

A Study of Technical Employability of Engineering Graduates in India

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Abstract

This study examines the technical employability of engineering graduates from tier-II engineering colleges in India. This involved mapping the students' skill sets across different streams against the skill sets required by recruiters, to identify and reduce the skill gap between the required and actual skill sets. The primary data was collected via assessment tools to capture the aptitude of the students. The dependent variable for the study was the student's 'technical employability' status or suitability for the role. Discriminant analysis was employed for the analysis. The results of the study suggest that aptitude explains almost 80% of the variation in employability among the students. Thus, engineering colleges must place more emphasis on aptitude development. The results of the study also suggest that the low level of employability of engineering graduates is due to lack of adequate soft skills training in engineering colleges. In fact, it could be inferred that soft skills play a much more important role in employability than technical skills. This is an issue which tier-II engineering colleges must address on an urgent basis.

Keywords: Technical Employability, Tier-II Engineering Colleges, Aptitude Development, Soft Skills

Introduction

The engineering education segment in India is one of the largest in the world. According to AICTE, there are about 3125 institutes offering engineering and technology courses at an undergraduate level, with an overall faculty strength of about 338,195 and an overall annual student intake of about 1,405,400.¹ The tier-I colleges, which include elite institutions such as the IITs, NITs, IIITs, BITS, and several others, are world-class institutions, with superior quality of students, comparable to the best in the world, and have access to superior quality of faculty and abundant resources for research and infrastructural development. The tier-II colleges are not as prestigious as the tier-I colleges but are well-established and have generally good quality of students and good quality of faculty, though they may be constrained for resources. The tier-III colleges are less well established and are still in the growth stage of their lifecycle. Of course, there is a very big difference in quality between tier-I, tier-II, and tier-III colleges (Chaitra, 2013). According to a report by Eckovation,² only 55–60% of the total intake capacity of engineering colleges is utilised. Further, there is a 30–35% drop-out rate, so that only 70–75% of the students who enrol are able to graduate and earn an engineering degree. Finally, less than 30% of students that graduate

¹ <https://www.facilities.aicte-india.org/dashboard/pages/dash-boardaicte.php>

² <https://engineering.eckovation.com/engineering-education-performance-report-engineering-colleges-india/>

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are able to get placed, while the rest struggle to get jobs.

India has been one of the major powerhouses in producing engineers in the area of computer science, and a lot of institutions thereby have been offering courses in this domain (Loyalka et al., 2019). Parallely, in recent years, the need for sales and marketing jobs has increased exponentially, in turn increasing enrolment into management courses. However, despite the exponentially growing requirement of engineers and business management professionals, there has been a widening mismatch between industry requirements and the quality of students produced by engineering and management colleges. It has been reported that only 16.25% of engineering graduates are employable in the IT services sector, 3.4% in IT products, 5.5% for software programming jobs, and 36.2% for non-core IT work.³ For business schools, only 7% of management graduates are employable.⁴

There have been several definitions offered for employability. Employability can be defined as the extent to which candidates with specific skillsets can get and retain a job profile matching their skillsets. This match between the candidate and job profile can be analysed at three different levels: skills, knowledge, and attitude (Rahmat et al., 2012). The current study focuses on technical employability, i.e. the extent of match between the technical skills required by specific job profiles and students' technical skills/abilities. This is a major component in the overall employability of students.

The current study focuses on understanding the suitability of academic background and the type of job profile that the aspirants look. Two distinct job profiles were taken, one from software engineering and the other of marketing and sales, to assess the extent of employability of engineering graduates from tier-II colleges.

Literature Review

There are many studies addressing the issue of employability. Broadly, the literature falls into two strands: first dealing with defining and delineating the scope of employability and second dealing with the determinants

of employability.

The definition of employability has been a subject of extensive discussion. Hillage and Pollard (1998) defined the scope of the term employability, in terms of having the capability to gain initial employment, maintain employment, and obtain new employment if required. At the level of the individual, employability depends on the knowledge, skills and attitudes they possess, the way they use and deploy those capabilities, the way they present them to employers, and, most crucially, the internal and external context within which they seek work. The Committee of Vice-Chancellors and Principals of the Universities of the UK (1998) defined employability skills in terms of four aspects, viz. intellectual skills, key skills, personal attributes, and knowledge of the organisation. Dunne et al. (2000) highlighted the dilemma associated with the assumption that skills have the same meaning in the context of education as that of employment. Green and McIntosh (2002) pointed out that lack of skills is not the only employability issue; however, over-qualification can also be an issue.

