REVIEW OF SIX SIGMA FOR SMALL SCALE BUSINESS

Biju P.K[1], P.Ravikumar[2], Dr. J Amos Robert Jayachandran[3]

[1] *PG Student, Mechanical Engineering, Kathir college of Engineering, Tamil Nadu, India*
[2] *Associate Professor, Mechanical Engineering, , Kathir college of Engineering, Tamil Nadu, India*
[3] *Dean and HOD, Mechanical Engineering, , Kathir college of Engineering, Tamil Nadu, India*

ABSTRACT

For making an organization more efficiently and profitably, Six sigma can be introduced. Six Sigma is a reference to the level of quality and the methods in six sigma can avoid the problems permanently and with the help of some statistical approach, we can able to make a precise result for small scale business .Also these methods and process can be implement in large scale business . A drastic change can be made in an industry due to the six sigma implementation and it results in a good profit in all aspects.

Keyword : - *Six sigma , Methodologies, progress, Quality, Small business, Profit etc.....*

1. INTRODUCTION

Six Sigma is a proven set of methods to help you run our business or organization more efficiently and profitably. The task of six sigma is to identify the most important causes of problems in our processes and implement changes that will eliminate these problems permanently— to the benefit of everyone. In Six Sigma for Small Business, we will systematically take you through this methodology.

2. DETAILING OF SIX SIGMA

2.1 Six sigma

Six Sigma is a reference to the level of quality produced in a manufacturing process. Most traditional companies believe that 99.9% good quality is a terrific achievement. World class companies ship products to their customers with 99.99966% good quality. From a statistical point of view, this means that they are shipping Six Sigma quality--no more than 3.4 parts per million defects.

2.2 Bell curve

The term six sigma refers to the number of standard deviations away from the mean (or average) point in a bell curve (also known as a "normal distribution")

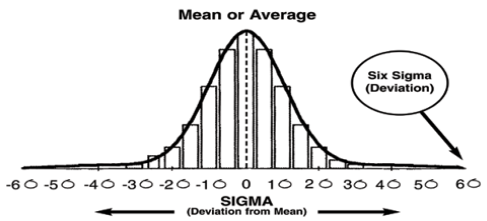

Fig -1 : *Bell curve*

3. METHODS OF SIX SIGMA

Six Sigma has two key methods: DMAIC and DMADV. DMAIC is used to improve an existing business process. DMADV is used to create new product or process designs.

3.2 DMAIC

- **D**efine high-level project goals and the current process.
- **M**easure key aspects of the current process and collect relevant data.
- **A**nalyze the data to verify cause-and-effect relationships.
- **I**mprove the process based upon data analysis using techniques like Design of experiments.
- **C**ontrol to ensure that any deviations from target are corrected before they result in defects.

3.2 DMADV

- ***D**efine* design goals that are consistent with customer demands and the enterprise strategy.
- ***M**easure* and identify CTQs product capabilities, production process capability, and risks.
- ***A**nalyze* to develop and design alternatives, create a high-level design and evaluate it for best design.
- ***D**esign* details, optimize the design, and plan for design verification.
- ***V**erify* the design, set up pilot runs, implement the production process and hand it over to the process owners.

3.3 Equations

Sigma is commonly used to signify Standard Deviation. Put simply, standard deviation is the average amount that a sample set varies from the average (or mean). Standard deviation (SD) is calculated as follows:

$$\sigma = \sqrt{\frac{\sum(\bar{x} - x)^2}{n - 1}}$$

Another symbol "sigma". This is a capital sigma though and denotes "take the sum of". The "x" is the value of each sample. "x" with a line above it (often called "x-bar") denotes the average of the sample set. Finally, "n" is the number of samples in the sample set.

4. CALCULATION OF SIGMA LEVELS

First, you need to calculate your capability in terms of sigma. The higher the sigma, the better your system is performing in terms of costs, profit, and defect rates

Table -1: Sigma levels

Sigma Level	Defects per Million Opportunities	Cost of Poor Quality (% of Sales)
6 Sigma	**3.4**	**<10%**
5 Sigma	**233**	**10%–15%**
4 Sigma	**6,210**	**15%–20%**
3 Sigma	**66,807**	**20%–30%**

2 Sigma	**308,537**	**30%–40%**

4.1 Progress of small business by six sigma

It is of course important not to confuse Six Sigma with TQM or to try to put parallels between them. Six Sigma brings an excellent structure to implement TQM since it constantly drives the improvement wheel and helps people see the art of the possible and 'what can be done' to improve quality. TQM is really what the customer identifies with because it is a measure of value creation on their behalf. Six Sigma is the 'evidence of delivering value'. **Zero Defect** has to be translated as **Zero Defection** ultimately. In all, the prognosis for Six Sigma looks good, even the best are not good enough

Fig -2 : *Progress graph*

4.2 Advantages of six sigma

- We can turn our current mistakes in to profit.
- We could maintain time management.
- Increase profit.
- We could make a better product/service at lower cost with less waste and rework.
- We can deliver higher quality services and products to your customers.
- We want to increase the satisfaction of our customers.
- We can grow and expand our business.
- We can maximize our employees' contribution and increase their level of commitment.

