International Journal of Advance Research in Engineering, Science & Technology(IJAREST),
ISSN(O):2393-9877, ISSN(P): 2394-2444,
Volume 2, Issue 6, June- 2015, Impact Factor: 2.125

DEVELOPING A MODEL TO PREDICT EMPLOYABILITY OF ENGINEERING STUDENTS IN CAMPUS PLACEMENT FOR IT SECTOR

[1]Vijay N. Kalbande, [2]Dr. C.C. Handa
[1]Associate Professor, Department of Mechanical Engineering, RTM Nagpur University, Nagpur, MS, INDIA
[2]Professor & Head, Department of Mechanical Engineering,RTM Nagpur University, Nagpur, MS, INDIA
[1]viju_kalbande@yahoo.com
[2]chandrahashanda@rediffmail.com

ABSTRACT

Due to non availability of trained engineering graduate students, companies compromise on their expectations to fulfill their requirement of manpower. The company invests huge time & money (budget) on training fresh engineering graduate to make them ready for work. This paper identified parameters/skills on which employability of engineering graduate students depends and correlation of parameters/skills with employability by using statistical tool Chi Square test, T-Test in SPSS 10 (Software Package of Social Sciences). A logistic regression mathematical model was developed which predicts probability of Employability of engineering graduate students in campus placement based on skills set required in IT Sector. Sensitivity analysis was carried out to check impact of input variables like Aptitude, Communication, Technical & Personality factors on Employability. Identified Threshold cutoff point to get optimum accuracy of placed as well as unplaced group of students. Company may use this approach to tap quality talent from untapped region & providing equal opportunity to all fresh Engineering Graduate students. This study tries to find out gap between Industry expectations and Institute produce in Technical Institutions This study clearly guides Technical Institutes to change traditional focus to special effort to develop competencies of their students that best fosters employability.

Keywords: Engineering Graduate, Employability, IT Sector, Logistic regression model, Sensitivity Analysis

I. INTRODUCTION

India's substantial growth in recent years and globalization has resulted in a significant increase in demand for technocrats. To meet requirements, All India Council of Technical Education (AICTE), New Delhi has approved new technical institutes as well as second shift within the same infrastructure & also diluted eligibility criteria of admission. It has been observed that the growth of Engineering and Technology educational Institutes increase in ten folds in India to fulfill requirement of future technocrats [1]. This remarkable quantitative growth of Technical Institutes has directly affected quality of technical education & employability of students [2].

The issue of employability of Engineering Graduates is not only the concern of Technical Institutes but also the Industries and the Government at large. Interaction between Institute and the Industry is now widely recognized as an essential requirement to train and develop the right kind of Technical manpower necessary to sustain and promote Industrial and Economic growth. Aspiring Mind study revealed that about 62 % of engineering undergraduates need training to be employable for job in the information technology (IT) & IT enable services (ITeS). It is observed that employability in IT services companies is highest in North, followed by East, then West and then South. It is observed that states with more Government colleges as compared to Private colleges fare better on employability [3]. In addition to this the majority of students enrolled in Engineering and Technology courses in the Maharashtra State came from non-English speaking backgrounds [4].

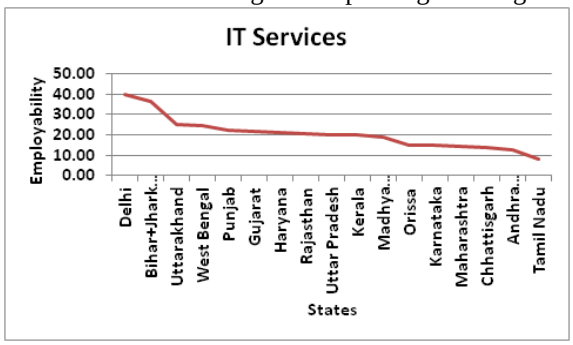

Fig 1: Employability scenario in various states for IT Sector

Dr. Abdul Kalam has rightly said that India does not have problem of unemployment but unemployability. Indian and Multinational Employers complain that only 25 % hired technical graduates found employable on probationary training course completion [5]. PurpleLeap study stated only 7 percent engineering students were found employable when all factors like Technical Skills, Analytical Skills & Communication Skills considered. Surprisingly more than 80 percent of the students do not meet the requirements on problem solving & analytical skills. It was found that just by raising problem solving & analytical skills, it was possible to more than double the employable pool from 7 to 16 percent [6]. Survey carried out by the Federation of Indian Chambers of Commerce & Industry (FICCI) & the World Bank, 64% of employers are

