Performance improvement in Garment industries by reducing defects using six sigma methodologies

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ABSTRACT

Globalization and Quick access to information, products and services has brought world so closer that it is very difficult to sustain in the market without making innovations in work practices to gain competitive advantage over others. The purpose of this study is to illustrate the application of Six Sigma DMAIC (define-measure-analyse-improve-control) methodology to reduce the defects which occur during various processes in garment Industries. This research also works to develop an application guideline for the assessment, improvement, and control of wastes in garment Industry. Improvements in the quality of processes lead to cost reductions as well as service enhancements. An attempt is made to introduce and implement DMAIC methodology in garment Industry located in Solapur.

Keywords*: six sigma, DMAIC, service enhancement,*

Innovation, cost reduction.

I. INTRODUCTION

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. It is accompany-wide systematic approach to achieve continuous process improvements. Six sigma is not only a technique but also a philosophy, performing at Six Sigma means producing only 3.4 defects out of every million opportunities for a business process.

"Six sigma" is a strategic initiative to boost profitability, increase market share and improve customer satisfaction through statistical tools that can lead to breakthrough quantum gains in quality. Six Sigma methodologies can be effectively applied to small, medium and large enterprises. The Six Sigma strategy works well in billion dollar corporations as well as $50 million privately held companies. In fact, it has been experienced that the results are usually quicker and more visible in small manufacturing units. The contribution of textile Industry to GDP of India is 5%.It plays a vital role in providing employment. It is 2nd largest employment providing sector in India after agriculture sector. The textile industry is important in the business sector of India and it has to face cut throat competition in market through international brands having cheaper rate with good quality products. The problem which Indian garment industry currently facing are unskilled manpower, improper use of resources.

This study presents the case of a garment industry engaged in manufacturing of child wear in India. The industry was suffering with huge production losses due to improper utilization of overall resources. The industry is suggested to adopt Six Sigma DMAIC methodology to improve processes thus eliminating reprocessing cost and delay in material delivery.

II. LITERATURE REVIEW

Mukhopadhyay& Ray (2006) illustrated the use of Six Sigma methods to solve the problem of high rejection of yarn cones in a garment company. It was found that variation in yarn length; yarn count, empty yarn container weight, and yarn moisture content were the root causes for this rejection.

Brue and Howes (2005) mentioned six sigma as a strategy for improvement and problem solving methodology that can eliminate root cause of effects.

Kumar &Sosnoski (2008) highlighted the potential of DMAIC Six Sigma in realizing the cost savings and improving quality by using the case study of a leading manufacturer of tools. The study examined one of the chronic quality issues on shop floor by utilizing Six Sigma tools. The study showed that DMAIC Six Sigma process is an effective and novel approach for the machining and fabrication industries to improve the quality of their processes and products and ensuring profitability by driving down manufacturing costs.

Snee (2004) focused on process outputs that are of critical important to customer. Six sigma was described as business improvement approach that finds and eliminate defects or causes of mistake in processes.

Macmanus (2007) analyzed that there would be team work in every organization for process improvement. This kind of team approach is important for sustained progress toward process excellence to improve the sigma level.

Kwak and Anbari (2006) discussed the obstacles and benefits of six sigma. They also identified future of six sigma approaches.
Gijo and Rao (2005) suggested that selection of suitable belt projects plays an important role in six sigma implementation and six sigma projects should be selected on the bases of organization goal and objectives.
Sekhar&Mahati (2006) illustrated an integrated application of Six Sigma in order to improve the ambient air quality in foundry industries. The study used Six Sigma tools such as Cause and Effect Diagrams and Failure Mode and Effect Analysis to explore the root causes responsible for the problem and cost-effective remedies to solve the problem.
Joseph Staryarsky and Whitfield (2007) presented the building blocks necessary to help manufacturing organization to move towards "World Class" Safety performance, which resulted in a major reduction in lost workdays due to on-the-job accidents.
Kumar (2004) state that although Six Sigma is normally used in defects reduction (industrial applications), it can also be applied in business processes and to develop new business models.
Banuelas (2005) claim that benefits such as an increase in process knowledge, participation of employees in Six Sigma projects and problem solving by using the concept of statistical thinking can also be gained from the application of Six Sigma.
Tushar N.Desai & Shrivastava, R.L (2008) DMIAC is adopted in manufacturing company to identify, quantify and eliminate sources of waste in an operational process, up to optimization usage of the available resources, improve the sustain performance of the production line improvement with well executed control plans in future.

