

Indian Continuing Engineering Education: Challenges and Opportunities

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Abstract

Indian Continuing Engineering Education was designed to hone the skills of employed engineers but after initiation of Liberalisation, Privatisation and Globalisation (LPG), nature and structure of employment among engineers have changed. On the basis of responses of CEE students of two surveys, successively done with a gap of a decade, reveals that students enrolled in CEE (academic institution) do not look for linear career progression as it may be the case before opening up of the economy, in fact, they want to get optimal career benefit. Those engineers who pursue CEE for career enhancement prefer to enrol in an engineering institute, but depend on ICT if they are looking to acquire knowledge. There is need to converge both. Faculty and students need to be given opportunity to develop cost-effective CEE module which can be delivered through ICT. The paper also discusses developing engineers for global workforce, to incorporate green technology and to enhance R&D and innovation in the curricula, as main challenges before CEE. Working engineers also need to be sensitised about technological need of deprived group in the society for inclusive growth. These challenges can be transformed into opportunities if engineering institutions work along with corporate sector and professional societies.

Keywords

Continuing Engineering Education, Globalisation, ICT, Growth, Green Technology

1. Introduction

A knowledge economy requires high quality and universal education system from early childhood to highest level of tertiary education and extended into life-long learning opportunities for workers. But Continuing Engineering Education (CEE) has special significance as it is crucial for technical manpower to hone their skills. It was well realised by planners and policy makers and was in place in India. However, changes in macroeconomic variables as liberalisation, globalisation, privatisation (LPG), and advent of information and communication technology (ICT) have drastically changed the scenario. Technology is continuously being upgraded by the firm to enhance quality of products and productivity of resources to sustain in the market. Any such change/ improvement in the existing technology ultimately changes the set of skills required to handle them and hence forth, engineering manpower needs to be re-trained through CEE to remain employable. Added to it, ICT has provided another mode of providing training through CEE. In this background, the paper tries to count challenges which Indian CEE system is facing in the changed environment and how these challenges can be transformed into opportunities. Second section of the papers throws light on emerging pattern of employment among engineers in context of LPG and advent of ICT. Third section of the paper gives brief review of CEE in India. Fourth and fifth section discusses challenges before Indian CEE system in the emerging economic environment and how these challenges can be transformed into opportunities. Last section concludes the discussion.

2. Effect of Liberalisation, Privatisation and Globalisation (LPG) and Advent of ICT on Employment of Engineers

LPG has led to reduction in restrictions on movement of goods, services and capital through reduced transport and production cost all-round. The new technology has made capital mobile and has increased its bargaining strength in relation to labour and the state (Deshpande et.al., 2004). Again, ICT has made it possible to shift a particular segment of the production process to a far-off place if it can be performed in a cost-effective way. This situation has given an opportunity to the Multinational Corporations (MNCs) to shift their labour intensive work to India as India has a large pool of comparatively cheap English speaking engineers. MNCs are bringing new technology and large amount of investment with them which has ultimately made the market very competitive. To survive in the market, firms are continuously upgrading technology. However, any such change makes

corresponding change in the skill set required among engineers. Not only that, LPG has also affected nature and structure of employment among engineers¹ also.

Table1: Comparison between Pattern and Employment Structure among Engineering Manpower before and after implementation of LPG in India

Sl. No	Before Initiation of LPG in the Indian Economy i.e. before 1991	After Initiation of LPG in the Indian Economy i.e. after 1991
1	Government sector/ Public sector was major employer which is considered as formal employment, was major employer	After globalisation, informality has increased. Share of formal sector employment is decreasing in favour of the informal sector. At present, only seven percent of total employment is in formal sector which is secured and formatted.
2	Generally, there was one time employment in the career.	After globalisation and liberalisation, opportunities for engineering manpower have increased. Most of them are practicing job hopping. Every other year they are changing job.
4	Employment of graduate and diploma holders was clearly demarcated.	The demarcation has become fuzzy.
5	Government sector/ public sector were higher paying sector and private sector jobs were lower paying.	Now, the employment structure can be compared as 'small o' surrounded by 'big U'. 'small o' represents government sector/ public sector and the surrounding U represents private sector which may be higher paying than the government sector as well as lower paying (Singh, 2005).

