

Higher Engineering Education in India-Challenges ahead

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ABSTRACT

Higher engineering education is the significant component of human resources development in improving the quality of life of the people. The growth of higher engineering education in India has been phenomenal after independence. There has been increase in number of colleges, universities including technical and vocational institutes, ensuring quality of education, promoting the spirit of quest, to working out meaning full curricula aligned with the job market. This growing social consciousness needs to be competent with the real time requirement of the nation and sustained. This paper makes an attempt to focus, the engineering education in India along with imperatives for the challenges ahead in building a knowledge society in the context of globalization effects..

Key Words: Engineering education, Industry-Institute interaction, public-private -partnership

1. INTRODUCTION

The word 'Engineer' is derived from French word '*ingenieur*' means that incorporates innovation. The Lamme medal of IEEE has meaningful inscription: "A engineer views hopefully the hitherto unattainable" The root word of Technology is 'techine' which in Greek means 'art'. An artist creates a picture that resembles a real horse, where as an engineer and a technologist create a horse-powered vehicle that works like a horse. There are different kinds of engineering colleges/ universities-(a) research model (b) applied engineering model, (c) comprehensive model. The aim of these colleges/university is to cultivate its students in an all-round way, viz-, morally, intellectually, physically aesthetics with, emphases on ability cultivation. Thus, engineering university's target is to train their students to become advanced engineering and technological personnel who are armed with knowledge of modern science and a remarkable ability in application and problem-solving undertaking along with key factors -Quality faculty, Physical infrastructure, Curriculum, R and D activities and Industry interaction.

Engineering education is the activity of teaching knowledge and principles related to the professional practices of engineering. This includes the initial education for becoming an engineer and the specialization that follows. For engineering university, its ultimate goal is to cultivate high-leveled, application-oriented graduates. Thus in engineering education, cultivation of engineering ability, curriculum teaching and curriculum teaching reformation are critical parameters.

Engineering education spans a wide spectrum from doctoral to first degree to diploma and to craftsman levels to meet the industrial and societal needs. Each level has its role .After independence, setting up the five Indian Institutes of Technologies, followed by 20 Regional Engineering Colleges, was a game-changing investment. It paid off by providing world-class UG engineering education, with their graduates proving to be as good as or better than engineering graduates. Technical education at all levels in the country is witnessing a consistent growth pattern marked by the setting up of new Institutions and the improvement of the existing ones in tune with the quality assurance norms set by the regulating and accreditation agencies.(Figure 1) During 2017-18, it is assumed that approximately 132999 (8% of UG intake) students are pursuing PGs and 33259 (2% UG intake) Ph Ds in India.[1]





After the globalization, exciting, challenging and potentially more rewarding opportunity is knocking at present at the Indian higher engineering education. If pursued with a sharp focus, the present young generation with high-quality advanced engineering education through their publications, innovations and entrepreneurship will take India to the centre stage of global knowledge economy. The aim of higher engineering education is to sustain a learning society with the following objectives::

• to inspire and enable individuals to develop their capabilities to the highest potential levels throughout life, so that they grow intellectually, are well equipped for work, can contribute effectively to society and achieve personal fulfillment;

• to increase knowledge and understanding for their own sake and to foster their application to the benefit of the economy and society;

• to serve the needs of an adaptable, sustainable, knowledge-based economy at local, regional and national levels;

• to play a major role in shaping a democratic, civilised, inclusive society.

The PG in engineering education forms the core for training of future teachers and researchers and for building up international reputation through publications and so on. These professional leaders are capable of transforming the industry. The number of engineering Ph Ds produced in a country is a good indicator of the generation of advanced knowledge and innovation.

Students after completion of Bachelor degree, they have the option of continuing their education either through a taught Master's degree or through research. (Figure 2). Research Master's Degree usually takes two years, after which a student may progress to a doctorate (PhD); alternatively, a student may go directly pursue for doctorate that may take three to four years. These two routes are classified as "postgraduate research courses".



Figure 2. Engineering graduation and higher studies

The purpose of a taught Master's degree is said to be threefold: to specialise in a specific subject or area, to convert from an expertise in one discipline to a degree in a second discipline, or to enhance a Bachelor's degree to qualify for a "license to practice" in an area such as engineering. Doctoral graduates may choose to enter general employment or take a post-doctoral position with a view to pursuing a career in academia.

