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Six Sigma Implementation in Small and Medium Scale Electronic Industries: A Case Study

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Abstract:
Six Sigma (6s) is a methodology to propose the most appropriate solution based on problem understanding and problem causes. Six Sigma is very effective tool to enhance quality performance of any process. It is a powerful business strategy which is aimed at increasing customer satisfaction and profitability by improving the quality of products and services. Many organizations have implemented Six Sigma and achieved significant levels of success. Successful implementation of Six Sigma leads to outcomes that would be welcome in the Electronics industry, given its reputation of suboptimal performance. The Electronics industry relies heavily on small and medium enterprises (SMEs). Any improvement in SMEs would lead to improvements in the Electronic industry as a whole.

Keywords: *Six sigma, electronic industry, small and medium enterprises (SME's)*

1. Introduction

Customers have been putting pressure on the industry for the products they purchase to be of higher value. This has spark various industry to adopt various quality management tools and concepts in order to strive towards a better quality product, lower lead time and lower cost. This leads to adaptation of different quality management concept into the firm's production

The Six Sigma (SS) is a business concept to produce high quality defect free products to the society. The processes are set in such a fashion that outcome is defect free products. Six Sigma methods get publicity when Motorola won Malcolm Baldrige Quality Award. It was further popularized by General Electric when they extensively utilized Six Sigma techniques to most of their processes. Small & Medium Enterprise (SME) is facing the pressure from its competitors-mainly large companies as they could provide products of greater value with lower cost as compared to SMEs.

Many researchers and industrial practitioners have been discussing about Six Sigma as the latest quality management concept. The implementation of Six Sigma will facilitate the achievement of zero defect manufacturing in organizations complemented by the elimination of non-value added activities which leads to greater results than either system can achieve alone. Little research has been carried out on the practical side of the SS concept, but early results shown by some researchers in implementing SS framework to guide larger firms to adopt this concept has so far been successful. This paper aims to provide critical success factors and challenges faced by SME Electronic industries in order to reduce waste and variation in their production; aiming to increase its productivity while reducing the cost of production.

Sigma level (Process Capability)	Defects per Millions Opportunities (DMPO)
1	697,700
2	308,537
3	66,807
4	6,210
5	233
6	3.4

Table 1: Breakthrough Performance gains

1.1. Electronics Industry in India

The Electronics Industry started in India around 1965 with an orientation towards space and defense technology. This was rigidly controlled and initiated by the government, followed by developments in consumer electronics mainly with transistor, radios, Black & White TV, calculators and other audio products. 1985 saw the advent of Computers and telephone exchanges which was succeeded by

Digital electronics exchange in 1988. The period between 1984 and 1990 was the golden period of electronics, during which industry witnessed continuous and rapid growth. In recent years the electronics industry is growing at a brisk pace (30% growth per annum).

	2009	2015
Market	211,000 Cr $ 45 Bn	900,000 Cr $ 190 Bn
Production	103,000 Cr $ 22 Bn	206, 000 Cr $ 44 Bn
Export	19,000 Cr $ 4 Bn	50,000 Cr $ 10.5 Bn
FE Outgo	100,000 Cr $ 21 Bn	700, 000 Cr $ 148 Bn
Components Import (25% of production)	20,000 Cr $ 4 Bn	40,000 Cr $ 8.5 Bn
Employment Growth {Direct + Indirect (Ratio 1:3)}	20 Lacs	40 Lacs

Table 2: Foreign exchange outgo of Electronic Components

India is becoming hub for manufacturing of Multinational companies like LG, Samsung, NOKIA, GE etc. The growth of Electronics Industry reported at US$ 1.75 Trillion globally is the largest and fastest growing manufacturing Industries in the world. It is expected to reach US$ 2.4 Trillion by 2020. The demand of Indian market was US$ 45 Billion in 2008-09 and is likely to reach US$ 400 Billion by 2020. The domestic production in 2008-09 was about 20 Billion but having with low values addition due to various structural changes resulting in higher costs. At the present rate of growth, the domestic production can meet to a demand of US$ 100 Billion by 2020 as against projected demand of US$ 400 Billion and balance would have to be met by imports. Demand supply gap will be nearly around US$ 300 Billion by 2020, unless the situation is improved. The National Policy of Electronics, 2011 envisions creating a globally competitive Electronics System Design and Manufacturing (EDSM) industry including nano-electronics to meet the country's need and serve the international market.

