

Current State of Six Sigma in Education Services and Practices through literature review

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Abstract- In developing countries like India, getting a degree is like a boon for an Indian family. The demand for highly skilled college graduates is expected to increase around the world India being the country with the youngest population, have a great scope for jobs, hear as well as in other countries. Six Sigma is a process through which we can attain excellence in areas providing services to the customers. For an educational institute, the quality of education is important to students, parents and the management of the institute. Quality education helps students acquire their goals which ultimately leads to help in satisfying the needs of the society and development of the nation. In this paper we try to study the implementation of different tools and techniques used by various higher education institutes for quality monitoring and improvement.

Key Words: - Six-sigma, Quality, Higher Education, Quality in Education

INTRODUCTION

The global economy is undergoing structural transformation: there will be need for a workforce of 3.3 billion by 2020, increasingly in the services and capital intensive-manufacturing sectors. The phenomena is also expected to play out in India – by 2020, 90% of India’s GDP and 75% of employment is expected to be contributed by the services and manufacturing sectors. Technological advancement will make several jobs redundant while also creating new job roles. This structural shift in employment will increase demand for sophisticated workers, innovators, and thinkers who can thrive in a globally-connected and dynamic economy. India, with its large workforce and increasing pool of higher education graduates, is strategically positioned to reap the benefits of this shift. However, the ‘demographic divided’ will be squandered unless India is able to create a “globally relevant and competitive” higher education system that serves the requirements of both the domestic as well as global economy.

WHAT IS SIX SIGMA?

The Greek symbol σ (sigma) is a statistical term denoting “standard deviation” (S.D). S.D denotes how far the data points are from the mean, typically, and it may be computed with a formula. The phrase six sigma refers to several things: One, six sigma is a performance level - for a six sigma process, 6 standard deviations each may be fitted between the mean and the upper and lower specification limits. Allowing for machine wear & tear and operator fatigue, this performance level equates to 3.45 dpmo (defects per million opportunities) for a process with a single-sided specification (or 6.9 dpmo for a process with a double-sided specification). Six sigma also is a disciplined and data-driven approach to insuring that repetitive work processes function in the best

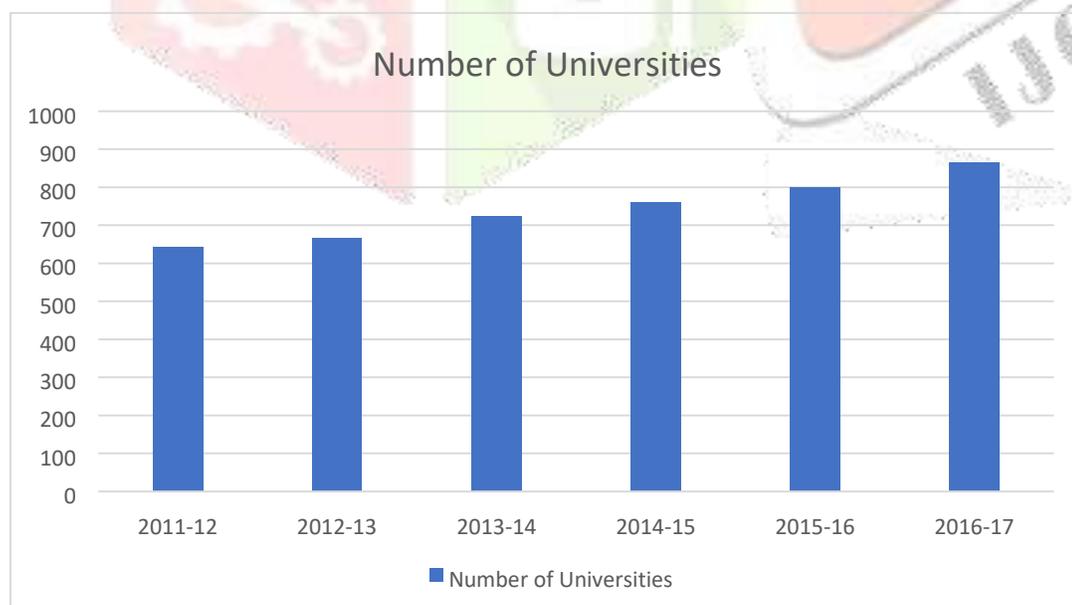
possible manner. The primary goal of six sigma is to minimize defect levels in the outcomes of work processes, a defect being anything that causes customer dissatisfaction. Maximizing customer satisfaction leads to improved bottom-line performance and globally competitive positions.