III. Methodology: Six Sigma DMAIC

In six sigma, DMAIC (Define-Measure-Analysis-Improve-Control) methodology was adopted by our team for improving the garments manufacturing process and reducing the defects.
Each term of DMAIC methodology is explain below in brief.

- **Define phase**

Research case: As quality plays important role in all aspects of life reducing the number of defectives, variations, and providing quality product is an important function of garment industry in India. Due to rapid globalization and modern trends Indian Garment industries are facing tremendous competition from Europe and China because of their quality product at cheaper rate. In this competitive market, it is essential for manufacturer to reduce defects in their products and become more competitive.

Problem statement: Garment industries are suffering from high rate of rejection due to defects in products and variations.

Project Goal: To reduce the defect percentage to minimum level and thereby improve quality, reduce wastes and increase productivity of the garments.

CTQ: (Critical to Quality Characteristic) :No of defective shirts

SIPOC (supplier-Input-Process-Output-Customer)

Table: 1 SIPOC flow at garment Industry

Supplier	Inputs	Process	Output	Customer
Sahara Textiles	Unstitched cloth. Machinery Threads Needles Colour Buttons	Cutting Fabric components Stitching Printing Pressing Packaging	Stitched T-shirt Baba suit	Shah Enterprises.

- **Measure phase**

Measure is a step where a mapping process, systems evaluation and assess the baseline performance of the company's capabilities.

Objectives of the "Measure Phase" were:
1. To prepare a data collection plan.
2. To find out the baseline performance.
In this phase, the process was defined. Each process step was detailed and the inputs ware categorized. The Team made an initial assessment of critical inputs and current performance of the organisation by discussing with the manager and the supervisor.

Step 1- Data collection

The team collected proper data for a period of three months (from December 2016 to February 2017) for various product manufactured in the organisation.

Step 2- Baseline performance

The company manufactures variety of garment products like T- shirts, Kurta, Shirt and Baba Suit .One product, i.e., Executive Shirt is inspected for defects since this was the critical product for the company as it had lot of demand and the profit margin for this particular product is high. Table.1.3 indicates the total number of shirts checked and the number of defectives.

Table: 2 Demand of products per year.

Products	Demand/year
Shirt	25000
T-shirt	20000
Baba suits	15000
Kurtas	8000

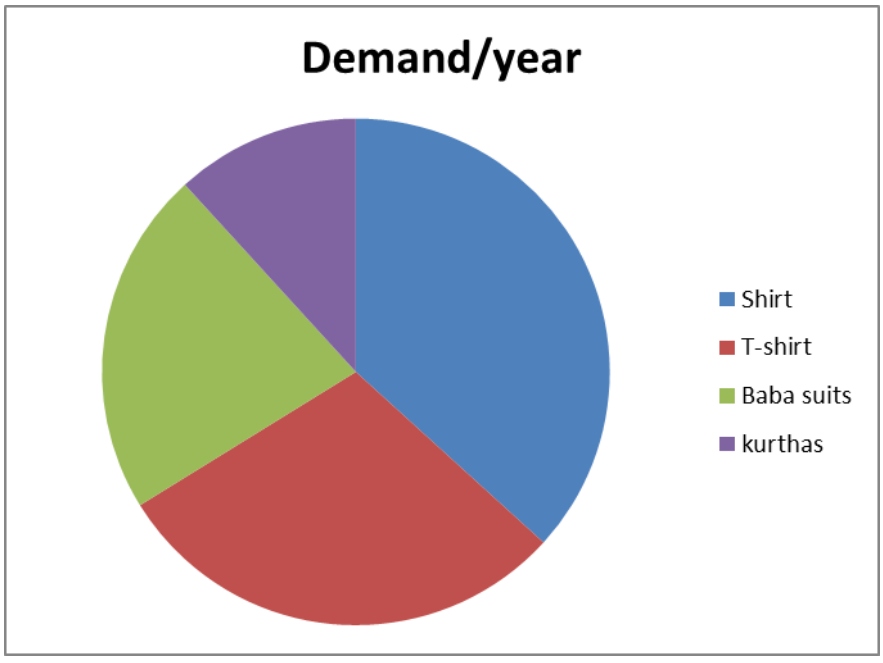

Fig 1: Pie chart of demand of products per year.

