

Application of Six Sigma Methodology in Engineering Institute

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Abstract—In this paper shows how six sigma methodology can be used to enhance the quality of engineering institute. Education quality is main thing for the customer of educational institute such as student, parents and the reputed organisation where they going for the employment. Here the critical to quality is established to identify customer needs. Standard deviation is calculated in the measure phase from the past data as per customer requirement for improvement. In the measure phase fish bone diagram and Pareto chart are drawn to give the priority to the problems. In the control phase shows how to monitor and control the academic functions to improve the quality. This paper shows the role of six sigma in improving the quality of engineering institute.

Keywords: Critical to quality, Pareto chart, Fish bone diagram.

1. INTRODUCTION

Nowadays engineers play a vital role for complete development of the world and the socio-economic growth of the society. They played an important role for country's development. But nowadays in India the no of engineering colleges increases but quality of them not so much to fulfil the criteria of the society and industry. According to Juneja [3] that with growing maturity of society with respect to education culture and standards of living the user expectations and demands for improved quality of service are increasing. It is very difficult to exactly match expectation of the society and industry but the engineers must have some technical skill, creative thinking to fulfil their idea and requirement. According to US National Science Foundation task force the quality engineering is the development of intellectual skills and knowledge that will equip graduates to contribute to society through productive and satisfying engineering career as innovators, decision makers and leaders in the global economy of the twenty first century. [4]

In this paper the engineering student consider as a raw material of the system and after completing the process means after graduation whether they meet customer requirement. Here we are trying identifying the problems of the system and what steps should be taken to improve the quality. To make the process capable six sigma approach is taken, which will help to reach the goal of the engineering education in India.

2. WHY SIX SIGMA

Six sigma concepts came from Motorola Company in the year 1985. They were facing problem of to compete the Japan technology in electronics field. So Motorola developed Six sigma in 1987 and achieved 3.4 defect ppm. [8]

The six sigma method is a project-driven management approach to improve the organization's products, services, and processes by continually reducing defects in the organization. It is a business strategy that focuses on improving customer requirements understanding, business systems, productivity, and financial performance. Dating back to the mid 1980s, applications of the six sigma methods allowed many organizations to sustain their competitive advantage by integrating their knowledge of the process with statistics, engineering, and project management.[5]

Today higher education has become commercial enterprise and is treated as marketable commodity. Many institutions and universities throughout the world are preparing for marketing their educational products and services. Day by day the competition from various institutions and universities is mounting up. Quality of education is going to be of foremost importance in all further higher education [7]. Six sigma mainly applied in the manufacturing industry. It has been globally accepted; company like LG, TATA, GE, Sony and Philips has been quite successful with six sigma. Thus Six sigma can be accepted in education field. It can be applied to improve the curriculum, objective of the learning, student teacher interaction period, following the international standards, established the accreditation and validation of vocational training from the industry.

3. SIX SIGMA METHODOLOGY

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. 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.[2] Prior to

implement six sigma methodology in any organization, it is necessary to establish six sigma team structures to accomplish all the phases of the methodology. It is also shown by Ramasubharaminiun [6].

Table 1: Six sigma phase

PHASE	MEANING	YIELD TO PHASE	TOOLS
DEFINE	This phase will help to find out problem, customer requirement, and student problem.	Project chart, Data collection plan, Overview of the process to be done.	<ul style="list-style-type: none"> Flowchart Timeline chart
MEASURE	This phase will help the organization to identify what is to be measure, types of variations, conduct the measurement	Process capability and performance variables that can affect.	<ul style="list-style-type: none"> Data collection Control chart
ANALYSE	. In this phase the collected data in the measure phase have been examined to generate a priority list of the sources, to identify cause of problems	Cause and Effect Diagram To identify the problem and its solution	<ul style="list-style-type: none"> Relationship chart. Correlation analysis
IMPROVE	This phase find out the solutions which can be useful for the identified problems during the analysis phase	Information flow diagram	<ul style="list-style-type: none"> Implementation
CONTROL	To establish the control strategy, implement the control plan.	Control charts Quality measure process charts	<ul style="list-style-type: none"> Control chart Final report and presentation.

4. CASE STUDY

4.1 Define Phase

This data has been under taken in IEST SHIBPUR in India. The institution offers B.E. degree course and PG degree and also PhD in engineering branches. It is operative under proper administrative. In order to enhance the academic standards and credibility of the institution, the authorities of the institution should implement the Six sigma.

Table 2: Project charter

VOICE OF CUSTOMER	CUSTOMER REQUIREMENT	CTQ
Improve the quality of the education	Good infrastructure facilities	% SHS, % SSJ, % SSB,% USS

- I. SHS means Student in higher studies.
- II. SSJ means student selected for jobs.
- III. SSB means Student started self business.
- IV. USS means unsuccessful students.

4.2 Measure Phase

From the college database collecting the data of previous years, from which the standard deviation and mean of each CTQ (critical to quality) is calculated.