not satisfied with quality of skills from Engineering Graduate student's [7].

The most of the Authors/Researchers carried out work on upgradation of Quality of technical institute by using Statistical Quality Control, Total Quality Control, Six Sigma, Industry- Institute partnership etc[8][9]. AICTE, New Delhi is taking initiative to upgrade Technical Institute by providing grant through schemes like IIPC Cell, ED Cell, MODROB etc. Industries is also taking initiative by conducting various campus connect programme in Technical Institutes to reduce gap [10]. Employability of Engineering Graduate is determined according to student success in campus placement recruitment drives of multinational software companies, i.e. whether they receive an offer of employment & number of companies participated.

II. OBJECTIVES OF RESEARCH

The objectives of the research study were selected after exhaustive literature reviews & discussions with experts, is to develop a model which predicts probability of Employability in campus placement and to decide the importance of various factor i.e. Aptitude factor X1, Communication factor X2, Technical factor X3 & Personality factor X4 on Employability of engineering graduate students.

III. SAMPLE COLLECTION

After exhaustive literature review, we have identified 7 Parameters and 41 skills sets which are responsible for Employability of Engineering students [11][12][13][14]. Most of the researchers predict various correlations based on opinion collected through questionnaire about fresher's hiring. During the literature search, no reference were seen in which the systematic attempt to measure the employability skills was undertake. Hence we have developed a systematic approach to measure employability skills of engineering graduate students during course. The opinion of the stakeholders involved in campus placement selection process was taken for selection of employability parameters/skills. The stakeholders are Recruiters (Company Executives HR), Students (Placed through campus placement process and got confirmation after successful completion of probation period), Training & Placement Officers (min 5 years experience) & Trainers (min 5 years experience)

The opinions of 45 stakeholders were collected on importance of listed parameters/skills to recruit fresh engineer through campus placement selection process in multinational software companies. We have finalized 5 parameters & 22 skills for research study based on importance given by stakeholders. Confirmative factor analysis method was used for reduction of skills into four major factors for study. The parameters & factors are as below

Parameters

- Academics Performance (X^{th}, XII^{th} & B.E. Aggregate %)
- Entrance examination scores (AIEEE & SEEE Scores)
- Branch (Computer & Information Tech. Group, Electronics Group & Mechanical Group)
- School Board (ICSE, CBSE & State Board)
- Gender (Male & Female)

Factors

Aptitude Factor: X1

- Problem solving skill,
- Analytical skill
- Mathematical skill
- Business awareness skill
- Logical thinking skill
- Visualizing skill

Communication Factor: X2

- Oral communication skill
- Written communication skill
- Reading skill
- Listening skill
- Presentation skill

Technical Factor: X3

- Basic computer knowledge
- Subject concept knowledge
- Application of technical knowledge

Personality Factor: X4

- Team working skill
- Leadership Initiative skill
- Flexibility
- Creative/Innovative
- Self confidence
- Self motivated
- Positive attitude
- Goal setting skill

Engineering Graduate Employability Test (EGET) was designed to measure selected employability skills of engineering graduate students. Standard questionnaires were use to design EGET. The test was conducted in various reputed technical instates and a data of 2000 students was collected. Using our assumptions in research study and the BoxPlot statistical tool, the sample size was filtered from 2000 to 362.

