

### 3. INCULCATING ENTREPRENEURSHIP SKILLS IN ENGINEERING GRADUATES

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#### **Abstract**

*The purpose of this paper is to explore the new trend in engineering education that should be brought into education system and to suggest the methodologies of its implementation. It has been constant observation that engineering education is producing large number of graduates each year, maximum of which tend to be employees in nature. Very little percentage of engineering graduates tends to be entrepreneurs. The paper discusses in detail the case study of Indian engineering educational trends. Looking at the low rate of growth of Indian industry, a drastic change in engineering education system should be brought. To achieve overall excellence into the engineering education, the paper discusses possible areas of skill set, that should be incorporated into engineering academics. The paper also suggests few implementation techniques, which should be dealt with each year of engineering academics to get the effective results. The paper asserts that engineering educators have to change their traditional mindset while designing the syllabus and other activities for each year of graduation and should give a new thought on effective utilization of graduation period for further improvising the overall knowledge diversification level of the engineering graduates. Entrepreneurship skills combined with technical skills of engineers can bring remarkable change into Indian industry growth rate and can well support the economical growth of the country.*

#### **1. INTRODUCTION**

Justification of today's technology is a relative thing and we all have to decide what we want. Emerging technologies are discovering new horizons on each passing day. You think of any advances, you need to have in your daily operations and the related engineering branch has the solution. In short, emerging technologies are in air !! Discovering new ideas and improvisation of old ideas to suit to newer requirements is a ongoing process when emerging engineering trends are considered. But wait a while !! As a wise and analytical observer of upcoming engineering trends and technologies, a balanced thought needs to be given on following points.

- 1) Does the new trend is immediately analyzed, studied and introduced in engineering education? In other words, are engineering educators keeping concerns or putting efforts to bring the emerged technology into the engineering education?
- 2) If answer to above question is positive, then, does the new trend in engineering education is taught in appropriate depth with additional skill set required so that a student can get well acquainted with it, to give himself/herself a start as an entrepreneur in the related trend?

Unfortunately answers to both above questions fall on negative side. Engineering

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educators need to put serious thought especially on the second question.

### 1.1 What engineering educators are doing?

Engineering educators have historically believed they were only responsible for turning out technical experts. Yes, it was sufficient in old days, when technological base of our country was developing and was put on test very often. But now, Indian technology seems to be in flying colors. But still, while engineering educators design the syllabus or activities for engineering academics, they end up with a technocrat person, may be fully equipped with the knowledge in his/her engineering discipline. That is perfectly fine with the graduating person as far as knowledge of that particular engineering discipline is considered. Technologically it sounds that, engineers are need of country and current engineering syllabus is achieving this goal quite well. But these educators also need to give a serious thought on what happens to these technical experts afterwards?

According to the All India Council for Technical Education, India (AICTE) it produced 4,01,791 engineers in 2003-04, 35 percent being computer engineers. In 2004-05, the number of engineering graduates increased to 4,64,743 of which 31 per cent were computer engineers. Compared to India and China, the United States produces only 70,000 engineering graduates every year. All of Europe produces just 1,00,000. [3] India currently has 113 universities and 2,088 colleges, many of which teach various engineering disciplines. Engineering colleges in the country have been growing at 20 per cent a year, while business schools have grown at 60 per cent. Also have a look at growth of Indian Economy.

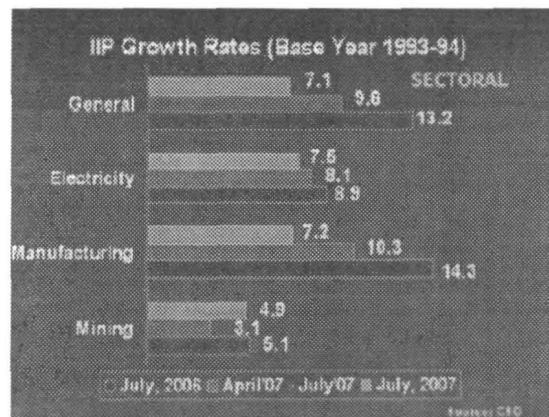


Fig.1 Indian Industrial Growth: 2001 to 2007

(Source: <http://eurekhaonline.blogspot.com/2007/09/>)

Looking at this statistical data following conclusions can be made.

- 1) After China standing at first position, India stands second in the world, in producing number of engineering graduates every year.
- 2) Although the number of engineering graduates produced per year is very large, industrial growth rate is considerably low. So it is obvious that many gets absorbed in industries and very few can start as an entrepreneur.