The other major strand in the employability literature is that of determinants of employability. Heavey and Morey (2003) emphasised on the skills graduates need to deal with their career and those that make them learn throughout their working life phase. Morley (2007) emphasised that educational experience and processes play important role in the development of employability skills and socio-economic privilege. Manson et al. (2009) suggested that the experience an individual goes through in an academic course has a positive impact on his/her competency to secure adequate employment. Stoica (2010) verified the existence of a perceptual gap between the skills required and successful employability and focused on the necessity of understanding the recent skills required and the effect on the quality of employment. Rahmat et al. (2012) found a strong relationship between graduates' in information science and technology understanding of their skills as assessed on their basic knowledge of programming and the level of employment that they could secure. They also looked into the necessity to identify whether the skills possessed by graduates during their academic experience are helpful or not to perform in the exiting job market. Pandey (2012) found that life skills play an important role amongst the important factors affecting the employability of management graduates for increasing the chance of

³ National Employability Report, Annual Report- Engineers, 2019, Aspiring Minds Assessment Pvt Ltd

⁴ Employability Report, 2018 - ASSOCHAM

getting a job and sustaining it. Chitra (2013) looked into the perception of employers as well as the employees towards employability skills required for entry-level engineering graduates in multinational software companies. Shah et al. (2014) studied the market expectations for management students and identified the factors of employability for them revealing the major skills necessary.

Thus, employability is a well-studied issue. The current study contributes to the literature by examining the technical skills component of the employability of engineering graduates in tier-II engineering colleges in India.

Methodology

The objective of the study was to analyse the technical employability of engineering graduates. This involved mapping the students' skill sets across different streams against the skill sets required by recruiters, to identify and reduce the skill gap between the required and actual skill sets.

The target segment considered for the study were the tier-II engineering colleges, with a good reputation but not-so-good placements. This segment was considered, as tier-I engineering colleges tend to have good placements, so the employability problem lies with tier-II and tier-III engineering colleges. In particular, the tier-II colleges tend to be technically/academically sound but fail to convert this into good placements.

The sample units for the study were final-year students in tier-II engineering colleges. The samples for the study were selected by convenience sampling. The sample size for the study was 2282; however, many data values were missing. The student demographics are summarised as follows. The branch-wise distribution of students was as follows: 8.1% of the students were mechanical engineering students, 41.2% were electrical/electronics/communication (EEC) engineering students, 5.3% were civil engineering students, 25.5% were computer science engineering students, and 7.4% were information technology engineering students; also, 12.5% of the students were MBA students. The students were from some major Indian states, including Karnataka (40.6%), Andhra Pradesh/Telangana (36.6%), Maharashtra (10.3%), Punjab/Haryana (9.4%), Rajasthan (2.2%), and

West Bengal/Bihar (0.9%). Within Karnataka, 42.8% of the students were from Dakshin Kannada, 22.5% were from Greater Bangalore (including Mysore and Kolar), 17.0% were from mid-Karnataka, 16.6% were from North Karnataka, and 1.2% were from Uttara Karnataka. Further, 28.9% of the students were from tier-I cities, 46.3% from tier-II cities, and 24.8% from tier-III cities.

For simplicity, only two target job profiles were considered: a sales/business development role and a software development role. In terms of the job profile, 37.8% of the students preferred the sales/business development profile, and 56.6% of the students preferred the software developer profile, while data for 5.7% of the students were missing. The software development profile was exclusively for the 'circuit' branches, with 50.3% of students from EEC, 41.8% from Computer Science (CS), and 7.9% from Information Technology (IT). The sales/business development profile was for other, non-'circuit' branches (e.g. Mechanical and Civil), but 'circuit' branch students were also allowed to opt for the profile. The composition of students for the sales/business development profile was: 21.1% from Mechanical, 26.1% from EEC, 13.8% from Civil, 6.8% from IT, and 1.2% from CS; further, 31.0% of the students for the sales/business development profile were from MBA.