Source: Compiled by Author

Originally, engineers used to be employed (refer Table-1) in two sectors i.e. formal and informal. While formal sector provides protection under various Government provisions, the informal sector provides almost none. If taken two indicators, salary and social security, these two sectors provide just opposite situation. While the formal sector used to provide high salary as well as high social security, the informal sector provides low in terms of both indicators. The newly added MNCs have added a distinctly different work structure. They provide low security, which is more than compensated by very high salary. In the present scenario, MNCs have been able to attract the preference of engineering manpower over the formal sector. Formal sector is generally considered as safety valve of last resort. Initial salary in private sector, public sector/ government sector and MNCs are distinctly different and in the ratio of almost 1:2:4-5 (Singh & Thankachan, 2005). Now, the employment structure of engineers can be compared as 'small o' surrounded by 'big U'. 'Small o' represents government sector/ public sector which may be higher paying than the government sector as well as lower paying (Singh, 2005). Along with it, different forms of atypical employment are also coming into practice. Short-term contracts, marginal part-time work, new forms of employment, in- and out sourcing and tele-works are representative of the changing nature of employment in the informal sector (Singh, 2008). Managers, generally, initiate changes in the firms' employment relation practices to improve a firms' performance based on their knowledge and experience. Changes in the post-reform period indicate a 'paradigm shift' in the belief and practices of managers that contrast distinctly from those that existed until the mid-1980s and before. The shift involves wide ranging changes in the areas of skills/multi-skill function), functional integration (from specialized to generalization, employee-control (flexible) and work culture. On the other hand, engineers both degree as well as diploma holders are also ready to explore new avenues in their career. For them, job choice is driven by a desire to achieve higher position in the 'labour market' rather than 'employment' security through robust employable skills and good access to ongoing opportunities (ILO, 2001) However, engineers will be able to explore all the avenues only if they will achieve qualitative continuous training (Singh & Thankachan, 2005).

3. Review of State of Continuing Engineering Education in India

To overcome obsolescence of working engineer, a number of academic institutions, professional bodies and industrial organisations offer continuing engineering education in India. However, CEE through academic institutions has special significance due to its wide acceptability, transferability and universal format.

3.1 CEE offered by Academic Institutions

Jawaharlal Nehru Technological University, Hyderabad was the first university to start continuing engineering education programme at degree level (B.E. / B.Tech.) in engineering subjects. A School of Continuing and Distance Education was set up in 1983 which started B.Tech. programme in civil, Electrical & Communication and Mechanical engineering. Since then, many institutions have started programme at Degree and Diploma level through 'face-to-face'² mode as part-time programme as well as 'distance'³ mode. At present, there are 44 degree level institution with intake capacity 9247 and 58 diploma level institution with intake capacity of 7222. In the beginning, training was given in the traditional branches as Mechanical, Civil and Electrical engineering but Computer engineering is an addition during post globalised period. However, there are branch wise as well as regional variations. At the degree level, only 1.3% seats are in Eastern State, 22% seats are in Western states, 57% seats are in Southern states and rest of the seats are in Northern states. Not only that, some of the states which are industrially very active have very low intake capacity as in Gujarat or not at all as Punjab and Haryana. Branch wise also, more than one-third of the total intake capacity is in civil engineering (34%) which is followed by mechanical engineering (21%). So, civil and mechanical together have almost sixty percent of the intake capacity and both the branches are being taught in all the states where the facility is available. Rest of the branches in which facility is available are electrical engineering (18%), Electronics engineering (13%), computer engineering (7%) and others (5%). Facility for CEE at diploma level is almost 20% less than degree level. If discussed region wise, almost two-third facility is available at Western region and very low in rest of the three regions which are eastern region (16%), 14% northern region and only 4% in the southern region. If discussed branch wise, mechanical engineering constitute of same percentage as at degree level (i.e. 21%) but contrary to degree level, civil engineering only constitute 12%. Electronics engineering constitute is highest intake capacity (39%) but electrical and computer are as low as 14% and 3%. Others which include branches like chemical, mining, metallurgy, production, textile etc. It constitutes 11% of the intake capacity (Kumar, 2004).

After initiation of the economic reform programme in 1991, a substantial displacement of organised sector workers was envisaged by the Government of India (GoI). The Industrial Policy in 1991 recognised the possibility and was obliged to protect the interest of labour, enhance their welfare and equip them in all respect to deal with the inevitability of technological change. A National Renewal Fund (NRF) was launched to protect the workers from adverse consequences of technological transformation, provide retraining to them, so that they are in a position to remain active productive partners in the process of modernization (GoI, 1998). However, as the year progressed, CEE has lost some of its significance in favour of Engineering Education (EE) (regular). From, 197-98 onwards, engineering education has experienced exponential growth but CEE has remained almost stagnant. This may be driven by the objective to get the advantage of 'demographic dividend'⁴ (Singh, 2012.a). Skill formation is one of the key areas. National Skill Development Fund (NSDF) is in place and in the Union Budget for 2012-13, the allocation under NSDF has almost been doubled. A Credit Guarantee Fund for Skill Development has also been launched. The Finance Minister has also provided tax benefit to the manufacturer for costs incurred in talent development and has exempted vocational training institution from service tax (Mukharjee, 2012).