How can Indian engineering educators neglect this very important point, which has deep impact in India's economy? So conclusions for question 1.1 above is, Indian engineering educators

- are focusing on producing large number of technical experts, each year
- have failed to incorporate, entrepreneurship skills into the engineering graduates

These point raise obvious questions like

- 1) Where and what needs to be changed in engineering education system?

- 2) Can a new trend in engineering education resolve the problem above?

This paper focuses on bringing a new trend in engineering education by

"Inculcating Entrepreneurship Skills in Engineering Graduates".

The paper suggests some basic and simple improvisations in Indian engineering syllabus.

## 2. WHAT CHANGE IS NEEDED?

We assert that current engineering syllabus is quite carefully designed as far as the technical knowledge of a graduate is considered. But if we want an engineering graduate to become a successful entrepreneur, the students should possess knowledge related to following areas in addition to the technical knowledge, they seek from their specific engineering discipline. As we suggest this new skill set, we do not want to disturb the regular learning period of an engineering student as we understand the depth of subjects involved and hence the length of time span required to accomplish the desired knowledge level. Instead, we focus on effective utilization of overall graduation period of engineering education.

### 2.1 Skill set that an engineering graduate should possess.

Let us put the skill set required in sequence.

#### 1) Regulatory Environment:

**Goal:** As an upcoming entrepreneur student should be aware of regulatory environment of India. There are many branches of it. Although deep knowledge of each branch cannot be expected from an engineering graduate, overall conceptual information will be very useful, irrespective of the type of industrial setup he/she will do in future. Some important areas under regulatory environment are: Industrial policy, trade policy, labor laws, capital market regulations, cyber laws and regulations, legality

of financial contracts etc. should be the main topics, an engineering graduate should have the knowledge of it.

#### 2) Finance / Investment:

**Goal:** Finance is the most mandatory aspect for setting up any business. Any decision-making is based on the availability of finance.

Knowing in advance your financial position and options that are or will be available dramatically reduces stress and time required in decision making. So students should be aware of the basics of finance management. Some important areas that can be covered for them should be: Cash flow management, working capital management, accounting and costing, borrowings & expenses management, overdrafts and surplus management, various investment options and financial planning, impact of inflation and related future planning etc.

#### 3) Taxation Knowledge:

**Goal:** Taxation pervades every area of life, including property, family, employment and business affairs. Tax law is well suited to disciplinary study as it does intersect the economy of any business.

As an upcoming entrepreneur, an engineering graduate should have conceptual insights of at least following areas. Corporate income tax, general tax incentives, concessions offered to specific sectors, individual income tax, capital gains, tax treaties, indirect taxes and other taxes.

#### 4) Intellectual Property Rights:

**Goal:** The concept of intellectual property has been established soundly at all levels: statutory, administrative and judicial.

Any researcher or entrepreneur should have insight of the major aspects of these rights. The engineering graduates should have knowledge of importance of all these and the related

procedure involved, as they will be soon or afterwards involved in the procedure. The four main aspects of India's intellectual property rights regime are copyrights, trademarks, patents and

industrial designs. The knowledge of legal procedure involved in doing all these is very important. The students should get insight of importance of all above areas.

### **5) Business Ethics:**

**Goal:** Business ethics examines ethical principles and moral or ethical problems that arise in a business environment. The range and quantity of business ethical issues reflects the degree to which business is perceived to be at odds with non-economic social values. Aim of giving knowledge of this to engineering students is to prepare them in areas given ahead.

Ethics of accounting information, human resource management, confidentiality of information, sales and marketing ethics, ethics in conflicting interests, ethics of behavioral values, advertisement ethics, communication ethics in business etc. are important aspects of this subject. Ethical issues in different business area and study of the approaches are essential.

### **6) Developing Social Capital:**

**Goal:** The networks of relationships among persons, firms, and institutions in a society, together with associated norms of behavior, trust, cooperation, etc. enable a business to function effectively. By involving this subject, focus should be on highlighting the theme that an investment in social capital does not cost much, but it yields rich returns and increases with use. This is very useful theme for the successful entrepreneurs. Following should be the main points during consideration.

Rules and norms governing social action, practices to build trust and relationships, types of social interaction, benefits gained through social resources, techniques or media for social interaction, social etiquettes, social platforms,

government aids/schemes/concession for social projects.

### **7) Human Resource Management:**

**Goal:** Human resource management (HRM) is the strategic and coherent approach to the management of an organization's most valued assets - the people working individually and collectively contribute to the achievement of the objectives of the business. The goal of teaching human resource management is to help a business person and his/her organization to meet strategic goals by attracting, and maintaining employees and also to manage them effectively. So upcoming entrepreneur should be skilled in following areas.