Six sigma was first used at Motorola in late seventies and popularized at General Electric in the nineties. Since much what we do from the time we wake up to the time we go to bed, including all that we do at work, is a series of repetitive activities, six sigma really is for life, meaning that we must all think, work, and live the six sigma way.

EDUCATION IN INDIA

The major Stakeholders in Higher Education are University Grants Commissions, All India Council for Technical Education, Medical Council of India as well as State Governments

- (i) **All types of Universities:** - Central Open University, Central University, Deemed University- Government, Institution Under State Legislature Act, Institution of National Importance, Deemed University- Private, State Private University, State Open University, State Public University, State Private Open University and Deemed University- Government Aided.
- (ii) **Colleges:** - Affiliated College, Constituent College, PG and off. Campus Centre and Recognized Centre.
- (iii) **Stand Alone Institutions:**-Diploma Level Technical Institutes, Teacher Training Institutes, Nursing, PGDM and Institutes directly under the control of various Central Ministries.



According to the All India Survey on Higher Education (2016-17) data, there is an approximate increase of 35% in the number of universities in India in the past 8 years. There are 864 Universities, 40026 Colleges and 11669 Stand Alone Institutions listed on AISHE web portal and out of them 795 Universities, 34193 Colleges

and 7496 Stand Alone Institutions have responded during the survey. 278 Universities are affiliating i.e. having Colleges. Only 2.6% Colleges run Ph.D. program and 36.7% Colleges run Post Graduate Level programs. Total enrolment in higher education has been estimated to be 35.7 million. About 79.4% of the students are enrolled in Undergraduate level program. 1,41,037 students are enrolled in Ph.D. that is less than 0.4% of the total student enrolment. On the other hand, second to Under Graduate, 11.2% students are enrolled in postgraduation which is approximately 40.0 lakh students. The student enrolment from UG to PG is thus decreasing steeply.

SIX SIGMA AND EDUCATION.

Six Sigma is used for improvement in the performance of a work process which is repetitive in nature. Education is also a continuous work process, including repetitive processes like Recruiting, Admission, Registration, Lectures, Examinations and finally Graduation. Factors influencing successful six sigma projects include management involvement and organizational commitment, project management and control skills, cultural change, and continuous training. Understanding the key features, obstacles, and shortcomings of six sigma provides opportunities to practitioners for better implement six sigma projects (Javed Mehrabi.2012).

Quality in higher education is treated from different perspectives in various articles and literature. According to Paval and Saebu (2014), characteristics of six sigma are compatible with ISO 9000, a quality management system and integrating six sigma in any higher education institute will be successful.

SIX SIGMA METHODOLOGY: Quality Models in Higher Education.

Application of DMAIC methodology (Design, Measure, Analyze, Improve & Control) is used in quality management. Attempts to establish a relationship between DMAIC methodology and its scope in the academic environment involving undergraduate engineering programs have been studied (Shoeibi & Zahmatdoost,2015).

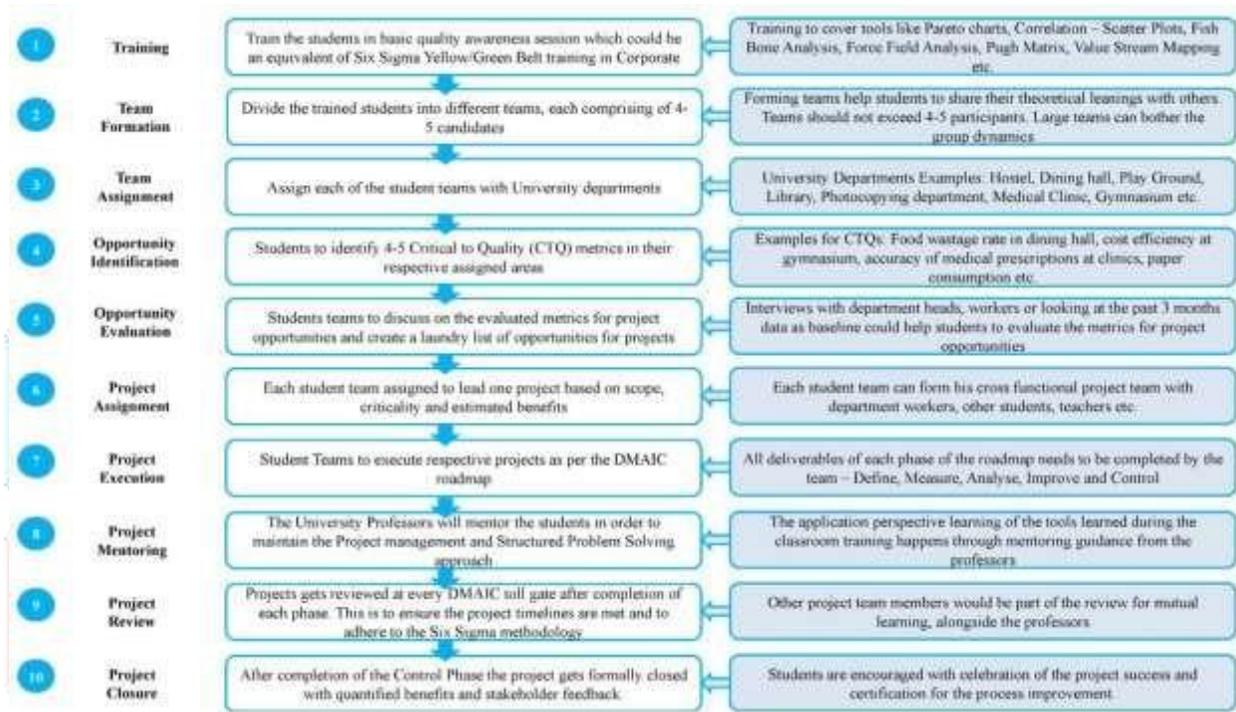
Vijaya Sunderm (2016) has analysed the uniqueness of higher education institutes and compared them to the manufacturing industry. There is a vast difference between the corporate terms such as market, defect and customers which are used in manufacturing, has a different definition altogether in Higher education institutes.

