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Employability of Graduates - A Search through the Educational Processes of Indian Engineering Institutions

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Abstract

There is a big boom in manpower requirements in IT industries in India in recent years. Presently India is aiming at becoming the major source of manpower in IT and other technical fields in the global scenario. To achieve this target, enhancement of employability of graduates coming out of engineering colleges are very important. A study has been conducted, which critically evaluates the educational processes and its influence on the student performance, which can be treated as a measure of employability. The study is primarily based on the accreditation data of National Board of Accreditation (NBA), India. Most of the process factors are found to be correlated with the student performance and major differences were observed between the process levels of various categories of institutes. Integration of effective teaching methodologies and necessary supporting processes in the curriculum may enhance the performance of the graduates from the engineering institutes.

Keywords: Employability, Processes, Engineering institutions in India

1. Introduction

Software development and IT enabled services are emerging as a niche opportunity for India in the global market. Electronics and information technology is the fastest growing segment of Indian industry both in terms of production and exports. Today, the electronics industry is de-licensed, and along with the liberalization in foreign investment and export-import policies of the entire economy, this sector is attracting considerable interest not only as a vast market but also as potential production base by international companies (Indiacore, nd). Engineering graduates from different disciplines are coming to IT field. ‘Employability’ rather than mere subject knowledge is important for these graduates. Role of engineering colleges as ‘production centers of employable human resources’ are becoming dominant in this situation. Employability can be considered as the ability of employees to actively manage their work life to be assured of continued employment in a rapidly changing environment. In order to remain employable, they should update their skills to adapt to changing job requirements, and there by, enhance the odds of getting another job (Lee et al, 2003). Fugate et al. (2003) define employability construct as a multidimensional aggregate of career identity, personal adaptability, and social and human capital. It is asserted that employability captures the conceptual commonalities among these dimensions, as they relate to active adaptability at work. Moreover, employability includes a strong and important cognitive-affective element (career identity) that both directs and energizes one’s active and adaptive efforts.

Engineering council/Royal academy of engineering, UK, defines engineering (E C, 1997) as: “a creative process in which facts, experience and skills in science, engineering and technology are applied to seek one or more technical solutions to meet a requirement, solve a problem, and then exercise informed judgment to implement the one that best meets constraints”. The engineering problem-solving process is not a simple systematic procedure involving the mechanical completion of one task after another. An engineering graduate would be expected to have an appropriate level of understanding of all of the steps involved in engineering problem solving, and to have recognized the need to develop and apply iterative procedures efficiently. The Engineering Professors Council (EPC), UK, through discussions with an advisory group consisting of members from the engineering employer’s federation, the engineering council, the department for education and employment and the quality assurance agency, formed a profile of attainment for a graduate from an engineering course (EPC, 2002). Engineering graduate output standards could be both defined and expressed using this profile. According to EPC, the ability to exercise key skills is expected of all engineering graduates and these should be encouraged and developed during the degree course. The key skills are ‘communication abilities, general IT user abilities, application of number, working with others, problem solving and improving own learning and performance’. In addition to this, the graduates should also demonstrate attributes of drive, motivation and innovation.

These standards and the demand of industrial sector for enhanced employability in engineering graduates ask for a detailed study to find out the ways and means to achieve this target.

2. Problem formulation and Objectives

In India, except for a few autonomous institutes, all engineering colleges are affiliated to different universities. These universities frame curriculum for various programmes and the syllabus for various courses coming under these programmes. Some studies on scientific and technical manpower development (STMDI, 2000) and employability profile of fresh engineers (Ghani, 2002) in India points out the inadequacy of the curriculum followed by these universities. National Board of Accreditation (NBA) is charged with the task of evolving a procedure for quality assessment in the technical education sector in India on the basis of specified guidelines, norms, benchmarks and criteria. NBA aims to recognize and acknowledge the value addition in transforming the admitted raw student into a capable engineer, having sound knowledge of fundamentals and acceptable level of professional and personal competence for ready employability in responsible engineering assignments (NBA, 2000). NBA has formulated the criteria or standards, by which the strengths and weaknesses of the individual programmes in any institution be judged. Though the NBA criteria are not covering all the features that are described earlier and that are expected from a graduate engineer, some representative measures can be developed by combining different variables staggered under various criteria of NBA. Hence it is decided to formulate the study of Indian engineering education programmes based on the NBA assessment process and data.