3.2 Micro Level Survey to study Students' Response of CEE

In marketing parlance, students are buyer and consumer of the services provided by institution and universities. So, their feedback is very important, time-tested and being used all over the world for continuous improvement of the system. This section discusses two such studies which has been made with the gap of 10 years. First evaluation of CEE system is based on responses of 327 part-time B.Tech. students at Delhi College of Engineering (upgraded to Delhi Technological University (DTU) in 2009), Delhi in 2001 which has highlighted that the courses under CEE are long in terms of duration and obsolete in terms of content. As the first year course, mainly consist of those topics, which the students have already done at the diploma level. So, the duration may be made of three years in place of four years at the degree level. Majority of the students opined that latest computer language should be incorporated in their course curricula. Again, majority of the students consider the course coverage as partial. They suggested that to maintain continuity and to enhance the quality of teaching more permanent teachers should be recruited. Guest faculty should be invited only for very specific topic. Though majority of the students were satisfied with the system of examination, but they were concerned about the delay in the examination's result. Academic calendar should be announced well in advance and it

should be maintained. Better library facility and industrial trips should be arranged for the part-time students. They should also get chance to appear for placement through campus placement (Singh and Kumar, 2003). In the second study⁵ (Singh, 2012.b), responses from the CEE students of Delhi Technological University (DTU) reveals that though the CEE structure is even now of the same duration but the content has been changed and upgraded. Library and book bank facilities have been improved. But even now, the students have shown their concern about quality of teaching. Again they have emphasized that their teaching should be made by permanent faculties. However, they do not get opportunity for innovation and R&D. They do not get facilities of campus placement⁶ which a student of EE (regular) may be getting. These opportunities are not being given as CEE is based on the hypothesis that the students are already employed and their are acquiring degree for upward movement in the organisational ladder. Some flexibility in terms of duration but with fixed content has been introduced but maximum is eight years in Indira Gandhi National Open University (IGNOU). The enrol student has to complete the degree within eight years. In an answer to the question that why they have opted for 'face to face' method from a famous engineering college rather than a course through ICT, they opined that (answers are chronologically arranged as per its preference given by the student):

0 Acceptance by the employer:

At the time of giving promotion, employers give preference to CEE course done through face to face method rather than any other mode.

0 Cost components:

There are some courses which are already being offered at exorbitant cost. But the respondent have preferred university for its cost-effectiveness.

0 To acquire knowledge:

The respondents have given least preference to the reason for acquiring knowledge to enrol in the course.

3.3 Training through Information and Communication Technology (ICT)

Advent of ICT has given an additional mode for imparting training which overcomes the constraint arising due to distance, language or availability of free time and it is being used in much innovative way by various service providers. To provide adequate infrastructure, even the Government of India has launched EDUSAT, an exclusive satellite for educational purpose. to impart training in a very cost effective quality educational resources in an inclusive manner. Flexibility in terms of duration but with fixed content has been introduced by Indira Gandhi National Open University (IGNOU). There is a special channel of IGNOU, 'Gyan Darpan' to impart training. Various global educational service providers are also in the business, providing services at a very exuberant cost.

In fact, laptop with internet connection has become a symbol of awareness and knowledge. Many engineering institution gives laptop all enrolled students at the time of admission. Many instates have Wi-Fi connection and many more claims that they have. A study of fifty engineer consultants in the area of construction to study how they acquire knowledge about green technology reveals that internet is the mode through which they acquire knowledge about latest development (Singh, 2011). The latest mindset is reflected in the election campaign also. In latest Vidhan Sabha (lower house in the bi-caramel state legislative) election in Uttar Pradesh, the winning party has promised laptop to all youth if they come to power⁸.

4. Challenges before Continuing Engineering Education in the era of LPG

Two broad trends have emerged in CEE system during the era of LPG. They are as i. The students enrolled in CEE (academic institution) do not look for linear career progression rather they want to get optimal career benefit from the opportunity and ii. All those who pursue CEE for career enhancement prefer to take route of engineering institute, but to acquire knowledge, professional engineers follow route through ICT. The challenges which have emerged before CEE may be discussed as follows:

4.1 Preparing Engineers for Global Work Place

With growing number of Multinational and Transnational Corporation, both- Indian and foreign, working in a Multinational and Transnational enterprise has become a normal experience for Indian engineering manpower. So, once working in a gender-neutral team was an issue, Indian engineers is now preparing themselves to work

in cross-cultural team which may be separated by continent which means, they have to learn to overcome time zone also.