Provision of structured frame work and resources, will help to enhance the quality of teaching and learning. This supports the professional development and learning culture throughout the system.

• Supporting leaders and managers to develop an organisational culture and infrastructure within which student and staff learning can thrive, and in which change is managed confidently and creatively;

• Responding quickly and intelligently to the most urgent and significant strategic issues and contemporary challenges that the sector is facing, supporting the sector to react wisely and decisively during times of unprecedented change and acting as a national voice to positively influence change;

• Underpinning all of the above with high quality and rigorous research and evidence and applying this insight to enhance policy and practice.



Education is for life not for mere living. The higher education in India aims to provide access, equity, quality and accountability at affordable cost to all aspiring citizens with utmost transparency so as to ensure sustainable economic development of the nation. Due to the decades of globalization impact, engineering education in India is witnessing a severe competition and only those Institutions who strive for excellence will survive. Data on doctorates particularly in, engineering suggests that only a few institutions have real research focus. [7] This is achieved through the more thrust on creation, transmission and dissemination of knowledge and the following are the few challenges ahead.

1) Towards knowledge learning Society- Human activity requires contributions from experts, in knowledge learning society, and this will place the entire sector of higher education in sharp focus. The country will have to prepare itself to invest more on higher education and, simultaneously, measures will have to be taken to refine, diversify and upgrade higher education and research programmes. This can be achieved by attracting meritorious students to the PG and PhD programmes, increasing the fellowship amount, involving industry to sponsor special doctorial fellowships, special outreach / publicity to potential students. It is necessary to highlight the research facilities, ongoing research and technology demonstration projects to our bright students.

2) Industry Institute Interaction- Industry Institute interaction is necessary to ensure curriculum and skills in line with requirements of local requirements. Strengthening of technical skill building is the key point to ensure employability of academia in order to understand and make sure good jobs. The following specific suggestions can help:

- a) Industry's recognition of the need for skilled PGs for research, development and design.
- b) Industry role in defining key research areas, potential research problems.
- c) Academia to be responsive to industry's future manpower and special training needs
- d) Establishment of research consortiums in different areas
- e) Encourage experienced industry engineers / managers to associate with engineering colleges
- f) Institute Industry meets to provide useful feedback to the engineering departments.
- g) Industry Sabbaticals for Faculty and Research Sabbaticals for Industry

3) Motivation for Teachers and Researchers- It is essential to create enabling mechanisms that facilitate faculty research. The systems for procurement, fabrication need to be streamlined so that faculty can focus on the research per se. It is necessary to have efficient support staff that facilitates faculty research. The availability of quality research students could be a major attraction for new faculty to join. Specalised courses are to be offered, so that students and industry get the latest and best in education and they are also industry ready and employable. In order to attract more young students, teachers and researchers Incentives should be provided.

4) Encouragement for innovation- Present day challenges offer many technological avenues leading to many opportunities for economic growth, improved health, better service delivery, improved learning and socio-cultural advances. Thus it is required to improve the country's innovative capacity, along with the efforts should be to build on the existing strengths in light of new understanding of the research innovation-growth linkage.

5) Information and communication technology - Information and communication technology has given opportunity to new and cost-effective approaches for providing the reach of higher education to the youth across the world. Continuing education for meeting the demands of explosion of information, fast-changing nature of occupations, and lifelong education has transformed into new domains. Availability of the knowledge, is a crucial resource in the research and development, leading towards individual enlightenment.

6) Student-Centred Education- Methods of higher education also have to be appropriate to the needs of learning to learn, learning to do, learning to be and learning to become. Methods of teaching –learning through lectures will have to subordinate to the methods that will lay stress on self-study, personal consultation between teachers and students. Distance education programs, seminars, workshops and webinars have to be employed on a vast scale so as to reach all the aspiring students.



Improve or enrich the Ph D experience by providing access to good research facilities, funding to attend international conferences, increasing the rigor, providing special level coursework, Facilitating exchanges between students, faculty and industry through annual national workshops. Special efforts are required to ensure that industry provides challenging careers and attractive salaries to fresh Ph Ds, Seed grants / Loans and access to venture capital could be provided for Ph D students who wish to commercialise their research results into technology products.