1.2. Challenges Faced by Electronics Companies

- To achieve a turnover of about 400 Billion by 2020 involving investment of about USD 100 Billion and employment to around 28 million by 2020.
- To set up over 200 Electronics Manufacturing clusters.
- To significantly upscale high- end human resources creation to 2500 PhDs annually by 2020 in the sector.

Presently after China, India is the manufacturing hub for Electronics items assembly segment. The challenge for these manufacturing facilities is to manufacture item having no quality defects with least cost. In consumer electronics there is a cut throat competition with regard to price. All manufacturers try to curtail manufacturing cost. So there is a great stress in the process of manufacturing. Through put of the processes should be near to 100%. The onus lies on to process engineers/ supervisor to meet the challenges.

2. Methodology

The step it follows is called DMAIC (Define, Measure, Analyze, Improve and Control). First step is to define the process to be improved and after that the performance of the existing process is measured. The performance data is then analyzed, Problematic areas are identified, after analysis improvement programme is defined and applied.

Industry wants to achieve defect free through put at the minimum cost to satisfy customer expectation. Since most of the electronics industry processes are automatized, there is an effort to achieve defect free output as close to 100%. Due to this reason, industries are adopting Six Sigma techniques.

3. Critical Success Factors for SS Implementation (CSFs)

These factors are critical to the success of any organization, in the sense that if the objectives associated with the factors are not achieved, the organization will fail. Organizations can ensure success if they direct their effort and focus onto the critical success factors. Figure 1 presents over different critical success factors that appeared in the case studies.

