



## EMERGING TRENDS IN ENGINEERING EDUCATION IN INDIA AND ITS PERSPECTIVE MANAGEMENT

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### **Introduction**

Engineering is one of the oldest professions recorded in history. Now, engineering is a vast global industry with immense opportunities. However, the challenges that modern engineers face can seem very daunting, especially in the areas of transport engineering, infrastructure building, energy management and power generation, climate change, water supply and construction engineering to name only a few. In this context, of the global challenges the future engineering is being framed by the complex forces that influence these sectors. These challenges are particularly poignant when the modern technological and scientific advances open up exiting new possibilities for sustainable engineering solutions, especially in developing countries. In order to address the challenges of this fast moving world of science and technology, the education of our future engineers needs to be kept in pace with the time and they need to be trained to manage the changes, complexities and uncertainty that in the engineering field. Therefore, designing and executing the solutions in a practical and sustainability way from the pillars of the modern engineering education is an essential requirement.

Sustainable solutions is meant that the needs of the present generations to be met without compromising the needs of future generations. The engineering curriculum is already very crowded with 'core' engineering topics. The sustainability demands to embed topics with relevance to the core topics. But finding space within the engineering curriculum to embed topics is a challenge in itself. Though the importance of inclusion of sustainable development is now being reflected in government policy on engineering courses, the engineering curriculum development and reforms without eroding scientific and technical depth of engineering subject is yet to be formulated in India Now more than ever, professional bodies in engineering are bound to recognize the importance of the 'global engineer'.

### **Framework of Professional Education**

India has been witnessing almost a revolution in the spread of higher education, particularly, professional education. India has invested enormously in upgrading its school education. On the other hand, professional education has largely privatized and talented poor and needy are funded in the form of scholarships and monetary assistance. There may be no need to create new tax payer funded institutions but it has to be remembered that the technical education has to be developed for the economic development of the country, Private professional educational institutions started as an unintended consequence of social evils and to satisfy the requirements of parties with vested agenda. These private investors are not interested to impart quality education. They are interested in making profit, recouping their investment at one stretch and thus making a mockery out of the one who is in need. Thus the quality of engineering education is under deterioration day by day and producing unskilled, shameful technocrats. For the name sake they are technocrats, but a big shame for themselves, society and for the nation.

### **Applicability of Engineering Education**

Technical and professional education helps a person to become self dependent or getting employed in any related sector instead depending government to provide him employment. Technical education has to be developed for the economic development of our country. The question is how many engineers do we need to tackle the challenges ahead? Over the next thirty years, it is estimated that the population of the world will increase by three billions. The world must produce more world class graduates and engineers than ever before and these engineers will need to act in a globally connected world. The requirement for engineer to be knowledgeable, technically adept, culturally aware and able to demonstrate leadership is certainly not new, but its importance is growing. Engineering skills are portable and international mobility for professional engineers continually increasing. The students pass out from the engineering colleges should be made employable by all concerned.

### **Employability of Engineering Graduates**

One and a half million engineering pass outs are there in India every year. Fewer are getting hired. This may be due to non extension of conceivable facilities, opportunities and resources for the empowerment of engineering students to acquire the skills required by the corporate sector. Engineering colleges have been springing up like wild mushrooms in India in the last few years. Their number has gone up from a not too modest, 1511 college in 2006-07 to an astoundingly high 6214 engineering colleges at present. The fact, however, remains that 20-33% out of 1.5 million engineering graduates passing out every year runs the risk of not getting a job at all. For those who do, the entry level salary is path critically low, and has stagnated at the level for the last eight nine years, though the prices everything from groceries to vehicle fuel have shot up



during the same period and continues at present also. Whether it is the below par quality of education provided by the private colleges or the stagnating and shrinking demand for the number of engineers, the huge engineering pass outs which are incidentally, more than the total number of engineers produced by the USA and China combined together. They do not get jobs for which they are qualified or 'suitable' jobs which matters worse. Thus, there is both unemployment and underemployment. In spite of academic achievements majority of engineering graduates seeking employment are rejected by the industries. Several engineers end up working as sales executives, so there is no link between what they studied and what they do.