NBA uses eight criteria (Mission, goals and organization, Financial & physical resources, HR-faculty & staff, HR-students, Teaching learning processes, Supplementary processes, Industry institute interaction and Research & development activities) to assess the capabilities of engineering programmes. Out of these eight criteria, fourth criterion represents student aspects and the next four criteria represent the process aspect of the programme. For a specified programme where almost every resource can be treated as unchanging over the time period of concern, the processes play the major role in achieving the objectives. More over, the focus of present study is to determine the possibilities of enhancing employability skills through the educational processes. Hence the last five criteria scores of NBA assessment data are taken up for the study.

Undergraduate engineering programmes are offered by four major categories of institutes in India. National Institute of Technologies (NIT) and some other high profile colleges are functioning under autonomous status. They enjoy academic, administrative as well as financial autonomy. Central and state governments administer the second category. Third category of colleges is coming under grand-in-aid sector. Education societies or private bodies are managing these institutes. They take up the responsibility of providing capital assets like land, buildings, etc. Government provides salary and other working expenses to these colleges. AICTE, state governments and universities to which these colleges are affiliated fix pay scales and service rules for the staff employed in the second and third categories of institutes. Fourth category of colleges is working fully under self-financing scheme. Education societies or private bodies, which take up the responsibility of running these institutes, are mainly responsible for providing physical facilities, teaching staff, equipments and other supporting staff etc. For the last three categories of colleges, university is mainly responsible for the framing of rules for the academic part. They frame course duration, subjects to be taught, examination pattern, grading system etc. Students are admitted to these institutes by government and management on merit, as well as reservations basis. As the engineering institutions are coming under four different categories, the second part of the study is designed for analyzing the Process factors of these four categories of colleges, namely Autonomous colleges, Government colleges, Aided colleges and Self-financing colleges. Hence, objectives of the study are set as

a) To determine the correlation structure of process factors to the outcome – student performance

b) To assess the level of Process and Outcome factors in various categories of engineering institutes

3. Methodology

As the number of variables involved in the assessment of student and process parameters in NBA accreditation process seem to be high (33 variables under the 5 criteria), an attempt has been made to find out the minimum number of variables that can explain the variability of performance and that will allow an objective assessment. NBA assessment scores of 49 undergraduate engineering programmes from different parts of India have been collected for preliminary study. Principal Component Factor method is used for data reduction and summarization. Since the process is categorized into 5 criteria, Factor Analyses (FA) are conducted on the variables pertaining to each of these 5 criteria. By looking at the weights on the underlying variables given by the FA, suitable names are given to these factors (Table 1). Out of the 9 factors, the first one 'Student performance', which is a combination of dimensions 'Academic results, Admission to post-graduate courses, Performance in competitive examinations, Placements, and Employer's feedback' is taken as the outcome factor representing the employability of the students. Second and third factors (Student Intake and Learning Facilities) are resource components and hence neglected from the analysis. The remaining 6 factors -

Instruction, evaluation & feedback, Academic calendar, Supplementary processes, Institute initiatives, Industry initiatives, and R&D activities are process representatives of the NBA accreditation and taken for framing the study. The entire framework is exhibited in Figure 1.

Data of additional 191 engineering programmes that have undergone accreditation process have been collected for further analysis. The degrees of association of various process factors with the outcome factor are analyzed to draw conclusions about the development of 'Student Performance'. The study is extended to determine the level of process factors in various categories of engineering programmes to find out the ways of improving the student performance. Categorization of programmes that are coming under the present study is given in Table 3. As the variances of four populations are not equal, the non-parametric counterpart of one-way ANOVA, Kruskal Wallis test is selected for comparison. The null hypothesis of equal median for all the four populations is tested using Kruskal Wallis formula (Table 4).