IV. DATA ANALYSIS

The data analysis were carried out by using Statistical methods such as descriptive statistics, chi square analysis, factor analysis, T-pair test analysis, logistic regression analysis and hypotheses testing by using SSPS 20. The adequacy & sphericity of data 362 samples were tested by using KMO & Bartlett's Test & was confirmed [14][15]. The importance of 5 parameters i.e. Academics performance, Entrance examination scores, Branch, School Board & Gender and four factors i.e. Aptitude factor X1, Communication factor X2, Technical factor X3 & Personality factor X4 on employability was tested & confirmed by using chi square test[16][17][18][24]. The correlation between factors i.e. Aptitude factor X1, Communication factor X2, Technical factor X3 & Personality factor X4 was established by usin T-pair test & were confirmed. Sensitivity analysis was carried out to check impact of input variables like Aptitude, Communication, Technical & Personality factors on Employability. Identified

Threshold cutoff point to get optimum accuracy of placed as well as unplaced group of students.

Development of model

Based on earlier work, the four factors were identified which was responsible for individual employability of engineering graduate students. Based on the literature search, it was decided to use Logistic Binary Regression Model to develop relationship between factors and employability [19][20][21].

Logistic Binary Regression Model

Logistical regression (LR) method used to determine the impact of multiple independent variables presented simultaneously to predict membership of one or other of the two dependent variable categories. LR forms a best fitting equation or function using the maximum likelihood method, which maximizes the probability of classifying the observed data into the appropriate category given the regression coefficients. Like ordinary regression, logistic regression provides a coefficient 'b', which measures each IV's partial contribution to variations in the DV.

Assumptions of LR

- No linear relationship between dependent and independent variables.
- The dependent variable must be a dichotomy (2 categories; placed 1 & unplaced 0).
- The independent variables need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group.
- The categories (groups) must be mutually exclusive and exhaustive; a case can only being one group and every case must be a member of one of the groups.
- Larger samples are needed than for linear regression because maximum likelihood coefficients are large sample estimates. A minimum of 50 cases per predictor is recommended. (4*50=200<362 Samples)

There were two reasons to used LR:

- Prediction of group membership. Since logistic regression calculates the probability of success over the probability of failure, the results of the analysis are in the form of an odds ratio.
- LR also provides knowledge of the relationships and strengths among the variables

A logistic Regression Binary model developed with help of SPSS 20 to predict employability of engineering graduate in campus placement based on measured factor skills. The output variable employability should be in binary code i.e. 1 coded for placed & 0 for unplaced students. The output of the model spread from 0 to 1 (i.e. probability of 1 on 0 calculated by model: it means probability of employment on unemployment)

$P= e^{a+bx}/(1+e^{a+bx})$ --- Eq (1)

Where P is the probability of 1 on 0
e is the base of the natural logarithm
a & b are the constant

Model can be represent as

Logit $P = a+bx$ --- Eq(2)

		B	Wald	Sig.
Step 1[a]	X1	.379	54.733	.000
	X2	.283	16.842	.000
	X3	.498	51.290	.000
	X4	.130	5.371	.020
	Constant	-14.414	85.122	.000

Table 1: Variable in the Equation with 95% CL

Logistic model from above table 1 formulated as

$$Y= e^{0.379X1+0.283X2+0.498X3+0.13X4- 14.41}/(1+e^{0.379X1+0.283X2+0.498X3+0.13X4-14.41}) \text{ - Eq(3)}$$

Logit $y = 0.379X1+0.283X2+0.498X3+0.13X4-14.41$ - Eq(4)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	220.633[a]	.534	.716

Table 2: Logistic Regression Model Summary

Nagelkerke R Square of model is 0.716 and Cox & Snell R Square are 0.534 which indicates a moderately strong relationship between prediction & grouping factors as shown in table 1. All input factors X_1, X_2, X_3 & X_4 are significantly contributed to predict output Employability. Wald coefficient of factors indicates that aptitude factor (Wald Coeficient: 54.733) contributed largely where as personality factor (Wald Coefficient: 5.371) less to predict Employability as shown in table 1.