Table 3: CTQ value

YEA R	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
%SHS	25.6	27.3	24.2	23.5	25.3	26.7	22.7	17.8	18.2	19.6
%SSJ	56.8	53.9	56.2	55.7	44.4	40.9	40.2	63.2	71	68.9
%SSB	0	0.26	0.8	0.13	0	0.26	0	0	0	0
%USS	17.6	18.54	18.8	20.67	30.3	32.14	37.1	19	10.8	11.5

Table 4: Mean and STD value of CTQ

S. No	CTQ	MEAN(μ)	STD(σ)
1	%SHS	23.09	3.27
2	%SSJ	55.12	10.26
3	%SSB	0.145	0.213
4	%USS	21.64	8.28

4.3 Analyse Phase

To achieve the customer requirement engineering institute should maintain its standard, should follow the international standards. The Fishbone diagram shown in Figure is constructed by considering men, material, machines, methods, measurement with reference to engineering educational institution to find out the root cause of failure.

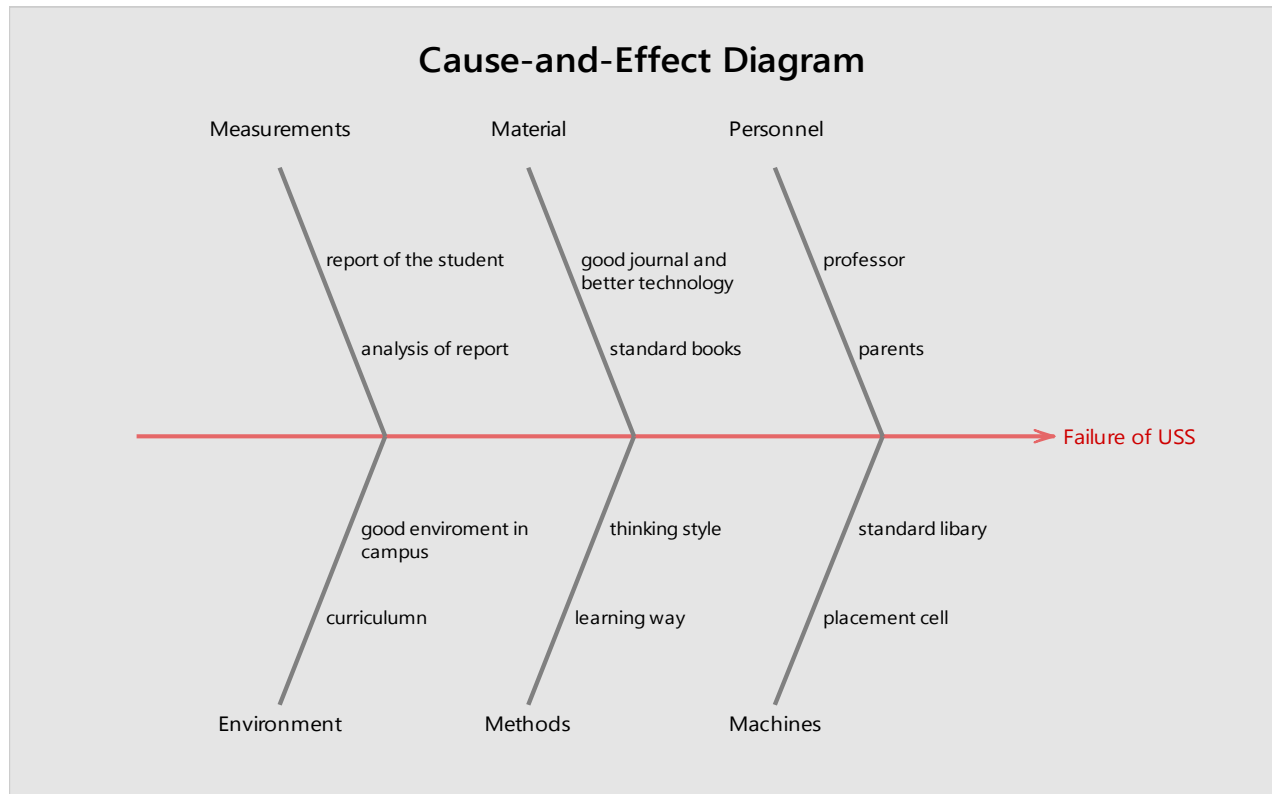


Fig. 1: Cause and effect diagram

Some important functions are found out to improve the customer requirement and increase the quality of the graduate student. The functions are

- I. STANDARD COMUNICATION
- II. COLLEGE-INDUSTRY TIE UP
- III. STANDARD LIBRARY FACILITY
- IV. CAMPUS PLACEMENT
- V. MODERN COURSE STRUCTURE

Now with the help of Analytical hierarchy methodology gives the priority to these functions and they are listed below. It is also shown by Durgaprasad[1].

Table 5: Priority list

SC	CIT	CP	MCS	SLF
3	4	8	6	2

Now prepare the pair wise comparison matrix and obtain important functions, which help to identify the critical areas that need immediate action with the help of Pareto diagram. The below matrix is solved in the Matlab.