4. Results and Discussion

All factors with the exception of 'Academic Calendar' are significantly correlated (Table 2) with Student Performance. 'Institute Initiatives' for industry institute interaction exhibits the maximum association with student performance. Figure 2 demonstrates the average level of process factors of Indian engineering programmes. Academic calendar, which is an indicator of pre-scheduled activities, seems not to be influencing the student performance/employability of the graduates. As most of the colleges in a state are affiliated to a single university, all the activities can be preplanned and hence the academic component acquired high scores irrespective of the category. Theoretical knowledge, which is tested through examinations, is only one of the several features of employability. Low value of correlation coefficient of 'instruction, evaluation and feedback' with student performance is an indication of this fact. Supporting processes (supplementary processes, institute & industry initiatives for interactions and R & D activities) exhibit high amount of correlation with the Student performance.

The performance of Process factors is not the same and the level of 'Supplementary processes; Institute-initiatives, Industry-initiatives and R&D activities' are significantly different in the four categories of colleges (Table 4). Level (%) of significant Process factors and Outcome factor for the four categories of engineering colleges are displayed in Table 5. Supplementary processes are at high levels in autonomous colleges and aided colleges (68%) in comparison with the other two categories. Government engineering colleges show the lowest level in supplementary processes. While good amount of institute initiatives for interaction with industries are there in autonomous and aided colleges, this is only at a nominal level (48%) in the other two categories of colleges. There is a major difference between the autonomous and self-financing colleges in terms of industry initiatives for interaction with institutes. Research and development activities are very limited in the engineering colleges, among which autonomous colleges are better (54%) and self-financing colleges are at the worst (39%) condition.

5. Conclusions

Employability is a generic term and can be treated as the capability of a person (engineering graduate) to readily take up a job assigned to him with out much amount of training. It is a holistic term representing all the attributes of an employee/employment. In the present study, a five-facet capability of an engineering graduate, *Student Performance,* is taken as the representative of employability. Supplementary processes, which promote informal interactions, among the students and with experts from various fields, are inadequate in most categories of engineering colleges. R & D activities and industry-institute interactions are in pathetic condition in all categories of colleges. These are the major impediments to the enrichment of student performance, and as a consequence, to the inadequate employability of engineering graduates. Embedding all the processes, which enhance employability of the graduates into the curriculum of engineering programmes is the only way to overcome this difficulty. Effective teaching methodologies and necessary supporting processes are to be integrated in the curriculum by which employability can be enhanced in the graduates of engineering institutes.

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STMDI - Scientific and Technical manpower development in India. (2000). *World Bank report.*

Table 1. Summary of PCA results

Criterion -NBA	Principal Components extracted
1. Human Resources Students	1.Student Performance
	2. Student Intake
2.Teaching – Learning Processes	3. Learning Facilities
	4.Instruction, Evaluation and feedback
	5.Academic calendar
3. Supplementary Processes	6.Supplementary Processes
4.Industry –Institution Interaction	7.Institute initiatives
	8.Industry Initiatives
5. Research & Development	9.R&D Activities

Table 2. Correlation coefficients of process components with Student Performance

Process components	Correlation coefficient (Pearson)	Sig.
Instruction, Evaluation and feedback (IEF)	.179	.007
Academic calendar (AC)	.078	.236
Supplementary Processes (SP)	.359	0
Institute initiatives (II)	.532	0
Industry Initiatives (IyI)	.310	0
R&D Activities (R&D)	.421	0

Table 3. Number of programmes under the four categories

Category of Engineering Colleges	Number of Programmes
1.REC & other Autonomous Colleges	47
2.Government Colleges	37
3. Aided Colleges	32
4. Self – financing Colleges	124
Total	240

Table 4. Result of Kruskal Wallis test

	IEF	SP	II	IyI	R&D
Chi-Square	2.170	20.498	67.287	14.187	77.937
df	3	3	3	3	3
Significance	.538	.000	.000	.003	.000

