Technical Education - Getting Quality Right

Vikas Ucharia[1] Chandan Guleria[2] Rupinder Singh Kanwar[3] Chetan Sharma[4] Prateek Guleria[5]
[1,2,3,4,5]School of Engineering, Bahra University, Wakhnaghat-173215, HP, India

Abstract— India is the youngest country of the world and is now facing a dire need to increase its technical force to accomplish as a developed country. The technical standards have been declining in India for the past 2 to 3 years despite of the competitive admission process. In India the number of the elite engineering colleges has seen a rise by 55 %(from 90153 to 140000) where as the number of the students are now growing smaller. The author has made a study regarding the major sets of the input based indicators i.e. the quantity and quality of new engineering students, the finance of undergraduate courses, availability of qualified factory and many more. This study may promote re-assessment of the current curriculum and accredited principles for Engineering Educational System. This study should foster an examination fit and stop the descent of the engineering students by not paring with quality. Author has applied Failure Mode Effect Analysis (FMEA), Cause and failure analysis and has used Pareto principle to contemplate and has recommended some suggestions by using the Six Sigma Methodology.

Key words: Indicators, Engineering Educational System, Failure Mode Effect Analysis, Pareto

I. INTRODUCTION

Engineering education has turned earth into a paradise. Technical education has played a vital role in the social and economic wellbeing of the nation [1]. Engineering colleges in India are performing without sustaining quality technical education. [2] Managing quality in education is not same as that in case of the industries and manufacturing units, whereas the principles that are used in the industries can be applied to the education sector. Most of the performance measurement system in education system does not reflect the actual potential that lies within the institution. Quality has now become a decisive factor in attracting the students and faculty to the institution. Many engineering institutions have now opted for the ISO 9000 system in order to improve results and wealth. In the last 5 years the number of institutions offering technical education has seen a large increase whereas unfortunately the quality of education is not satisfactory. Now-a-days high student failure in examination and fewer amounts of placement opportunities are creating havoc in institutions which in manufacturing units are considered as defects. This is the right time to study the various types of the failures that are accruing in the system and to study if they can or cannot be removed.

A. Concept of Six Sigma

Six sigma can be viewed as a metric, a mindset, a methodology [4]. It is a new approach to the quality assurance and quality management. The main purpose of this to reach level of quality and reliability that will satisfy and even exceeds demands of the today's demanding customer [5]. The Six Sigma concept was originated by Motorola in 1980's and its philosophy has been widespread in the field of the manufacturing industry, Healthcare, Education and many more[6].

B. Six Sigma Methodology

Six sigma is a process improvement methodology which includes different phases logically linked with one another. Six sigma methodology is generally described by the acronym DMAIC (Define, Measure, Analyze, Improve and Control) is used for continuous improvement of already existing products or processes [7]. One of the important aspects of six sigma is the involvement, training and reward of employees at all levels of the organization. Champions at the executive levels guide the selection of projects, securing of resources and goal setting for improvement efforts. Employees are given martial arts titles such as Master black belt, Black belt , Green belt, etc., reflecting their training and status in project improvement efforts [8].

II. CASE STUDY

A case study has been under taken in reputed engineering educational institutes of Himachal Pradesh of India. In these institutions, the aspect of quality is being overlooked, as profitability is emerging as the primary motto. The measure of quality in the technical education are done with the parameters such as job placements, passing rate of students, extracurricular activities etc. Various industrial tools are used to study the various defects in the institutes (defects here include less number of students, minimal placements, loss of students). An initiative has been taken to contemplate the various causes and then give recommendations.

Voice of customer	Customer requirement	CTQ
Good education	Excellent faculty, good infrastructure, facilities, placements	SSCI SSHE SE

Table 1: Case study

SSCI Students Selected in Campus Interview
SSHE Students Selected for Higher Education
SE Students as Entrepreneur

A. Method

Parasuraman (1991) developed a SERVQUAL scale to measure service quality. SERVQUAL and its adapted versions have been employed extensively in different services such as banking, retail, wholesale, health, education in both developed and to some extent in developing nations (Babakus and Mangold, 1992; Dabholkar 1996; Chua, 2004; Tan and Kek, 2004; Mahapatra and Khan, 2007; Aghamolaei and Zare, 2008). [3] This tool remains popular despite severe criticisms (Cronin and Taylor, 1992, 1994; Carman, 1990; Schneider and White, 2004). Initially, Parasuraman (1991) identified ten determinants that characterized customers' perceptions of service quality. These determinants were reduced to five factors in their subsequent studies and comprised tangibles, reliability, responsiveness, assurance and empathy. The SERVQUAL instrument based on these five determinants used 22 items and a seven-point Liker scale ranging from "strongly disagree" to "strongly agree". Several studies have been

carried out successfully in other countries based on the adapted version of the SERVQUAL instrument to assess student perceptions of service quality.

Based on the SERVQUAL, an instrument for measuring quality in technical education was developed and validated. The new scale EduQUAL comprises of 28 items with five dimensions: Learning Outcomes, Responsiveness, Physical facilities, Personal Development and Academics. The same instrument has been implemented here and list of 178 questions has been prepared. Some related items were combined which led to the reduction to 158.Further after expert evaluation only 150 items were considered for study.