V. RESULT & DISCUSSION

The results of 362 samples were analyzed using Logistic Regression, Omnibus test, Hosmer & lemeshow test and Sensitive Analysis etc. The details are discussed below

		Chi Square	DOF	Signi.
Step 1	Step	276.777	4	.000
	Block	276.777	4	.000
	Model	276.777	4	.000

Table 2: Omnibus Tests of Model Coefficients

To check fitting of Model (without Predictors), Omnibus test was conducted and designed two Hypotheses, Null Hypothesis Ho: The model is a good fitting model and Alternate Hypothesis H1: The model is not a good fitting model (i.e. the predictors X_1, X_2, X_3 & X_4 have a significant effect). The difference between –2LL for the best-fitting model and –2LL for the null model (in which all the b values are set to zero in block 0) is distributed like chi squared, with degrees of freedom equal to the number of predictors; this difference is the Model chi square. Good fitting of model The -2LL value

from table 2 the model summary is 220.63 which is less than chi square of our model from table 1 is 276.77 with 4 degree of freedom & significance P<0.000. This indicates, model without constant has poor fit & predictors X_1, X_2, X_3 & X_4 was significantly affect output and create essentially a different model.

Hosmer & Lemeshow test was conducted to check fitting of model (with Predictors). Designed hypothesis Null Hypothesis Ho: model is good fit and altérnate hypothesis H1: model is not good fit. From table 4, Chi square calculated 11.23 is less than chi square 15.50 from chi square distribution table. Hence null hypothesis accepted. The model containing predictors X_1, X_2, X_3 & X_4 was good fit. The value of significance 0.605 indicated that the model was statistically significant and therefore our model was quite a good fit.

Step	Chi-square	df	Sig.
1	11.238	8	.189

Table: 4 Hosmer and Lemeshow Test

Observed	Predicted		Percentage Correct
	Y (0.00)	Y (1.00)	
Y (0.00)	138	23	85.7
Y (1.00)	25	176	87.6
Overall Percentage			86.7

a. The cut value is .500

Table 5: Predicted accuracy for design model

Prediction success overall was 86.7 %. Optimum correct predicted accuracy of placed group was 87.6 % where as for unplaced group was 85.7 % at threshold cutoff point 0.5 as shown in table 5.

Sensitivity Analysis

The sensitivity analysis assesses the effect on correct and incorrect predictions if the prediction probability threshold is altered [22]. Curve is plotted between Predicted accuracy of placed/unplaced group in % vs cutoff point. The cutoff point was varied from 0.1 to 0.9 and calculated predicted accuracy for placed and unplaced group in % as shown in table 7.

Cut off value	Predicted accuracy in %	
	Placed Group	Unplaced Group
0.1	97	47.2
0.2	94.5	63.4
0.3	92	72
0.4	90	79.5
0.5	**87.6**	**85.7**
0.6	85.1	90.1
0.7	82.6	92.5
0.8	74.6	97.5
0.9	60.7	99.4

Table 6: Predicted accuracy of placed & unplaced group in % with respect to cutoff point

The gradient of the curve was evaluated to determine best cutoff point value to achieve a desired balance between predicted accuracy of placed & unplaced group in % as shown in fig 2.

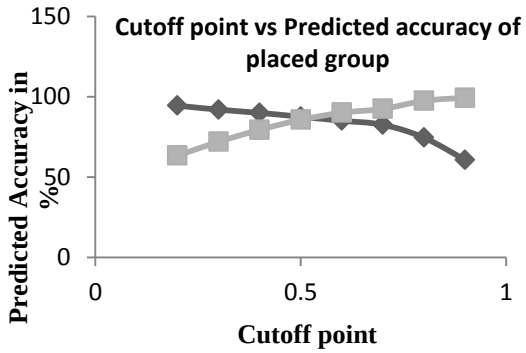

Fig 2 : Cut off point at optimum accuracy of placed and unplaced group

From curve, the predicted accuracy of placed group changes inversely proportional with cutoff point. We get optimum value of prediction accuracy at 0.5 cutoff point where accuracy of placed group is 87.76% & unplaced group is 85.70 %

Sensitivity analysis is also used to check effect of input factor X1, X2, X3, X4 on output factor Y.