Table 5. Level (%) of significant process components and outcome component

Components	Level	Autonomous	Government	Aided	Self-financing	Overall
Supple-mentary Processes	Min	52	34	46	42	34
	Max	86	80	86	78	86
	Mean	68	60	68	61	63
Institute initiatives	Min	50	0	55	13	0
	Max	85	85	90	95	95
	Mean	69	49	72	48	55
Industry Initiatives	Min	50	47	53	33	33
	Max	83	90	80	83	90
	Mean	70	66	67	63	65
R&D Activities	Min	20	27	23	0	0
	Max	83	60	73	67	83
	Mean	54	41	45	31	39
Student Performance	Min	60	33	46	37	33
	Max	89	88	83	85	89
	Mean	76	67	68	61	66

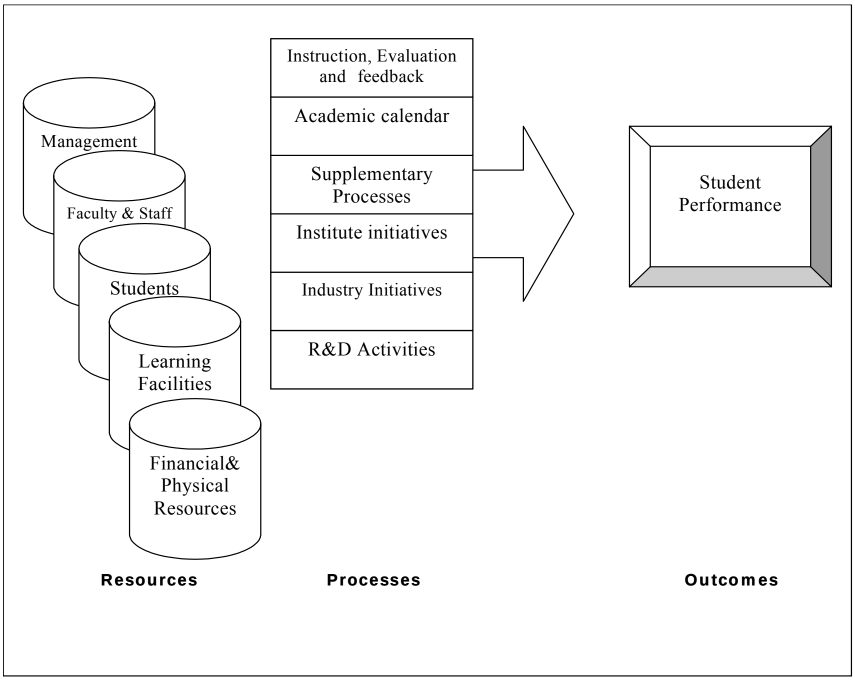

Figure 1. Framework of the study

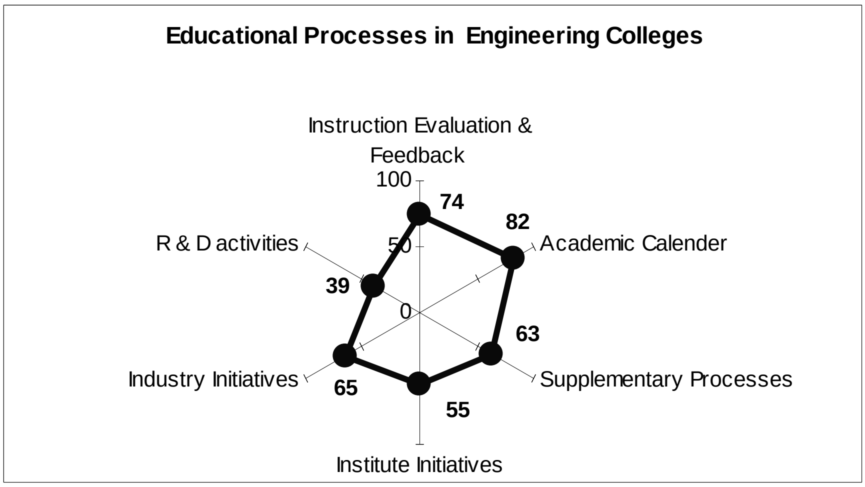

Figure 2. Average levels of process components of Indian engineering programmes