Lean aims at eliminating the waste by creating a culture of improvement. Lean thinking process focuses on satisfying customer while improving productivity and quality by continuously removing non-value-added activities (Muda). The integration of lean and six sigma is known as lean six sigma(LSS). The reason of LSS performance in services is largely because of the improvement it delivers irrespective of the complexities of the process. Antony, Cullan and Kumar (2012) has also shown Lean six sigma as a powerful business process which can be applied in the context of Higher Education Institutes through the tools and techniques like Process mapping, Cause & Effect analysis, Visual Management, Pareto Analysis, Supplier-input-process-outputcustomer and Rapid Improvement Workshop which are applicable to higher education institutes.

Design for Six Sigma (DFSS) methodology is applied in different industries, like healthcare, finance, marketing, automotive, process industries; creating a need for qualified people in this field. More than that, studies show that the Design for Six Sigma methodology helps in engineering education, forming a quality-focused way

of thinking and anticipating potential limitations in product design, as well as preparation of students for the workforce (Babajide, 2015).

In earlier times, the employers used to appoint the team and train them accordingly. Now a days, the universities have started specialized programs to train the students. A model of teaching design has been proposed by Nicolaescu & Kifor (2017) which follows DMADV (Design-measure-analyze-design-validate) approach. According to this research, the students are prepared for the real-world problems by teaching them Six Sigma methodology in the universities itself with the help of theories and practical examples so that they have a clear concept about quality improvement.



Six Sigma model for higher education (Sunder, 2014)

SIX SIGMA APPLICATION: Practices in Educational Services.

Recently there has been a lot of interest in the application of Six Sigma in the field of Education. Many papers have been presented on this subject and many institutions have also of adopted Six Sigma to improve their performance. Here in this section we have tried to study some of such success stories.

Dublin Board Of Education

In 2012, the board of Education of Dublin committed to their community that the operating levy portion of the 2012 ballot issue would last 3 years. With the help of lean six sigma, the levy cycle was stretched to 4 years, thus successfully implementing the concepts of six sigma.

<http://www.thisweeknews.com/content/stories/dublin/news/2015/02/24/school-notes-district-working-hard-to-maintain-pledge-to-taxpayers.html>

Clarkson University

A group of 11 engineering & management students from Clarkson University recently provided a healthy dose of procedural savvy to Canton-Potsdam Hospital while honing their own real-world skills. The 11 students divided into groups to handle five improvement projects. They determined ways to reduce food waste; streamlined the process of transporting meal trays to patients; redesigned the scheduling process for total joint replacements, reducing the average number of business days required in the preoperative schedule from 37 days to 24 days; trimmed the time to access safe patient handling equipment from about 7 minutes to 3 minutes; and improved the way digital patient information is entered, cutting the average waiting time for orthopedics patients in the St. Lawrence Health System orthopedics registration area from 16.5 minutes to 10.5 minutes.

<https://www.clarkson.edu/news/lean-six-sigma-projects-canton-potsdam-hospital>

Miami University

According to the recent U.S. News and World Report, Miami has placed in the top three each year — rising from number three in 2012, to number two in 2013 to number one in 2014. It scores high on academic achievement while spending less than other universities, by implementing the concepts of lean and six sigma in saving energy and reducing the cost.