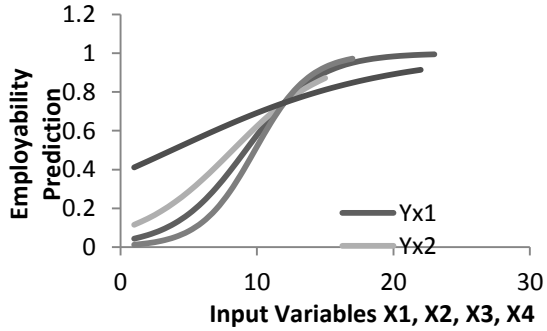

Fig 3: Effect of Input variables on Employability prediction

Aptitude factor X1 affects more to predicted probability of Employability whereas Personality factor X4 less. The ranking of skills as per impact on employability as fallows in table 9

Skill factor	Rank
Aptitude factor X_1	1
Technical factor X_3	2
Communication factor X_2	3
Personality factor X_4	4

Table 7: Rank of Input variable based on sensitivity analysis

The above discussion can be summerised as follows

- All input factor contributed significantly to predict Employability of engineering graduate students (P<0.05).
- Aptitude factor X1 was contributed maximumum (Wald Coefficient = 54.733) where as Personality factor X4 contributed least (Wald Coefficient = 5.371).
- There is negligible difference between Aptitude factor X1 (Wald Coefficient = 54.733) & Technical factor X3 ((Wald Coefficient = 51.290) contribution on output.
- Overall maximum accuracy of model was 86.7 % Where as Optimum accuracy of placed (87.6%) & unplaced (85.7) group at 0.5 Threshold cutoff value.

VI. CONCLUSION

The logistic regression model was the appropriate method to predict probability of Employability in campus placement for engineering graduate students in the range of 0 to 1. Aptitude factor is the major governing factor to predict probability of Employability. This study shows optimum accuracy of placed and unplaced group at threshold cutoff point 0.5. All of these means that the institute needs to change their traditional focus & make special efforts to help their students to develop competencies that best fosters Employability. The model can be used to understant level of skills set required by IT Sector well in advance, which help them to work upon weak areas to get offers as early as possible in campus placement. Further Employers, may use this approach to find out quality engineering tialent from untapped region and provide equal oppourtunities to fresh Engineers. The finding of this study will also work as guiding tool to Technical Institutes, T & P Officers, Trainers as well as Engineering students to develop strategy to enhance probability of employability.

VII. ACKNOWLEDGEMENTS

The authors would like to acknowledge to help & support extended by HR team of Software Companies Accenture, TechMahindra, Wipro Technology, ADP, Zensar Technology, KPIT Cummins, Persistent Technology, Infocepts for sharing their opinion to hire fresh engineering graduate. The author wishes to express his gratitude to senior T & P Officers of Rashtrasant Tukodoji Maharaj Nagpur University Engineering Colleges & Trainer's from Nagpur region. The Authors extend wishes to passout students of Bapurao Deshmukh College of Engg., Sevagram for their cooperation during collection of opinions from multinational software companies.