5. PROCESS OF SIX SIGMA

The life cycle of six sigma work consists of five phases:

I. Define Opportunities:

- What must we do to meet VOC - Voice of the Customer?
- In this phase, you must clearly identify your customers and analyse customer related information, translating this in to critical to quality.
- CTQ's are requirements that your processes must perform up to if you expect to meet customer expectations.
- Once you understand this, then you can initiate six sigma projects to address the specific performance issues

II. Measure Performance:

- How much variation is taking place in our processes?
- Measure your variation in relation to an acceptable level of performance or specification limit
- This is driven by the characteristics of your CTQ
- Certain statistical tools are used, such as sampling, frequency distribution, and control charts.

III. Analyze Opportunities:

- What are the root causes behind this variation?
- Identify the sources of variation
- A good place to start is with a non statistical tool: Root Cause Analysis, including the Five Whys.
- Begin to use certain statistical tools, such as analysis of variance, to better understand the sources of process variation.

IV. Improve Performance:

- What can we do to reduce this variation?
- The vital few or root sources of variation are now identified
- One of the more popular tools used for improvement is called Design of Experiments (DOE).

V. Control Performance:

- How can we design the process so that we never cross the Upper or Lower Control Limits?
- This is where you sustain your desired performance levels and where practical, seek to improve it by removing more variation from the process.

6. STATISTICAL CONCEPTS OF SIX SIGMA

I. Mean and Standard Deviation:

- Expressing process performance begins with the Mean and Standard Deviation.
- Mean represents the average of your sample values; sum of all values divided by the number of observations in your sample.
- Standard Deviation is the spread of data around the mean.
- Standard Deviation is calculated by going through the following steps:
    a. Calculate the difference from the mean for each observation.
    b. Take the square of each difference.
    c. Sum all of your square values and divide by the number of observations less than 1.
    d. Take the square root of your value from step c (variance). This gives you the standard.

II. Sigma Value:

- After calculating the Mean and Standard Deviation, express this performance related to CTQ - customer requirements.
- Done by calculating the Sigma Value (sometimes called the Z-Score) which represents the number of standard deviations from the mean
- In order for this to work we need a normal distribution of data.

III. T test:

- Since we use samples to represent populations, we will most likely not know the standard deviation of the population.
- And when our sample size is small (less than 30 observations), we can use the t test to help us with a hypothesis test about the characteristics associated with the population.

IV. F test:

- We may want to take samples from different segments of the population
- You can use the F test to help understand differences in standard deviations between samples taken from different populations.

V. ANOVA:

- Used to conduct hypothesis testing when you have two or more groups of data.
- The purpose of ANOVA is to test the equality of the means between the data groups.

- When you test and analyze only one variable this is a One-Way ANOVA.

7. CONCLUSION

- Six Sigma is a systematic and data driven approach to improve process capability.
- Accuracy level of a six sigma process is 3.4 DPMO or 99.997% which is fairly accurate.
- The team must develop a control plan, which consists of five basic parts:
    a. Training plan
    b. Doccument plan
    c. Monitoring plan
    d. Response plan
    e. Institutionalization plan
- The benefits of implementing six sigma in a smaller business:
    a. Financial results and cultural transformation that stem from Six Sigma will propagate more quickly through a smaller organization.
    b. Focusing the Six Sigma tools at virtually any properly scoped project will drive savings to your bottom line and achieve breakthrough change in your organization.
- " So we can conclude that the best quality management process for a small scale business is six sigma."

8. REFERENCES

[1] Pardeep Rattan, Dr. Pyare Lal.,"Pros and Cons of Six Sigma: A Library Perspective", International Journal of Digital Library Services, Vol 2, Issue 4, Oct – Dec 2012.

[2] Ahmad Ali Al-Zubi, Imtiaz Basha,"Six Sigma In Libraries: A Management Perspective, Canadian Journal on Computing in Mathematics Natural Sciences, Engineering & Medicine Vol. 1, No. 3, April 2010.

[3] Chitra Koushik, Et al.,"Six sigma application for library services, DESIDOC Bulletin of information technology, Vol. 27, No. 5 September 2007.

[4] Coronado, R.B., Antony, J.,"Critical success factors for the successful implementation of six sigma projects in organizations", The TQM Magazine, Vol. 14, No. 2, pp. 92 – 99, 2002.

[5] Dong-Suk Kim,"Eliciting success factors of applying Six Sigma in an academic library: A case study", Performance Management and Metrics, Vol. 11, No. 1, pp. 25-38, 2010.

[6] El-Haik, B., Roy, D.M.,"Service design for six sigma: a roadmap for excellence, John Wiley and Sons, Inc., Hoboken: New Jersey, 2005.

[7] Harry M., Schroeder, R.,"Six sigma: The breakthrough management strategy revolutionizing the world's top corporations, 1st ed., Random House Inc., New York, 2000.

[8] Sarah Anne Murphy,"Leveraging Lean Six Sigma to Culture, Nurture, and Sustain Assessment and Change in the Academic Library Environment", College and research Libraries, May 2009.

[9] Suresh N.,"Application of Six sigma concept to effective academic library management and users satisfaction", National conference on future academic libraries challenges and opportunities 2011, Madurai Kamaraj university.