Checking Defective Shirts

Table: 3 Inspections of Shirts

Batch Number	Checked Pieces	Defective
1	270	18

2	275	20
3	260	22
4	280	16
5	275	18
6	265	16
7	275	20
8	280	22
9	272	16
10	265	18
	Total-2717	Total-186

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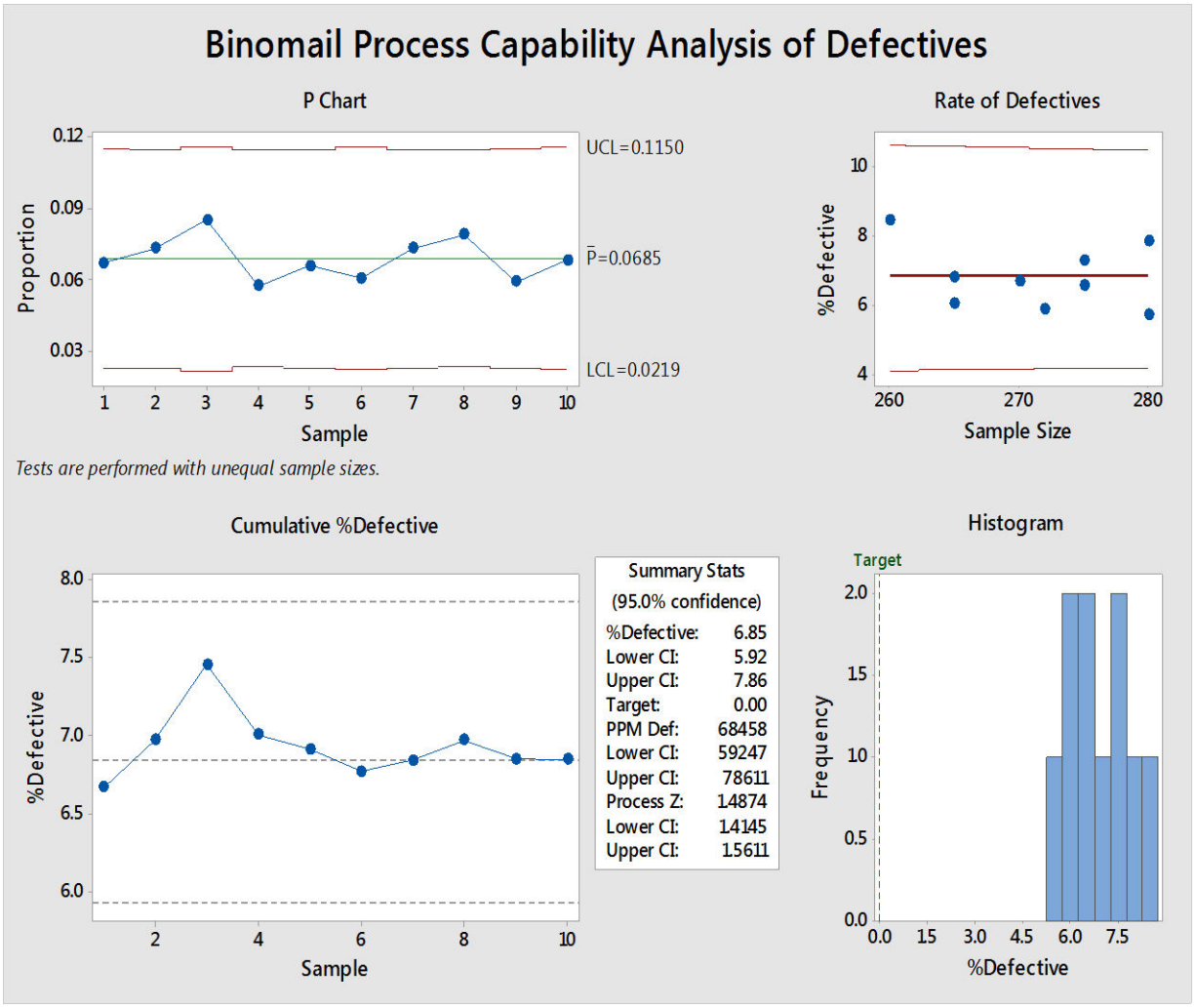