The primary data was collected via assessment tools to capture the aptitude of the students. Students who opted for the software development role were assessed for coding aptitude via tests for C, C++, and OOPs skills. Students who opted for the business development role were assessed for sales aptitude via tests for negotiation skills and selling skills.

The dependent variable for the study was the student's 'technical employability' status or suitability for the profile, as assessed through the tools discussed above. Specifically, it is a screening criterion: any student who does not clear the round is not considered for further rounds, i.e. the technical and HR rounds. Discriminant analysis was applied to analyse the impact of aptitude on employability, as the dependent variable was binary.

Findings & Analysis

The descriptive statistics of the students' scores in the negotiation skills and selling skills tests for the sales/business development profile are presented in Table 1 below.

Table 1: Descriptive Statistics of Students' Test Scores for Sales/Business Development Profile

		<i>Mech.</i>	<i>EEC</i>	<i>Civil</i>	<i>IT</i>	<i>MBA</i>	<i>Total</i>	<i>F Stat</i>
Negotiation Skills	Mean	11.7353	11.8295	10.6283	12.9474	11.8191	11.7363	3.091**
	Std. Dev.	3.9262	4.0704	4.1880	4.3606	4.2932	4.1625	
Selling Skills	Mean	9.8187	10.2089	9.2017	9.6780	10.5880	10.0928	2.795*
	Std. Dev.	3.4297	3.9727	3.9048	4.1872	4.6585	4.1270	

There was found to be significant difference in the performance of the students across different branches with respect to both negotiation skills and selling skills. IT students were found to have performed better in the negotiation skills test than students from all other branches, including the MBA students. Further, there was found to be no significant difference in performance in the negotiation skills test between Mechanical, EEC, and MBA students, while Civil students were found to have performed worse in the negotiation skills test than students from all other branches. On the other hand, MBA students

were found to have performed better in the selling skills test than the engineering students, across all branches. Further, there was found to be no significant difference in performance in the selling skills test between EEC, Mechanical, and IT students, while Civil students were found to have performed worse in the selling skills test than students from all other branches.

The descriptive statistics of the students' scores in the C and C++ programming skills and OOPs concepts tests for the software development profile are presented in Table 2 below.

Table 2: Descriptive Statistics of Students' Test Scores for Software Development Profile

		<i>EEC</i>	<i>CS</i>	<i>IT</i>	<i>Total</i>	<i>F Stat</i>
C Programming Skills	Mean	3.5102	3.8026	3.6020	3.6430	1.743
	Std. Dev.	2.4779	2.4550	2.4568	2.4699	
C++ Programming Skills	Mean	4.8980	5.3609	5.2041	5.1206	2.961*
	Std. Dev.	2.9833	2.9911	3.0628	2.9995	
OOPs Concepts	Mean	5.4584	6.3703	5.4694	5.8448	8.872**
	Std. Dev.	3.0582	3.2190	3.1597	3.1623	

There were found to be significant differences in the performance of the students across different branches with respect to both C++ programming skills and OOPs concepts, but no significant difference in the performance of the students across different branches with respect to C programming skills. CS students were found to have performed better in all three tests than IT students, who in turn performed better in all three tests than EEC students.

The employability levels of the students for the profiles are presented in Table 3 below.

Table 3: Employability Levels of the Students

<i>Profile</i>	<i>Branch</i>	<i>Employability</i>
Sales/Business Analyst	Mech	90.66%
	EEC	83.56%
	Civil	84.87%
	IT	79.66%
	MBA	74.16%
	Overall	82.25%

<i>Profile</i>	<i>Branch</i>	<i>Employability</i>
Software Developer	EEC	48.46%
	CS	60.37%
	IT	50.51%
	Overall	53.60%

There was found to be a significant difference in the level of employability between the profiles ($\chi^2 = 186.65^{**}$), with the higher overall level of employability for the sales/business development profile than for the software developer profile. The combined overall level of employability of the students was found to be 61.4%. There was found to be a significant difference in employability levels between students in the different branches for both the sales/business development and software development profiles (respectively, $\chi^2 = 24.05^{**}$ and $\chi^2 = 17.25^{**}$). For the sales/business development profile, Mechanical students were found to have the highest level of employability, followed by Civil, EEC,

and IT students, while the MBA students were found to have the lowest level of employability. For the software developer profile, CS students were found to have the highest level of employability, followed by IT students and EEC students.

