the industrial areas developed in western parts of Maharashtra especially Mumbai, Navi Mumbai, and few other nearby districts of the region. For systematic development of different type of industries the Industrial Area is divided in different zones, such as Engineering Zone, Chemical zone, Textile Zone, Food Processing Zone, Electronic Zone and Knowledge Park.

The region houses many industries such as the Software Technology Parks include the International Technology Centre Park (ITC Park), the Dhirubhai Ambani Knowledge City, and the Millennium Business Park which are in New Mumbai. The Santacruz Electronic Export Processing Zone (SEEPZ) at Andheri, Mumbai and other textile, auto IT- enabled services & business process out sourcing units were also set up. An International IT Hardware Park (ITHP) is being established near the Jawaharlal Nehru Port in New Mumbai.
This industrial development in and around the Mumbai region resulted in huge requirement of skilled technical human resources. This has fuelled growth of technical education institutes in and around the Mumbai creating manpower as per the needs of the industry. From the world experience it is realized that sustaining and increasing rate of growth in competitive environment is not a contribution of capital investment alone. It requires highly qualified and trained manpower. The professionals are required to be competent by nothing less than global standards. This requirement is fulfilled to a large extent by the Institutes established in Mumbai and Navi Mumbai region.

4.3.2 Growth and Development of Engineering Education in Mumbai

The growth of technical education in Mumbai dates back to 1887 when the India’s premier engineering and technology school VJTI was established with only two departments, namely the Sir J. J. School of Mechanical Engineering and the Ripon Textile School for the two branches of industry in which Bombay was vitally interested at the time. The aim was with a desire to meet the technical manpower requirements of Bombay. The first step in the expansion of the Institute was taken in 1903 when courses in Electrical Engineering were introduced. The Technical & Applied Chemistry Department was added in 1906 (http://www.vjti.ac.in/). The Veermata Jijabai Technological Institute (formerly Victoria Jubilee Technical Institute) enjoys the pride and status of a premier Autonomous technological institute among engineering colleges in the country.

In the year 1933 the Institute of Chemical Technology (ICT) was established as a University Department of Chemical Technology (UDCT) of the University of Mumbai, through an active support of the industries and philanthropists. The ICT is one of the premier chemical engineering research institutes located in Mumbai focused on training and research in various branches of chemical engineering and chemical technology. The
Deemed University status was granted in 2008 and it is the only state funded deemed university in India (http://www.ictmumbai.edu.in/).

In 1945, the Tata Institute of Fundamental Research was founded. This was the vision that guided the TIFR which Homi Bhabha founded with the support from the Sir Dorabji Tata Trust. TIFR has been conferred the status of a Deemed University by the UGC. On January 3, 1954 Atomic Energy Commission started Bhabha Atomic Research Centre (formerly Atomic Energy Establishment, Trombay) Dr. Homi Bhabha was the Secretary to the Government of India for the Department of Atomic Energy. BARC's core mandate is to sustain peaceful applications of nuclear energy, primarily for power generation. It manages all facets of nuclear power generation, from theoretical design of reactors, computerised modelling and simulation, risk analysis, development and testing of new reactor fuel materials, etc (http://www.tifr.res.in & http://www.barc.gov.in/).

In 1957, the Bharatiya Bhavan conceived the idea of establishing an engineering college in Bombay (now Mumbai). The Engineering Personnel Committee of the Planning Commission had made certain recommendations for the establishment of new engineering colleges and polytechnics, in order to increase the technical manpower in the country. The proposal was favourably received by both the central and state governments and also sanctioned the fund to Bharatiya Bhavan. It was thus decided that naming the Engineering College after the late Shri Sardar Patel, then Prime Minister of India. On 19th August 1962 the Sardar Patel College of Engineering was inaugurated by then Pandit Jawaharlal Nehru, the then Prime Minister of India at Bhavan’s campus in Andheri (http://www.spce.ac.in).

The reputations of VJTI, Mumbai University, TIFR, IIT Bombay, BARC, SPEC and other prominent educational and research institutions have made an impact on the growth and development of engineering education and also mark in imparting and
training students to develop multi dimensional skills required for the industry in this region. These are all main factors responsible for the establishment of more number of engineering in the Mumbai region.

There are several private educational trusts/boards/management playing a pivotal role in uplifting the status of the society by establishing such educational institutes which are the need of the hour. Most of these institutes have a standing of more than 20 years. Majority of these institutes are located in the Mumbai region and a few are in the NaviMumbai region. The trusts/boards, which have opened a chain of educational institutes in and around the Mumbai, are namely, Shri Vile Parle Kelavani Mandal, Bharatiya Vidyabhavan, Somaiya Vidyavihar (Somaiya Educational Trust), Vivekanand Education Society, Hyderabad (Sind) National Collegiate Board , Anjuman-I-Islam, Bharati Vidyapeeth, Fr. Agnel Charities, Mahavir Education Trust etc., have established some of the reputed colleges like Sardar Patel College of Engineering (1962), K.J.Somaiya College of Engineering, Vidyavihar (1983), Thadomal Shahani Engineering College (1983), Fr. Conceicao Rodrigues College of Engineering, Bandra (1984), Vivekanand Education Society's Institute of Technology (1984), M.H. Saboo Siddik College of Engineering (1984), Shah & Anchor Kutchhi Engineering College (1985), Bharati Vidyapeeth College of Engineering (1990) etc.

At present 365 Engineering Colleges are there in Maharashtra State (Including Govt., Govt. Aided, autonomous, University Managed and Un-aided) of which 63 colleges are affiliated to the University of Mumbai and one is the SNDT Women's University and all are recognized by AICTE. There are 35 Engineering colleges in Mumbai (include Mumbai, Mumbai suburban & Navi Mumbai). The Director of Technical Education, Maharashtra State, is the authority for Admission process in all
colleges. Students from adjoining towns and suburbs come to Mumbai in their quest for quality education.

Navi Mumbai has a number of premier schools and colleges with quality education facilities. There are 13 engineering colleges and a good number of other educational intuitions in the city viz. Degree colleges, polytechnic, Management institutes and private universities etc.

4.4 Summing Up

India has made tremendous progress in the field of engineering and technical education over the last twenty years. Engineering is a laudable profession which has contributed significantly to the improvements in the quality of life of the common man. It is quite evident that engineering, technology and society have a symbiotic and synergistic relationship. Technical education is a crucial ingredient in a country’s industrial, economic and social development.

Realizing the potential of socio political and economic benefits from higher technical education in transforming India into a knowledge society, the Govt. of India has placed a much higher priority on higher education in the Eleventh Five Year Plan. The government of Maharashtra is also making various attempts to reorient education systems, bring quality consciousness at every level and align initiatives to contribute effectively to achieve the objectives of Govt. of India’s 11th Five year national plan (MSBTE- http://www.tafnap.com/).

Hence, from the world experience it is realized that sustaining and increasing rate of growth in competitive environment is not a contribution of capital investment alone. It requires highly qualified and trained manpower. Also demands of improved and quality technical education, adaptation of newer technologies and galvanizing human resources have to be met effectively for the development of a nation. Stress should be laid on the
development of a sound system of technical education where innovation, excellence, relevance constant upgradation, and participation are the main factors. The development of Information literacy skills are also of most important components of current knowledge society, engineers should be trained, to make them information literates as well as lifelong learners. The system should be in tune with the globalization trends and the growth of national economy. The general aim must be the development with right linkages of science and technology with other parameter.
References


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