<https://www.daytondailynews.com/news/local/miami-ranked-most-efficientuniversity/Ha4deJaT9wbo9WItLHxFDN/>

Michigan State University

In 2015, Katherine.A.Franz became the executive director of Michigan State University Midland Research Institute for Value Chain Creation. With more than 25 years of experience, Katherine used her knowledge of six sigma in transforming the organization.

<https://msutoday.msu.edu/news/2015/new-executive-director-of-msu-value-chain-institute-named/>

Millikin University

The MBA students of Millikin University assembled to form team for the class project with Caterpillar Inc`s Decatur plant. After 18 weeks of classwork and 9 weeks with Caterpillar`s staff where using six sigma processes, they broke and analyzed how things are done in a better way with less cost in a process.

https://herald-review.com/business/students-sing-to-solve-cat-problems/article_1373d843-1188-539d-b1a92e6e934244c6.html

MIT University

John Milburg is the author of this article and Director of the Employee Training Institute at College of the Canyons. In a study at MIT, the students were offered three levels of cash rewards – low, medium and high in which the higher rewards actually led to lower performance if the task requires even rudimentary cognitive skill.

This study found that Lean Six Sigma along with opportunities for autonomy can create a high-performance workplace without fear of losing their jobs but by an internal force to improve.

<http://archive.signalsev.com/archives/151044/>

Rose-Hulman Institute of Technology

The students at Rose-Hulman Institute of Technology are practicing the concepts of Six Sigma to help reduce food waste in the Wabash Valley. Their findings stated that for every 120 students, more than 20 pounds of food was wasted. Six Sigma signified the reduction of a variation in a process and thus the students were able to reduce the wastage significantly, implement a food waste educational campaign and also helped feed students in less privileged communities.

http://www.tribstar.com/features/valley_life/rhit-students-using-six-sigma-to-tackle-food-wastein/article_1472562d-d2df-5314-801f-5c12902bf8cb.html

University of Kentucky

The director of Quality management used six sigma along with NCAA statistics for developing quality standards, developing processes and measuring those processes in an effort towards continuous improvement of football at Kentucky University.

<https://www.aseaofblue.com/2013/6/22/4441018/kentucky-wildcat-football-measuring-success-or-failure>

University of North Carolina

Since 2014, the pharmacy department at the University of North Carolina (UNC) has benefited by applying Lean Six Sigma (LSS) techniques to its inpatient pharmacy. To improve the work flow, the university had conducted 3 Kaizen events which improved the employees and customers satisfaction.

http://www.pharmacytimes.com/publications/health-system-edition/2014/september2014/lean-six-sigmainthepharmacydepartment?utm_source=GoogleNews&utm_medium=GoogleNews&utm_campaign=PharmacyTimesNews

Valdosta State University

Chancellor of the Valdosta State University took an initiative by implementing Lean Six Sigma in the year 2008. The process involved shifting the settings of LSS from business to education

<https://www.valdosta.edu/administration/six-sigma/>

University of California San Diego

University of California San Diego being a global leader in higher education, strives for excellence in all aspects of campus life – from offering world-class educational opportunities to leading the industry in research accomplishments. UC San Diego has partnered with UC San Diego Extension to provide their employees the knowledge of the valuable problem-solving tool through Lean Six Sigma. “What Lean Six Sigma teaches you is to explore the root cause of a problem and to measure it with data,” said Lisa Thai Schlossman, principal human resources analyst. Many staff members at UC San Diego earned a green belt and implemented the methodologies in the workplace to achieve better results.

<https://extension.ucsd.edu/news-and-events/extension-blog/january-2017/lean-six-sigma-produces-results-for-uc-san-diego>

CONCLUSION

Higher education institutes play a vital role in the development of a nation by developing an individual. They have the responsibility to prepare the students for the real world. The graduates from our education system are not sufficiently prepared for the demands of our country's rapidly changing economy. The number of colleges are rapidly increasing in India and its time for us also to prepare and train our students for the future requirements. Hence quality education is very much necessary. Six sigma plays a very important role in improving the efficiency and effectiveness of the institutes. In this paper we had studied various approaches and different tools and techniques which can be used in improving the quality of education at different levels. This paper also presents the list of the institutes in the world which are implementing six sigma methodologies successfully thus letting us know the significance of quality education. Higher education institutes in India should also start implementing six sigma methodologies for maintaining high academic standards and improving it continuously.

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