4.2 Enhancing R&D and Innovations in the Curriculum

When geographical boundaries have lost its significance and economic boundaries have become fuzzy, technological superiority is going to give the edge to any enterprise. R&D and innovation has become buzz word and any CEE programme must concentrate to incorporate it in the curriculum. Only point of satisfaction is the increasing intake capacity in M. Tech. and Ph.D. is giving to do research activity in CEE.

4.3 Sensitizing towards Green Technology

Unsustainable use of technology and ruthless plundering of natural resources to achieve high economic growth has brought us on the edge. The damage caused to the natural resources has grim consequences and one of them is climate change. The achievement of sustainable development remains the greatest challenges before humanity today. Countries including India, are incorporating sustainable development policies into their development agenda. The essential task of development is to design and implement policies and programmes which encourage the efficient use of resources and adopt technologies that lead to less environmental harm which is intricately linked to labour force skills. There is growing demand for smart buildings and infrastructure. The Indian CEE system should be prepared to impart training in green technology because professional engineers may not have learnt these skills during their engineering degree or diploma curriculum.

4.4 Poverty Eradication and Inclusive Growth

Traditionally, engineering manpower in India was developed to work in industry to enhance productivity. However, it is being realised lately that engineers are not only required to enhance industrial productivity but to improve life of poor and deprived. It is well known fact that poor cannot afford to remain unemployed they work whatever they get. But as their productivity is very low, their earning is low and it is a vicious circle. Poor earn less, have less healthy and nutritious meal to eat and good environment to live which leads to health problem, have lower working capacity and thus, ultimately get employment in low productive work. The LPG has deteriorated condition of the poor. The gap between earning of lowest 10 per cent and highest 10 percent population has grown from six times to twelve times. Planners and policy makers in India are quite concerned about the situation. In eleventh five year plan (2007-12) and again in, the twelfth five year plan (2012-17) has been designed to achieve inclusive growth. The engineers need to be sensitized about problems of poor people and should work for imparting technological help which can improve life of poor and brought them to better life standard than before. This type of sensitization to the professional engineers can be planned through CEE programme.

4.5 Providing Cost-Effective CEE

A good number of renowned universities and institutions are providing CEE programme at an exorbitant cost. However, the problem is of affordability. Not many will be able to upgrade/ enhance their knowledge if the cost is very high. Not only in India but such demand is from many countries of Latin America, Africa, Middle East countries. Or in this phase of global melt down, low-cost is the buzz word throughout the world and the challenge is to provide good quality courses at a reasonable prices.

5. How to Turn Them as Opportunities

During the LPG period, nature and structure of employment among engineers has changed which has posed challenge before CEE to enhance their skills in the emerging economic environment. At the same time, India has certain advantage in the area of CEE, as large pool of English speaking Engineers who are also very good in mathematics and computing. Now, the task before CEE is to transform these challenges into opportunities.

5.1 Revamping of CEE

The engineering institution need to come out from the mindset for linear career growth for CEE students. They need to be given all the opportunities which may have been given to EE (regular) students which must include sufficient opportunity regarding green technology, innovation and R&D. Again, engineering institutions are giving emphasis on cross-cultural fabric to its campus. In fact number of foreign nationals in the campus is one of the indicators on which engineering institutions are ranked.

ICT should not be seen as substitute but of 'face 2 face' mode but, it should compliment it. All possible use of ICT should be introduced. The faculties and students entrepreneur should be encouraged

to develop cost effective training modules. A group of alumina of DTU has developed a web site, 'agla sem.com' which has all past question papers, notes, most relevant book etc.

5.2 Involving Corporate Sector

To sustain in the competitive environment, corporate sector is involving more in the activities of engineering education than ever before. Their association with engineering institutions has taken a new dimension. moved ahead from being part of Board of Directors, Board of Management or Board of studies of engineering institutions is very common practice. They are playing very effective role in the are signing agreement with the engineering institution/ university to train their employees. Samsung has signed an agreement with the computer engineering department of Delhi Technological University to train its employees in Post-Graduate Programme in Computer engineering. ICICI Bank has signed MoU with ten good engineering colleges (Delhi Technological University is one of them) for development of technology which will benefit the banking processes. Many CEO of Corporate bodies are member of Board of Studies and Board of Management of various engineering institution/ universities throughout the country.