7) Public-Private-Partnership- Privatization of higher education is absolutely necessary in Indian context. That will bring in quality in the higher education system. Through an appropriate policy Governments can ensure participation of PPP. Government should ensure facilities of latest technologies for accelerating this process. Many efforts have started both by the government and the private education institutions to develop the teaching staff at various levels. But this, this needs to be intensified with appropriate attention to all the aspects related in order to prepare quality and sufficient number of educational staff. Especially in the backward region of India, apart from metros, intensified efforts are required.

8) International Cooperation- Indian universities have been a primary conduit for the advancement and transmission of knowledge through traditional functions such as research, innovation, teaching, human resource development, and continuing education. Globalisation has set many objectives for research with International cooperation. With the increased development of transport and communication, the global village is witnessing a growing emphasis on international cooperation and action to find satisfactory solutions to problems that have global dimensions and higher education is one of them. International standard of education is the need of the hour in India. Many international universities allow studies in higher education for foreign students. Similarly Indian Universities should open up for collaborative research and student exchange programs. To achieve that goal it should adopt uniform international syllabus in its educational institutions

9) Towards a New vision- India realizes East and the West have to collaborate in bringing about concerted action for universal upliftment, and lasting peace and unity. Humanity stands today at the head of a new age of a large synthesis of knowledge. Presently, great cultural achievements of the past have to be recovered and enriched in the context of the contemporary advancement so that humanity can successfully meet the evolutionary and revolutionary challenges and bring about a new type of humanity and society marked by integrated powers of physical, emotional, dynamic, intellectual, ethical, aesthetic and spiritual potentialities.

10) Plan for Improving Quality- Universities and colleges should set up Internal Quality Assurance Cell and must follow a minimum standard to give degrees with respect to Indian conditions. Along with accountability, there should be operational, financial and academic autonomy. Regular academic audit ensures quality in all aspects. Private colleges should come forward for accreditation and fulfill the requirements of accreditation. A time bound action plan, with implementation can assure improved quality in engineering education

11) Quality of Education- Quality of education depends on its all functions and activities: teaching and academic programs, research and scholarship, staffing, students, building, facilities, equipments, services to the community and the academic environment. Along with characterized by its international dimensions: exchange of knowledge, interactive networking, mobility of teachers and students and international research projects, while taking into account the national cultural values and circumstances. Instead of concentrating on quantity, these institutions should concentrate on quality.

12) Personality Development- Globalisation has created many ways for the engineers. The production of quality goods and their easy availability everywhere in the world market are the results. As a result business process of outsourcing activities have increased competition in the world trade. Thus the world can be developed for peace, prosperity and progress by able and skillful men.

13) Stipends to Research Fellows- In order to increase number of quality Ph.Ds from Indian Universities with proper standards many financial help are to be in place. This should be seen in the context of extremely low fraction of Ph.Ds in India in comparison with other countries. Meritorious doctoral students should be recognized through teaching assistantships with stipends over and above the research fellowships. Identifying talented, meritorious students and encouraging them through recognition is very important to attract students into research and teaching.

14) Societal linkages- The choice of research problems that are relevant in the Indian context is important to realize this. The Indian engineering community also has a key responsibility in guiding the nation's technology



choices and providing directions to technology policy. The engineering institutions should play a role in educating the community on the impact of different technologies and alternative development paths. In order to develop sustainable futures, engineering colleges should attempt to educate school teachers and community leaders. The linkage and commitment of engineering institutions to the nation's development is essential before the engineering colleges can aspire to make a global impact. The history of development of most leading global institutions shows strong links to regional and national development.

Conclusion

The progress of these higher engineering institutions has demonstrated that leadership, dedication and autonomy can indeed elevate Indian technical institutions to great heights. Thus, there is full justification in cherishing the institutions can quickly climb the quality ladder to join the ranks of the world-class academia, if the ambience is created: total autonomy, independent, empowered Board of Governors, an outstanding academic as head, liberal funding by the government supplemented by private donations, good faculty with some stars, high quality students and good infrastructure. Many committees have submitted the recommendation reports to Government of India and the implementations are also done.

India has good intellectual capital that requires improved quality education and careful mentoring with right strategies for higher engineering education. The present young generation is on the threshold of most exciting opportunities for innovation. Recent programs are showing good results but more promising new approaches need to be tested keeping in view of Indian context. Time will tell, but the indicators are promising.

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