Fig 2: Capability study

Table: 4 Calculations for defect per million opportunities

Sr no.	Total Checked	2717
1	No. of Defectives	186
2	Percent Defective	6.84
3	Dpmo	68400
4	Sigma level	2.6

- **Analyse Phase**

In the analyse phase, the data collected in the measure phase is analysed so that the root causes of variations in the measurements can be identified and their effects can be subsequently validated.
Objectives of the "Analysis Phase" were:

1. To analyse the collected data
2. To find out the vital few contributor from the trivial many
3. To find out the root causes of the problem.

The collected data was analysed using Pareto chart and fish bone diagram

Table: 5 various Defects Occurring

Sr no.	Defects	Occurrence	%Occurrence
1	Padlock	10	15.625
2	front and back Shoulder joint	5	7.81
3	Label match	7	10.93
4	Embroidery	3	4.68
5	Astin touching	6	10.00
6	Misprinting	7	10.93
7	Button miss	9	15.00
8	Broken	11	18.33
9	Shade variation	6	10.00
	Total	64	

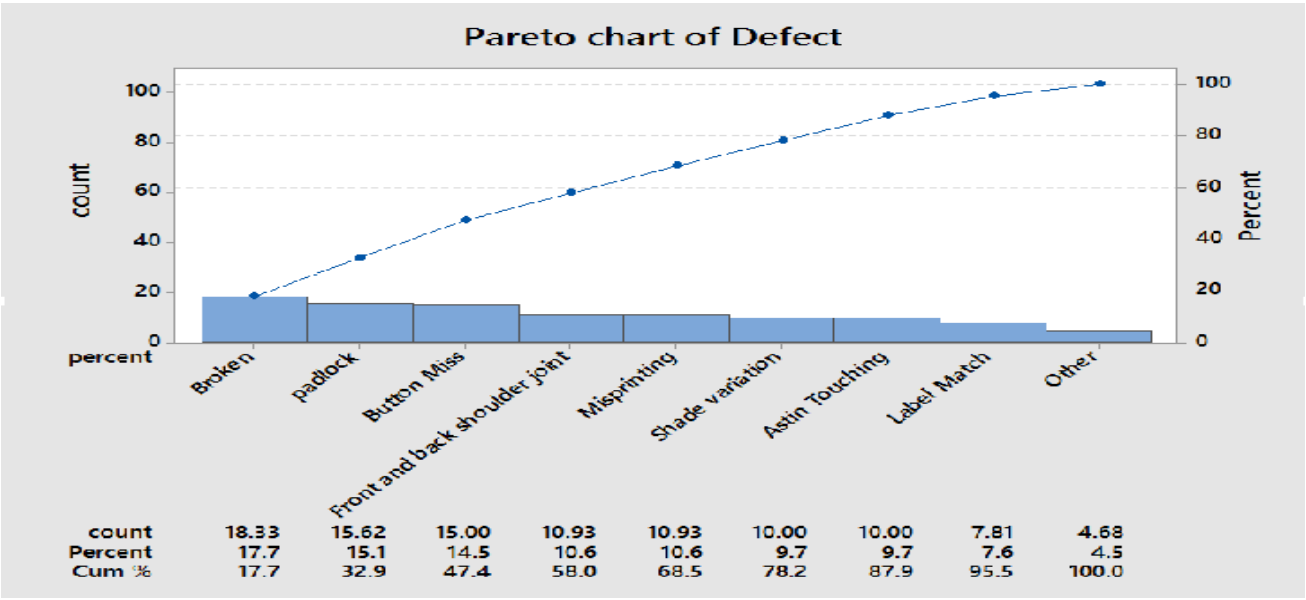

Fig 3: The major causes or types of defects from Pareto Chart

Table: 6 Major defects identified from Pareto chart

Sr no.	Defects Types
1	Padlock
2	Broken
3	Misprinting
4	Button miss

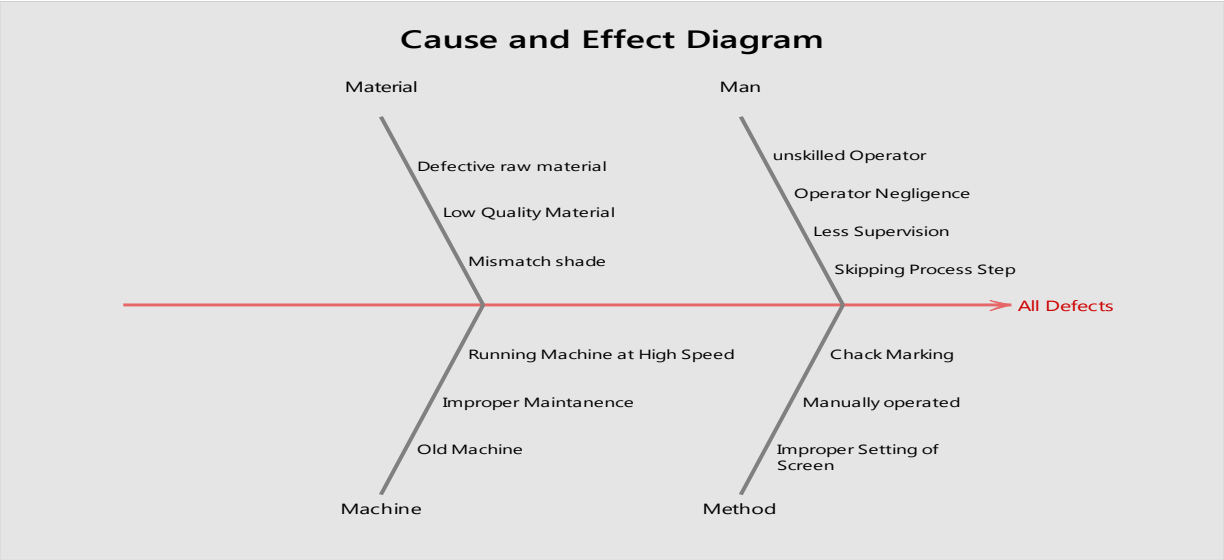

Fig 4: Cause and effect diagram.

- **Improve Phase**