All the more threatening is the fact that the two key industries which hire engineers in India; Information Technology and the manufacturing sector are also hiring lesser number of them than before. The IT industry in India which grew by as much 30% up for the last several years has slowed down to growth rate at present. The demand for qualified professionals in the field has understandably gone down too. The rapid growth in the number of engineering colleges can be attributed to an eco system built around feeding the outsourcing market and huge demand for engineers in the IT sector in India itself. Sadly however, the demand for IT related jobs in India fall sharply due to non linear growth models of IT companies and lesser number of men required handling the same jobs as before due to a higher degree of automation. Making matters the fact that startup salary offered is expected to fresh engineering pass outs is expected stagnate at more or less the same in the next few years. Entry level salary package for a software engineer which has lowered around Rs 1.8-2.5 lakhs to 2-2.75 lakhs since the last several years should not, therefore, hope for a turnaround or for better days.

### **Recruitment Status**

The biggest recruiters in the IT sector, TCS, Wipro, HCL, Cognizant, UST Global and Infosys do not plan to hike their entry level salary for fresh recruits and they are quite clear about it. According to the global heads of human resources of the top Information Technology industries, at the moment they are giving campus offers where they have not changed anything as far as the salary component is concerned. Entry level salaries remains stagnant for a while, they are going with same structure as they have and there is no change. Thus they are getting good talent. IT industries however, will continue to scout the various engineering colleges in its bid to hunt for the best talent in the industry and look forward to hiring more professionals in future as compared to the position of previous year. A worrying trend that has come to be observed is that only students from some of the lower rung colleges, but also some of the best brains that cleared the tough entrance tests to reach the exalted Indian Institute of Technologies. As against 76% of IIT pass outs are getting placements during years up to 2012, only a little above 66% out of the total could find campus placements in subsequent years. The ITI Industries will see 20 per cent less recruitment this year. Going forward, the demand for IT professionals will reduce; put straight, campus placement by IT companies will drop significantly. On the other hand, the supply of IT professionals from engineering campuses is still constant. There are no measures being taken to scale down the supply of IT graduates being churned out of engineering campuses. The situation is grimmer of tier 2 and tier 3 colleges. The huge disparity between startup salaries for top colleges and the not so highly pronounced, is expected widen further. While average start up salary for an IIT pass out is 9 to 10 lakhs per year, that of a second grade college pass out is basically with 1.8 to 2.5 lakhs per year. To worsen this situation, attracted by the glamour and benefits associated with the IT industry, engineers from other branches also compete for IT jobs. In fact 7.8 lakhs engineers (all branches together) pass out every year, and for most of them an IT job is first preference. Till now, IT industry has absorbed non IT engineers with open arms. However, there will be challenge in the future. In this situation, the typical mindset of an engineer is to aim for a core engineering job. But, again, such jobs are always limited because they are linked to the industry and functional area. So, instead of making desperate attempts to land an IT or a core engineering job, engineering graduates should also explore areas where they can make a career with the skills they have.

Students who came from humble economic back grounds and whose parents had to arrange education loans to be able to give their wards a decent education and ensure a bright future are worried too. The numbers are alarming. Most of the engineering graduates, who fail to grab an employment in their respective industry, end up joining call centers or Business Process Organisation's (BPO's) in MNCs that could be disastrous for them in the future. However, the promising and flourishing growth of the startup eco system in India is emerging as a serener for those who are hard working, but still fail to get through the stringent interview process in MNCs. Engineers who used to dream in swanky offices, living in penthouses and driving luxury cars are now concerned about finding 'decent' openings as they get into their final year at college. Not surprisingly engineers are taking up jobs for which they are not qualified. The logical Indian, a huge face book community which started their own website some time back, wrote about a mechanical engineer who is driving an autorikshaw in New Delhi because he has hungry mouths and a family to look after. Industries are interested to recruit diploma holders as they find them most suitable and easy to train according to their requirement. The doom of the construction industries, forced to take engineering graduates as an intern without paying any remuneration and extracting work out of them. The engineering graduates are resort to get employment as clerks, and also as peons in the Postal Department. Now, while that is a sad pointer to the grim,

scenario, it is pertinent to point out that only a small percentage of those who pass out from engineering colleges do possess any skills worth the name at all. Most of them are not 'employable' and or 'trainable', feel the employers, a tragic reflection of the state of our training and academic institutions. The engineers produced by the huge number of private engineering colleges which have come up after the government sanction for them add up only by way of numbers, in the absence of sound infrastructure, well qualified staff and no emphasis on imparting quality education.