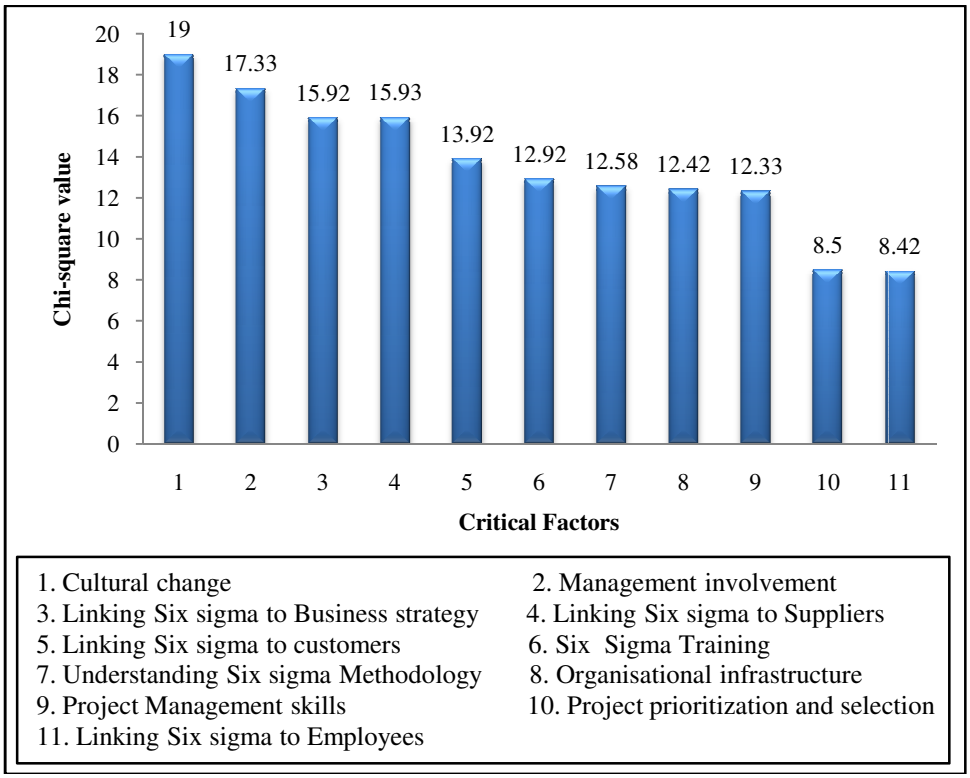

Figure 1: Critical Success Factors

Cultural change was the most frequently cited factor, followed by top management commitment and involvement. Other factors such as project management skills and project selection &prioritization appeared to be less important. However, CSFs varied from study to study and from company to company as well as between countries. CSFs cited as important in some studies were found to be less important in others. Unique CSFs also emerged, such as the development of project leader's soft skills, the need to give SS implementation time it needs, encourage SS thinking in employees' daily activities and results sustainability. These variations in CSFs could be as a result of different cultures in different countries, but this gap needs to be bridged by future research.

3.1. Benefits of Successful SS Implementation

The most frequently stated benefits were; increased profits and financial savings, increased customer satisfaction, reduced costs and significantly reduced cycle time. A number of cases cited a reduction in inventory & in-process waste as well as reduction in the percentage of production defects. Other benefits such as; identifying different types of waste, development in employee morale towards creative thinking and reduction in workplace accidents as a result of housekeeping procedures also appeared in a number of cases.

3.2. Reasons for Failure of Six Sigma Implementation

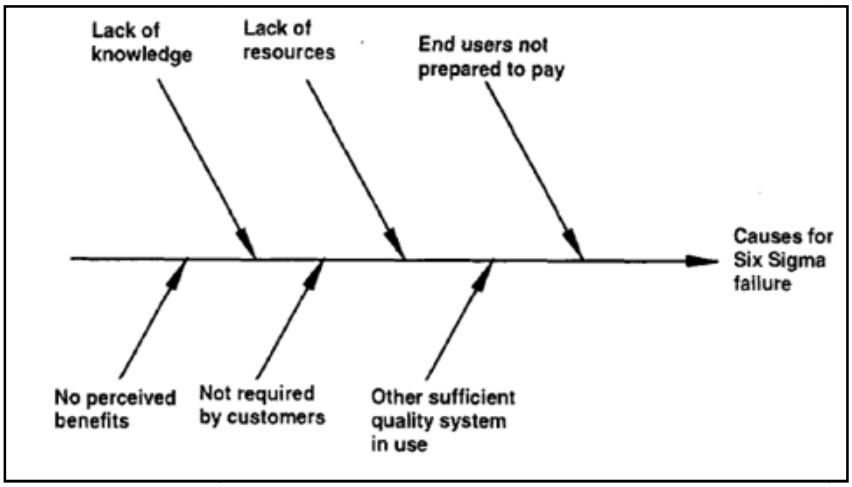

Figure 2

The absence of clear guidelines for SS in early stages of implementation, lack of SS curricula, lack of understanding of the usage of SS tools and techniques are cited as most important factors for the failure of Six Sigma implementation. Other factors are lack of roadmap to be followed, limited number of practical applications of SS, integrated framework, no globally accepted standards for certification, lack of real innovation in SS projects and the absence of accurate measurements for implementation. The most significant included lack of awareness about SS benefits in business, unmanaged expectations and lack of availability of resources.
Given the large amounts of information available about successes from SS implementation, it is clear that it is a lack of visibility of results rather than lack of tangible results. Other factors included lack of training and coaching, employee reaction towards a new business strategy and convincing the top management about the benefits of SS in business. The last is due to a belief by top managers that investment in quality improvement programs is no more than wasting money and increasing production cost.