B. Fishbone Diagram

The Cause-and –Effect analysis [9] is a graphical approach to the major classifications of the problems and potential causes. This also is referred to as fishbone analysis, a name derived from the fish shaped pattern used to plot the relationship between the various factors that contribute to a specific event

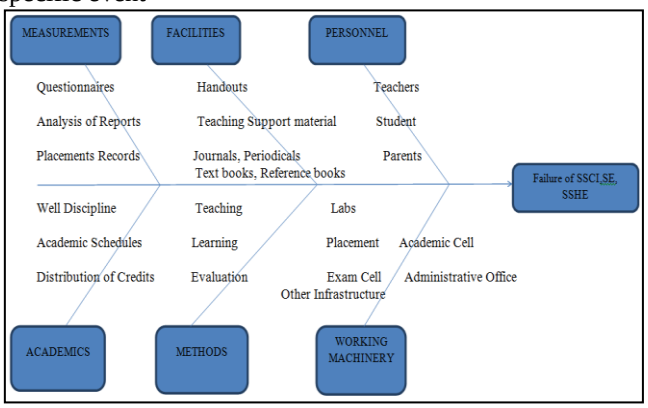

Fig. 1: Fishbone Diagram for Failure

C. FMEA Analysis

Process	Potential Failure mode	Potential effect Of failure mode	Frequency (likeliness scale 1 – 10)	Potential causes of failure	Current process Control (prevention)	Current process control (detection)	Severity (1 – 10)	Detect ability (potential for discovery 1 -10)	Risk priority number
Good education	Teaching Staff not good	Lack of ideas for students	6	Not trained teachers	Training should be provided	Students not performing	8	8	384
			7	Non serious attitude of teachers	Should be hardworking and fair	Attendance very low	6	8	336
			7	Discrimination by teachers			7	6	252
	Students not serious	Reputation of college depreciate	7	Not strict rules in academics	All things should be transparent	Lack of interest in subjects	6	7	294
			9	Not disciplined		Regulations not followed	8	8	576
	Books/Journal not available	Lack of new technologies	8	Not provided by management	Journals/online libraries subscriptions	Half-yearly check of stocks	7	9	504

Table 1: FMEA for Failure of Students

Failure Mode and Effects Analysis [10] (FMEA) was one of the first systematic techniques for failure analysis. It was developed by reliability engineers in the 1950s to study problems that might arise from malfunctions of military systems. An FMEA is often the first step of a system reliability study. It involves reviewing as many components, assemblies, and subsystems as possible to identify failure modes, and their causes and effects. For each component, the failure modes and their resulting effects on the rest of the system are recorded in a specific FMEA worksheet. There are numerous variations of such worksheets.

D. Data Collection

Data collection is made by the questionnaires given to be filled by the students of the colleges a total of 150 questions are prepared after consulting with the experts and being distributed to the students of the institutes. Feedback is being taken and then the data is run through the various test being performed by using Cronbach's Alpha Test.

E. Cronbach's Alpha Test

Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test. Internal consistency should be determined before a test can be employed for research or examination purposes to ensure validity [11].

A survey is done on the 100 students from 3 different colleges around Solan and feedback of the students is being taken into account at first.

F. Pareto Analysis

It is a formal technique useful where many possible courses of action are competing for attention. In essence, the problem-solver estimates the benefit delivered by each action, then selects a number of the most effective actions that deliver a total benefit reasonably close to the maximal possible one. Pareto analysis is a creative way of looking at causes of problems because it helps stimulate thinking and organize thoughts. However, it can be limited by its exclusion of possibly important problems which may be small initially, but which grow with time.

III. Conclusion

As per the above Pareto Analysis if we rely on the 80:20 principle, if we are able to resolve the 80 percent of the problems then we are able to solve most of our problem we are facing in the above mentioned problems. The problems that constitute the 80 percent mark are only considered in this.

The FMEA chart we get after resolving the problems

References

[1] R.V. Raj Kumar, "Engineering Education in India - Quality concerns and Remedial Measures", The Indian Journal of Technical Education; 30(3):73-90, 2007.
[2] H. Ramachandran, and Anil Kumar, "Engineering education in India", Productivity; 44(2): 187-194, 2003.
[3] A. Parasuraman, V.A. Zeithaml, and L.L. Berry, "SERVQUAL: a multiple-item scale for measuring consumer perceptions", Journal of Retailing, Vol. 64 No. 1, pp. 12-40, 1988.
[4] S.P. Goffnett, "Understanding Six Sigma: Implications for Industry and Education", Journal of Industrial Technology, 20(4):1-10.
[5] M. Sokovic, D. Pavletic, and E. Krulcic, "Six Sigma process improvements in automotive parts production", Journal of Achievements in Materials and Manufacturing Engineering, 19(1): 96-102, 2006.
[6] Maha Mohammed Yusr, Abdul Rahim Othman, Sany Sanuri M. Mokhtar. "Six Sigma and Innovation Performance: A Conceptual Framework Based on the Absorptive Capacity Theory Perspective", Int. j. emerg. sci. 1(3):307-323, 2011.
[7] Yousef Amer, Lee Luong , Sang – Heon Lee and M.Azeem Ashraf , "Optimizing order fulfillment using design for six sigma and fuzzy logic", International Journal of Management Science and Engineering Management, 3(2): 83-99, 2008.
[8] Monica C. Holmes, Anil Kumar and Lawrence O. Jenicke, "Improving the Effectiveness of the Academic Delivery Process Utilizing Six Sigma", Issues in Information Systems; 6(1):353-359, 2005.
[9] R. Keith Mobley Root cause Failure Analysis, Butterworth-Heinemann, 15 April 1999.
[10] FMEA from Theory to Execution, Second Edition by D. Stamatis.
[11] L. Cronbach, Coefficient alpha and the internal structure of tests. Psychomerika; 16:297-334,1951.
[12] G Karuppusami, R Gandhinathan, "Pareto Analysis of Critical Success Factors of Total Quality Management: A Literature Review and Analysis"- The TQM Magazine, 2006.