### **Employability Skills**

Skills have to be acquired through rigorous training, followed by determined, regular practice with vengeance. Those who pass out from engineering colleges not only lack the required skills by various industries, but majority of them are not doing anything to groom their personality. There are various studies conducted to ascertain employability, skills, gender, locations and institutions. The findings of these studies are alarming and require necessary rectification. The finding of the study is based on a sample of more than 10000 thousand engineering students who graduated from several engineering colleges. According to the Ministry of Human Resource Development, India has 6214 engineering institutions with 2.9 million students enrolled. Experts believe an economy with a large percentage of unemployable but qualified candidates is not only inefficient but a recipe for social instability. And the great mismatch in aspiration of graduating engineers and their job readiness is fertile ground for large scale dissatisfaction and disillusionment. The engineers who are observed and analysed are employed mainly in hardware and networking. While 90% of engineering graduates want mechanical, electronics/electrical and civil engineering jobs, only 8% are employable in such roles. In interviews conducted during the study, software was the preferred sector for 53% of engineers, while 44% preferred core engineering jobs.

Less than 20% of engineers are employable for software jobs. Only 19% out of 600000 engineers who graduate annually are employable for software engineer and IT services role; not more than 4% can be deployed on projects. Most engineers are employed in hardware and networking. Their work mainly involves technical support and network management. Among IT roles, there is high employability as sales engineers who sell tech support to companies. In non technical roles, most engineers find employment in the Business Process Outsourcing (BPO) sector mainly in tele calling and backend processing. In the more lucrative sector of Knowledge Processing Operations (KPO), an area of high revenues, only 11.5% of engineers can qualify for the role business analysts. The main reasons for low employability is lack of English communication (74% did not qualify) and low analytical and qualitative skills (58%). These are the people on whose shoulders rest the responsibility of building new powerful India and should make every effort to excel in their professional as well as personal life.

The key reason for such poor job prospects, according to studies are 'inadequate preparation in the domain area, the ability to apply basic principles, say computer engineering or mechanical engineering to real world problems. Lack of domain knowledge in the key reason for low employability in core job roles both software and non software domains. This may be due to lack qualified and experienced teachers in the institutions. As many as 92% of computer/ IT engineers and 60% of engineers from other branches fall short of the domain knowledge required for such roles. These concepts and principles are there in college curriculum, however there is a gap in teaching and learning pedagogy followed in majority of engineering colleges. Location matters, for jobs and college quality. Employability varies tremendously across engineering colleges. 18% software engineers are job ready in engineering colleges of tier 1 cities such as Bangalore, Mumbai and Hyderabad; whereas 14% are employable from engineering colleges of tier 2 cities, such as Surat, Nagpur, and Pune. This kind of variation is mirrored across states.

The message is that a large proportion of employable engineers are ending up without opportunity, a worrying trend for the higher education. The location of the engineering matters so significantly that candidate from a tier 3 college may be as qualified as a tier 1 student but the odds of finding a job are 24% lower and will also earn comparatively less salary every year. The source of the problem could be current entry level hiring practices by the companies. Companies visit only certain high ranking engineering colleges for carrying out recruitment. There is evidence that in typical resume short listing process, the college name is a key signal and resumes from unknown engineering colleges are not shortlisted. It is understandable that corporations do this to make their recruitment process more efficient. However, this is leading to a lack of equality in the employment market. It is also preventing companies from accessing a large set of meritorious students.

The IT services industry is not growing at the same pace as before and the growth of entry level job is diminishing. Companies are now looking for candidates who already decent expertise in programming. Secondly, IT services companies today realize that within two years of job, the candidate will have to communicate with international customers. As these trend catch up across industry, the employability for IT service sector, which is the largest in engineering will diminish further. To remain competitive in the job market, engineering colleges and engineering students need to have a fresh focus

towards programming and English (both written and spoken). Nation's engineering talents at present exhibits the grim reminder of the quality of freshly minted engineers:

- While 97% want jobs either in software or core engineering, only 3% are good enough to be engineers in software or product role, and only 7% can handle core engineering tasks.
- Only 11% find jobs in knowledge intensive sectors because their English skills are poor (74%), as are their analytical or qualitative skills (58%).
- A student from a tier 3 college will get salary comparatively less than a student of equal merit from a tier 1 college.

### Thoughts on the Future

Dedicated and competent engineering teachers are hard to come by these days. Teaching has become just like any other job. The students of today can become teachers in two or three years, though many of them do not have the knowledge and experience. Neither do they take steps to improve their knowledge base nor do they reach to the desired standards as a teacher. At present the performance of students in the country is in the decline. The students of today do not come prepared to classes, which was not so in the past. They do not have an understanding of the basic concepts. Hence, the time required to cover the syllabus is much more than what it took some ten years ago. Fewer, students are able to complete their assignments correctly and on time, though they have better facilities than before. Today students have access to computers and the internet. They need not go to libraries searching for books and journals. They will get the results whether they know basics or not. Hence independent thinking has plummeted. Many students lack the ability to interpret, verify and confirm the results.