4. Results and Discussion

The Process of implementing Six Sigma is a challenge for any organization. The implementation process introduces a huge time of adjustment, which is one of the primary challenges of Six Sigma. Many organizations are faced with challenges regarding implementation of Six Sigma, because they fail to assign metrics to all business functions. One of the necessities of Six Sigma is to quantify all business functions in order to improve them. Even when it comes to support functions such as paperwork, quality of this function must be analysed quantitatively. Starting that peripheral business functions are good or bad is not precise enough. It is essential to determine how many errors are made per million attempts.

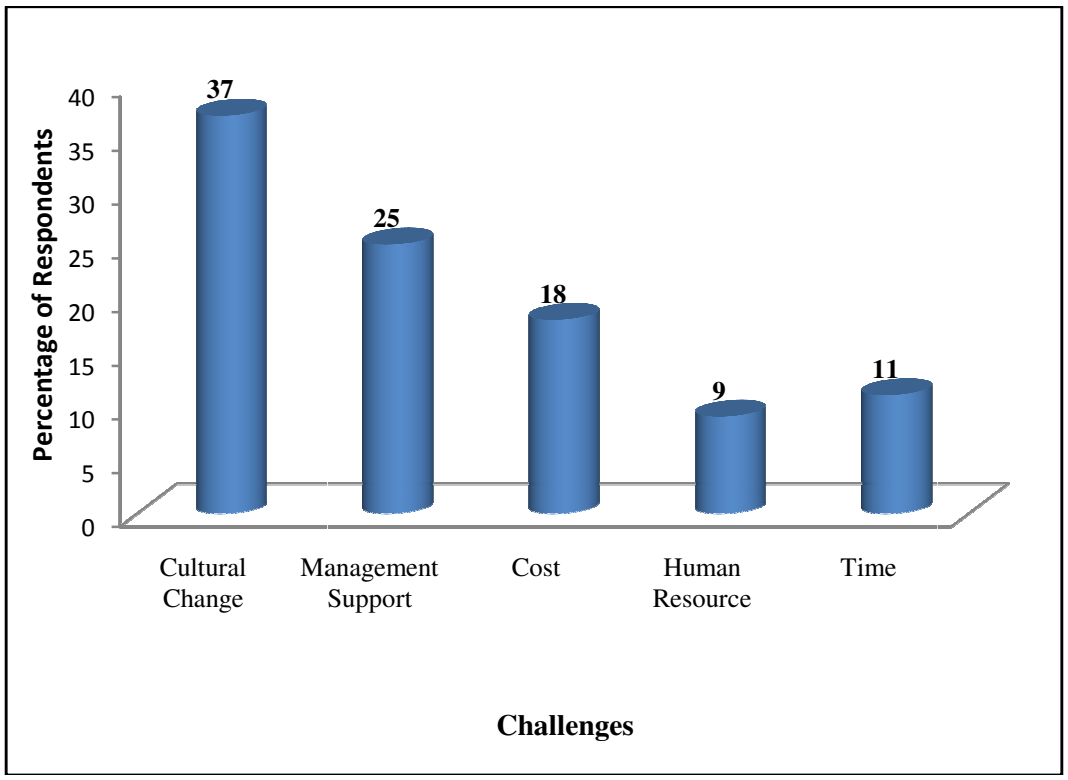

Figure3: Challenges faced in implementing Six Sigma

5. Conclusions

Levels of SS deployment are increasing, especially in large organizations in the US, UK and the Netherlands, and in some SMEs in developing countries such as India; the number of available SS publications is increasing accordingly. The application of SS methodology in the manufacturing sector has demonstrated the significant benefits that can be gained, along with motivation factors. Equally importantly, the limitation and impeding factors which need to be overcome are also stated. There are many gaps in the available literature that need to be covered in future research, and although a great deal of work has been undertaken on individual Six Sigma themes. In the past there has been little written on Six Sigma as a coherent strategy for business improvement and this is one of the more immediate gaps that needs to be bridged.

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