Personnel management, personnel administration, workplace management, personnel counselling areas and techniques, appraisals and training, workload management techniques, compliance issues and resolving approaches, etc. Thus besides being knowledgeable, influential, empathic, appreciative, supportive, reliable, responsible, active listener, efficient time manager a technical expert engineering graduate should be educated in above areas also.

### **3. INCORPORATING SUGGESTED SKILL SET INTO ENGINEERING GRADUATES.**

It is not that the above skill set is not incorporated in education system. There have been traditional approaches for gaining expertise in each of the above area. But some points do withstand:

- 1) These skills are taught in a specialized two or three year span's academic courses. Say for example Diploma in Taxation and Law. (D.T.L.), master of business administration (M.B.A.) in finance or marketing or human resource management, bachelor degree of business administration. (B.B.A) etc. In a competitive and fast growing world today, sparing two to three years more after

spending four years in engineering graduation is not of worth.

- 2) These courses offer distant learning options. But experience tells that the quality of education given by these distant or earn-and-learn schemes is questionable.

Hence the scenario enforces us to think of implementation of the required skill set during the engineering academic period only. Paper now suggests options available for this scheme.

### **3.1 Incorporating above skill set into Engineering Education.**

If we see the time span of 4 years of engineering education system following observations can be made.

- 1) Period of admission to first year engineering course is ruled by many elements. These include result of higher secondary exams, results of common entrance test, any legal complication that may arise at any point, efficiency of admission system of specific engineering institute and many more similar factors. So it is obvious that the academic year of first year engineering starts very late in the month of August or September. So additional subject / activity can not be thought to first year engineering students.
- 2) Period of assessment of students (examination period) is also very large. Written exam period is influenced by earlier exam result. (repeater examination / A.T.K. T. rules governs the written exam period).
- 3) The actual teaching period is just enough for covering up the related engineering discipline's subjects. To cover the subjects with appropriate depth this period can't be shortened in any ways.

To summarize, we can say that, the almost one month's vacation period after the written examination of each semester is the period in which extra activity to achieve our aim can be

utilized. While we suggest this period for implementation of our specific aim, the importance of holidays is equally considered. We do not assert on full day working of students, neither any exam nor other sort of assessment for suggested approach. But we suggest on 4 to 5 hours of time per day should be invested in gaining that knowledge which will be backbone for the future career path of the students. In fact, we are sure that students will equally enjoy these off track learning methodologies and will be very likely adopt them as a part of learning.

As cleared before, because we cannot consider, first year engineering students for our aim's implementation, we suggest that from second year engineering onwards the areas discussed above can be distributed in a two semester pattern given below.

Table 1: Proposed year wise allotment of new skill set.

Year	Period	Subject	Period	Subject
2nd	A	Business Ethics	B	Social Capital
3rd	A	Intellectual Property Rights	B	Human Resource Management
4th	A	Regulatory Environment in India	B	Finance and Taxation

#### **Symbols used**

A: denotes period after end of first semester.

B: denotes period after end of second semester.

### **3.2 Proposed Implementation Techniques.**

Now the question remains about how to efficiently implement the proposed activity. While designing the activity, factors to be considered are



- Availability of 20 to 30 days
- Time span of 4 to 5 hours per day.

Some ways of implementation are suggested below. Focus of all implementation techniques is on connecting practitioners, academics and students working in the same field.

#### 1) Second Year: Business Ethics & Social Capital.

- Arrange series of lectures in concern with above mentioned subjects where students will view video tapes, read case studies/profiles, or listen to speakers.
- Visits to service industries / manufacturing industries can be arranged to demonstrate the students ethical practices the concerned industry is exhibiting.
- During such visits, an expert belonging to industry can focus on hurdles they had experienced in implementation of ethical practices and the solution they have implemented.
- A resource person from franchisee based service industry can be called to speak on techniques used by them to utilize the social capital to wide spread and expand the business.

#### 2) Third Year: Intellectual Property Rights & Human Resource Management (HRM)

- Students can be involved in design of a logo / small utility / device and the related copyrighting and trade marking procedure.
- Case studies of old patents can be discussed.
- A lawyer as a resource person can be invited to explain the procedure and hurdles involved in patent / copy- righting / trade marking procedure.
- To examine HRM, group of 2 to3 students

can be made. Each group can be availed 3 to 4 full days training at HR department of well known company. The main observation areas will focus on recruitment procedures, identifying training needs and managing training programs for employees, working environment management and administration issues etc. Each group will prepare a training report to elaborate the things learned / examined / experienced.