REFERENCES

1. www.aicte.nic.in
2. Sreeram Manda & Naresh Kumar, Status of technical education in India- Emerging issues and challenges, published in Scribd digital library p.67-72, 2012
3. Aspiring Minds report on National Employability study IT/ITeS sector, 2011
4. Amit Bansal, CEO Aspiring Minds, 62% of engineering graduates need training to be employable, BS Reporter / Mumbai August 17, 2010.
5. PurpleLeap study, low employability skills among engineering students, in Andhra Pradhesh, published in Reachout's News Bureau, 2009.
6. V. K. Gokuldas, Predictors of Employability of Engineering Graduates in Campus Drives of Indian Software Services Companies, published in International Journal of Selection and Assessment, Volume 19, Issue 3, p. 313-319, 2011.
7. Survey conducted by Federation of Indian Chambers of Commerce and Industry (FICCI) and World Bank, Employability of fresh engineering during training period, 2009.
8. Stanislav Karapetrovic & Divakar Rajamani, An approach to the application of Statistical Quality Control Technique in Engineering Courses, published in Journal of Engineering Education, p. 269-276, 1998
9. Larry D Benefield, Quality Improvement in a College of Engineering Instructional Program, published in Journal of Engineering Education, 1997 p. 57-64.
10. M. Y. Yuzainee, Employability Skills for an Entry Level Engineer as seen by Malaysian Employers, at 2011 IEEE, Global Engineering Education Conference (EDUCON), P. 80-85, 2010.
11. V. K. Gokuladas, Technical and Non-Technical Education and Employability of Engineering Graduates: An Indian Case study" at International journal of Training & Development, Vol 14, Issue 2, p. 130-143, 2010.
12. Brian F. French, Jason C. Immeks & William C. Oakes, An Examination of Indicators of Engineering Students' Success and Persistence, Journal of Engineering Education, p. 419-425, 2005.
13. Mary B.Sacre, CAynthia J. Atman & Larry J. Shuman, Characteristics of Freshman Engineering Students: Models for Determining Student Attrition in Engineering, Journal of Engineering Education, p. 139-149, 1997.
14. Vijay N Kalbande & Chandrahas C. Handa, Developing a Mathematical Model to Check Employability of Mechanical Engineering Students, 2ND International Conference on Industrial Engineering, Surat, 20-22 November 2013 p. 861-865.
15. Abdussalam Shibani, Amrit Sagoo & Nawal Gherbal, Investigation of Total Quality Management in Libya: A Proposed Guideline of Implementation, presented in International Conference on IEOM, Istanbul, Turkey, July 3-6 2012, P. 75-81.
16. Brett Willian, Exploratory factor analysis: A five step guide for novices, journal of Emergency Primary Health Care, Vol. 8 Issue 3, P. 1-7, 2010.
17. Richard M. Felder, Krista D. Forrest & Lynne B. Ward, A Longitudinal Study of Engineering Student Performance and Retention I. Success and Failure in the Introductory Course, ,Journal of Engineering Education, p. 15-21, 1993.
18. Kang H. Park and Peter M. Kerr, Determinants of Academic Performance: A Multinomial Logit Approach, The Journal of Economic Education, Vol. 21, No. 2, p. 101-111, 2012
19. LP Steenkamp, RS Baard & L Frick, Factors influencing success in first-year accounting at a South African university: A comparison between lecturers' assumptions and students' perceptions, Journal of Accounting Research Vol. 23: No.1, p. 113 -140, 2009.

20. Malcolm Smith, Len Therry & Jacqui, Whale Developing a Model for Identifying Students at Risk of Failure in a First Year Accounting Unit, Higher Education Studies; Vol. 2, No. 4; p. 91-102, 2012
21. Anne Ditcher, Jill Tetley, Factors influencing university students' academic success: what do students and academics think? HERDSA Annual International Conference, Melbourne, 12-15 July 1999, p. 1-14,
22. Qing Li & Jiong Tang, Development of a Classification System for Engineering Student Characteristics Affecting College Enrolment and Retention, Journal of Engineering Education, p. 361-376, 2009
23. Gillian M. Nicholls, Harvey Wolf & Larry Shuman, Predicting STEM degree outcomes based on eight data and standard test scores, Journal of Engineering Education, Vol. 99 No. 3 p. 209-223, 2010.
24. Vijay N. Kalbande & C.C. Handa, Identification of important parameters & skills required by Engineering students in campus placement process, published in International Journal of Engineering Research, Volume 3, S2, p. 319-325, 2015