The results of the discriminant analysis for the sales/business development profile are presented in Table 4 below.

Table 4: Discriminant Analysis for Sales/Business Development Profile

		<i>Coeff</i>	<i>Std Coeff</i>
Negotiation Skills		0.168	0.655
Selling Skills		0.189	0.687
(Constant)		-3.889	
Function at Group Centroids	<i>Non-Employable</i>	-1.515	
	<i>Employable</i>	0.177	
Correctly Classified		78.7%	
Wilk's Lambda		0.788	
p-value		0.000	

The results of the discriminant analysis indicate that selling skills were marginally more important than negotiation skills in determining employability for the sales/business development profile. Using the discriminant function with the descriptive statistics of negotiation skills and selling skills yielded projected employability rates of 60.6% for Civil students, 72.4% for Mechanical students, 72.9% for MBA students, 73.2% for EEC students, and 74.5% for IT students.

The results of the discriminant analysis for the software development profile are presented in Table 5 below.

Table 5: Discriminant Analysis for Software Development Profile

		<i>Coeff</i>	<i>Std Coeff</i>
C Programming Skills		0.182	0.421
C++ Programming Skills		0.230	0.629
OOPs Concepts		0.271	0.738
(Constant)		-3.428	
Function at Group Centroids	<i>Non-Employable</i>	-0.968	
	<i>Employable</i>	0.807	
Correctly Classified		83.0%	
Wilk's Lambda		0.561	
p-value		0.000	

The results of the discriminant analysis indicate that OOPs concepts is more important than C++ programming skills, which in turn is more important than C programming skills in determining employability for the software development profile. Using the discriminant function with the descriptive statistics of C programming skills, C++ programming skills, and OOPs concepts yielded projected employability rates of 46.9% for EEC students, 49.6% for IT students, and 59.0% for CS students.

Discussion

The results of the study indicate that the employability level of the students is significantly higher for the sales/business development than for the software development profile, across the different branches. This reflects the technical nature of the software development profile, as opposed to the inter-personal/behavioural nature of the sales/business development profile.

The results of the study also indicate that there are significant differences in employability between students in different branches. For the sales/business development profile, the Mechanical students were found to have the highest employability levels, followed by Civil, EEC, and IT students; the MBA students were found to have the lowest employability levels for the sales/business development profile. This latter finding could be due to survivorship bias, in the sense that the students who enrolled for MBA studies in tier-II engineering colleges could more likely to be those who did not get jobs after completion of their BTech, which in turn was due to their lower levels of employability. For the software development profile, CS students were found to have the highest levels of employability, followed by IT and EEC students.

The results of the discriminant analysis suggest that aptitude explains almost 80% of the variation in employability among the students. For both profiles, aptitude scores contributed positively towards employability of the students. Thus, engineering colleges must place more emphasis on aptitude development. This is especially required for programming skills for EEC students, to improve their employability for the software development profile, particularly as 74.3% of the EEC students opted for the software development profile and they comprised 50.3% of the students who opted for the software development profile.

The results of the study present a much higher level of employability among engineering graduates than reported in the literature. For example, according to Eckovation,⁵ only 16.25% of engineering graduates are employable in the IT services sector and 5.5% for software programming jobs. This discrepancy is because the current study has only considered the technical skills/aspects of employability. The implication is that the low level of employability of engineering graduates is due to lack of adequate soft skills training in engineering colleges. It could be inferred that soft skills play a much more important role in employability than technical skills. This is an issue which tier-II engineering colleges must address urgently.

There are some limitations inherent in the study. Though the sample size was quite large, most of the samples were collected from engineering colleges in Karnataka. The results of the study may have a geographical bias and thus may not be generalisable to all tier-II engineering colleges, across India.

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⁵ <https://engineering.eckovation.com/engineering-education-performance-report-engineering-colleges-india/>