Table 6: Pair wise matrix

	SC	CIT	CP	MCS	SLF
SC	1	.75	.375	.5	1.5
CIT	1.33	1	.5	.66	2
CP	2.66	2	1	1.33	4
MCS	2	1.5	.75	1	3
SLF	.66	.5	.25	.33	1

Now from this method the priority of important functions and Pareto diagram is obtained..

Table 7: Priority chart

Important functions	CP	MCS	CIT	SC	SLF
priority	.3478	.2611	.1739	.1305	.088

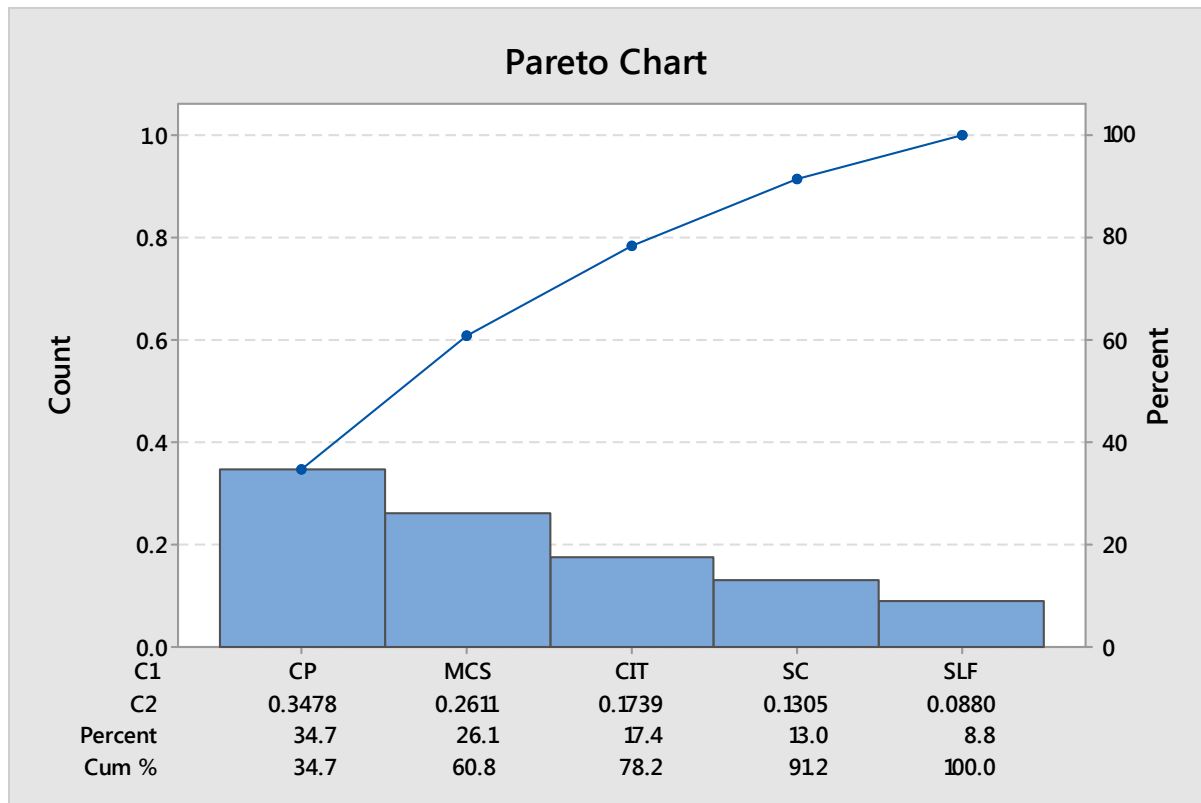


Fig. 2: Pareto chart

4.4 Improve Phase

From the help of the above three phase we can find out what is the main cause of failure. In this phase with the help of the FMEA (failure mode and effect analysis) we can sort out the problem. . The FMEA tabular form includes parameters such as mode of failure, effects of failure and its severity rating, possible causes of failure and their intensity of occurrence, current prevention methods, detection column, Risk Priority Number, recommended actions. It is very essential to look at the causes of failure like language problem, Infrastructure, Not modified curriculum, Lack of interest of student towards engineering. To improve the quality of education and to meet the society and industry requirement we should also care of the findings of the Pareto chart and give importance to its function which can improve the student quality.

4.5 Control Phase

Control charts help to monitor the processes in the system to attain the goal of implementing six sigma methodologies. To improve the important factors regarding to engineering education, it is required to concentrate the following factors towards the achievement of quality education in the observed institution. The capability analysis and individual value chart can be done to monitor SHS, SSJ, SSB, and USS rate every

year. This can shows the improvement of the institute and what should be done and how much to improve student performance.

5. CONCLUSION

Six sigma is an essential tool to improve the student success rate and meet the requirement of the society and industry. In the paper it is seen that all the administrative and academic work carry out in the institute shall be operated with the help of six sigma approach. Just like in the industry six sigma also in the educational institute can also reduce the defect and improve the quality. Thus educational institute should approach six sigma for quality improvement, reaching higher performance, after all students are the main stakeholders. Technical institute should implement the six sigma for improvement and achieve customer satisfaction.

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