Some of the engineering colleges and engineering universities are signing Memorandum of understanding (MoU) with foreign universities where students stay in India and in other country to complete their degree. However, this is done for engineering education (EE)(regular) courses rather than CEE course. Now, CEE through academic institution and through societies needs to proceed in this direction. As the CEE students are presumably employed, so corporate sector already come in the picture. These days, many of the corporate bodies are in education sector, they introduce this arrangement in CEE by involving their international partners. Corporate houses, as L'Oreal is funding projects for development of eco-friendly technology (Singh, 2011)

5.3 Involving Professional Societies

The Institution of Engineers (IoE) is already involved in CEE programme. Study shows that students are getting benefit of these opportunities spread all over India and some centres are abroad also. For environmental management, International Federation of consulting Engineers (FIDIC acronym), Institute of Electrical and Electronics Engineer (IEEE) are other international bodies for engineers which has developed standards and conduct workshop for making practicing engineers environmental sensitive (Singh, 2011).

5.4 Sensitizing CEE Students regarding Green technology

This is only possible when environmental issues are adequately identified, scientifically understood, appropriate technological solution are applied for their mitigation and sustainable resource utilization methods, the green methods into the ways workers perform their trade, profession or occupation. So, green method is a process of doing an activity which does not harm the environment. A re-orientation of CEE is, hence, required to impart green education which will lead to a highten sense of responsibility towards ecological sensitivity and development of eco-friendly technology (Singh, 2011).

5.5 Sensitizing Students regarding Technological Need of Poor and Deprived Group

All the corporate sector have certain amount of money year marked for social responsibility. The CEE institutions should pull in corporate sector and their funds for sensitizing, developing and distributing relevant technology to the poor and deprived groups. At EE (regular) in DTU, there is mandatory visit to slum by all the students and coming out with some technological suggestion to improve their life, is part of course work in the subject- Engineering Economics. At IIT Delhi, there is Centre for Rural Development & Technology which takes care of the rural technology (IIT, Delhi, 2012). These initiatives should be introduced in the CEE programme also.

6. Conclusion and Recommendation

Two broad trends have emerged in CEE system during the era of LPG. They are as i. The students enrolled in CEE (academic institution) do not look for linear career progression rather they want to get optimal career benefit from the opportunity and ii. All those who pursue CEE for career enhancement prefer to take route of engineering institute, but to acquire knowledge, professional engineers follow route through ICT. It has posed challenges of preparing engineers for global work place. Train them regarding green technology and enhance R&D and innovations in the Curriculum. They need to be sensitized towards technological need of poor and deprived group. Given the socio-economic background of a common CEE students in India, there is need of developing cost-effective CEE. Not only in India, there is such demand in many parts of Latin America, Africa, Gulf countries. For that matter, in the era of

global melt down, cost-effectiveness is one of the determining factor all over the world. Engineering institution should allow to develop entrepreneurial skill of its faculty and students in developing CEE module which can be delivered through ICT. It can done by engineering institutions if revamping of the CEE. Corporate sector and professional bodies may be involved in the management of CEE. They are already present in the campus for engineering education (regular course). There is need to expand their involvement.

Notes:

1. Only degree and diploma holders have been considered. Regular degree level education is of 4-years after higher secondary education (10+2 years of schooling). Regular diploma level engineering education programme is of 3-years duration after secondary education (10 years of schooling).
2. Normal class room teaching is done beyond normal working eight hours so that employed engineering manpower can enhance their educational qualification.
3. It combines the use of self study printed materials with other kinds of teaching techniques and types of media like television, radio, satellite broad caste.
4. Demographic dividend- Young population of India is increasing at a time when young segment in the total population is decreasing in developed countries. So, Indian youth, if trained properly, will be demanded all over the globe.
5. The second study is an All India Council for Technical Education sponsored on-going project with me as P.I. A sample of 100 students each from Delhi Technological University, Jamila Millia Islamia Central University, Delhi Centre & Patna Centre of the Institution of Engineers which together makes them as total sample size of 400 students. The Institution of Engineer (IoE) is a national body of professional engineers. They provide Associate Members of Institution of Engineers (AMIE) degree equivalent to engineering degree. Patna Centre and Delhi Centre of same organisation were surveyed to understand locational difference in centres of same organisation. One is at national capital and another one is in capital of backward state, Bihar.
6. Corporate representatives visit engineering institution to recruit students for their company .

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