#### 3) Final Year: Regulatory Environment in India & Finance and Taxation.

- A resource person from industry can be invited to give a series of lectures to demonstrate the concepts related to company setup, payroll management, employee fund management, rules related to buying, selling or renting a place etc. in accordance with the related regulatory laws.
- A resource person from private / public sector banks can be invited to elaborate details of various types of loans / finance options.
- A Tax planner / chartered accountant can explain in details the various tax obligations, that a proprietary or private or public limited firm has to consider.
- A financial planner can put lights on management of funds of a company so as to gain advantages of investment options available.
- A 3 to 4 full days workshop at a finance or tax managing firm can enable students to get detail insight of the actual work involved. A workshop report can be prepared by students to elaborate the things they have understood / benefited from the workshop.

#### 3.3 Other Implementation Techniques.

Other than series of lectures, small workshops and report presentation, other innovative techniques are suggested.

- 1) An engineering institute can start a small manufacturing or development unit, which will be run explicitly by students. The unit will have a separate setup in the institute campus and will be managed at off times or holidays or in extra time after or before college hours. Say for example
  - a) For production and mechanical engineering students a manufacturing unit can be thought of.
  - b) For computer and information technology engineering students, a software or web development or design unit can be thought of.
  - c) For civil engineering student, a unit, which looks into local infrastructure development in institute or campus, can be established.
  - d) For electronics and electrical engineering students, a unit, which looks into local support in the related field, can be established.

With support of local industry and contacts (social capital), the faculty members can provide the projects/ or assignments to these units initially. They will also look into rolling of the batches and involve students in handling workload to next batch. The roll of third and final year students can be fixed. Say for example

- 1) The third year students will look into ongoing rolling recruitment procedure (from their batch mates), regulating working environment and dealing with problems of working students. They will look into copy righting the unit's products. In short, they will model a ideal corporate environment in this unit.
- 2) The final year students will look into sales and marketing, knitting the business, funds management, costing and taxation involved. They will file the income tax returns; go through process of investment decision-making and actual investment procedures,

documentation of decisions taken with situation and reasons etc. The students involved in a this unit should prepare and present the reports of activities in a faculty-student meet and explain with reasons the decisions taken and effects of them on the unit they are running. For this meet, second year students can be involved to encourage them or to initiate their creativity. In this way, the students will face the "Audit Procedure." The students can be involved in inter departmental audits of units run by other engineering departments.

The idea here is that students should get prepared mentally that other than technical skills they are gaining from their academics, there are many other important aspects when it comes to start a company or own unit and that they must simultaneously be careful enough in acquiring the skill set.

- 2) Each student can become guest / annual member of various industrial clubs so as to develop their social capital and get insight of various issues a industry person has to deal with. The talks / events / conferences / meetings of these clubs can provide very good knowledge bytes for a would be industrial brain. The faculty members should take initiative to give a start for student branches in these professional clubs.
- 3) The students cab be encouraged to attend the conferences / events related to industrial development. Because of this students will not only begin building their social capital but also will get a chance to visit good industry setups or projects. In this way a series of lectures by the experts, small workshops and report writing can be added to make activity more interesting. To support to our theme of the paper let us tell you very interesting facts and figures in other countries.

Oxford University, U.K. has a strong track record in innovation. . Embracing historical, sociological, constructionist, subjects their business school focus on the environment;

social entrepreneurship; public sector entrepreneurship; consumer goods; entrepreneurship and innovation in emerging markets; venture capital, private equity and entrepreneurial finance; and science, technology and medicine.

- The University has produced over 100 companies with a combined market capitalization of over £2 billion.
- Three Oxford spinouts – VASTox, Evolutec and Physiomics – recently raised a total of £145 million on flotation.
- Oxfordshire's 82% growth rate in high-tech employment is the highest in the UK, and many of its 1,500 high-tech companies have links to Oxford University.
- Oxford has the highest number of academics working in five-star departments of any UK university; its researchers have won over 40 Nobel prizes.
- Oxford Entrepreneurs is the largest student and alumni entrepreneur society in Europe, with over 3,000 members, one in ten of whom is running their own company.

We hope that, this example is sufficient enough to activate and direct the thinking process of any one, especially engineering educators!!

#### 4 CONCLUSIONS

To conclude, we strongly assert that inculcating entrepreneurship skills into engineering graduates is the strongest point for betterment of academics of Indian engineering

education system. This inclusion will have a deep, positive impact on overall personality and skill set that a engineering graduate will possess. Once this skill set with suggested methodologies of implementation will be nurtured into the Indian engineering technocrats, there is no doubt that the progress of the individual will be fast, the percentage of success of upcoming entrepreneurs will improve. This will prove a catalytic approach in development of Indian economy. The whole world is already staring at economical growth of India. If the education system also offers its hand of help, dramatically positive results can be achieved. It is already high times when engineering educators should start towards implementation of such innovative techniques and help the individuals and hence the country to discover newer horizons of betterment and development.

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