Today 80 to 85 per cent of engineering graduates do not get the job they are meant to do due to mismatch between the technical knowledge they possess and what the industry looks for. Lack of soft skills is also a factor going against them. Besides skilling and up skilling the engineering graduates, there is a case for taking a relook at the academic system. The system of academics that is currently used to make students job-ready engineers needs a complete overhaul. The curriculum needs to be made more relevant to the dynamically changing business ecosystem. Present engineering education requires modifications which should be based on the following basis:

- **Simulator-Style Learning:** Traditional classroom should give way to those that simulate real-life problems they may face at the floor of companies. They should be taught how to resolve these issues through a practical approach. Here, the emphasis on theory is limited and simulation based problem solving is of paramount importance. Student is trained to think out of the box and yet apply the concepts found in the textbooks.
- **Customized Skillsets:** Single skilled jobs are on the wane. The studies reveal that employees who can successfully combine mathematical and interpersonal skills will found many rewarding and lucrative opportunities. Today's enterprising clients look for engineering graduates who have customized skill sets and will be productive from day one of their job.
- **Embrace Automation:** It is high time to think about the reality of automation and implement the same for imparting training to students. A robot can do any job at present. The World Economic Forum's "Future of Jobs" study predicts that five million jobs will be lost before 2020 as artificial intelligence; robotics and nanotechnology will replace much of the need for human employees which is an alarming number. At the same time the same technological advance will also create millions of new jobs. However, filling these new jobs require new skills because all these new jobs will be in specialized areas.
- **Skill Development:** Skill development is having very low priority and is at the peripheral of present education system. Skill development can be achieved by the use of smart phones, learning through mobile technology, etc. engineers today have to be constantly updated through continuous information flow, adapt to the technological changes in the IT world, be proactive and solve problems differently.

### Suggestions and Recommendations

- Necessary actions for measuring the aptitude of the students who desire to undertake the engineering profession as their career. Students with no aspiration for engineering subjects should be not being admitted. Talents and aptitude of each student who wants engineering admission to be ascertained.
- Admissions to the engineering colleges are to be regulated based on their performance in the entrance tests conducted by a government agency in the similar manner of Joint Entrance Examinations for IIT. Only eligible and intelligent students to be admitted for engineering education for enhancing the standard of engineering education and for the creation of talented engineering professionals.
- Teacher's talents and capability are to be assessed by conducting a National eligibility test and screening and evaluated their efficiency in teaching periodically. Teachers with a passion and capability to address the students should be appointed for delivering lectures. Teachers should be inspired to take classes effectively and confidently



without delivering notes. Severe shortage of qualified and competent faculty especially in high tech to be made up for imparting effective classes.

- Academic standards of the college are required to be reviewed periodically and necessary modification if required to be incorporated for achieving better standards and results. Teaching methodology is to be made as per the standards required by the industry.
- Few academic/professional experts with sufficient industrial and academic experience are required to be appointed in each department for rendering guidance and assistance to the fresher faculties. Their expertise talents to be effectively used for the teaching methodology which facilitates the students to think and workout, instead of the present technique of “spoon feeding”.
- A high state of behavioural retardation is experienced and seen in students. This may be due to the excess flow of money to the state and also due to the lethargic mindset of both parents and students. Measures to be taken for avoiding the behavioural retardation which badly affects the students.
- More emphasis to be given internship, so that the students should get awareness about the industry and its requirements. The practical knowledge and skill of the engineering graduates to be developed to match the industries requirements.
- Engineers are to be equipped with good logical, analytical and data management skills. Thus, the engineering curriculum should include management subjects to enable students to acquire required industrial standards.
- Suitable modifications of the rules and regulations of AICTE and Universities are to be made for meeting the present requirement of making the engineering graduates as industrially fit.
- Adequate encouragements to be given to engineering graduates for their creative ideas and innovative projects. They should be given training and proper guidance to think about start ups and entrepreneurship.
- Computational studies should be done to bridge the inability. Young engineers are required to hone their capabilities in looking the part and behaving with extra confidence, rather than concentrating on their physical attributes. Our engineering curriculum to be modified to produce academically brilliant graduates having excellent technical skills, excellent communication skills in English, along with a well groomed personality and leadership qualities for attaining their dream jobs in industries.
- Emphasis is to be given for extracurricular activities. Require to organise educational fest, seminar, workshops, sports and games, and cultural activities as a regular routine affair.

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