The improve phase focuses on developing ideas to remove root causes of variation, Improve the process and standardizing those solution.

Objectives of the "Improve Phase" were:
1. To find out the ways to eliminate the root causes.
2. To Give-up the causes where no solution exist.
3. To formulate implementation plan at full extent.
4. To calculate the improvement.

Table: 7 Remedial Actions

Defects	Action
Rundown	The operators are trained to control the speed of the machine.
Broken	The broken threads are due to the fabric and the initial swatch tightened so that wrong fabric does not roll out.
Misprinting	The operators are trained to place the screen properly and print shirt accurately.
Button Miss	Operators are trained to check for the total number of buttons before passing the product.

Implementation

Table: 8 based on the Cause and Effect diagram, pareto chart, the operators are trained in all sections of their job and after the improvement actions are taken, the products are checked for defects.

Batch Number	Checked Pieces	Defective	Percentage Defective
1	270	12	1.48
2	275	14	2.18

3	260	14	2.30
4	280	12	1.42
5	275	10	2.90
6	265	8	9.23
7	275	14	2.90
8	280	12	2.14
9	272	10	1.47
10	265	12	3.01
	Total=2717	Total=118	

Table: 9 Types of Defects and occurrence after implementing actions

Defects	occurrence	% occurrence
Padlock	6	3.22
Broken	8	4.1
Miss printing	4	2.33
Button Miss	6	3.22
Total	24	

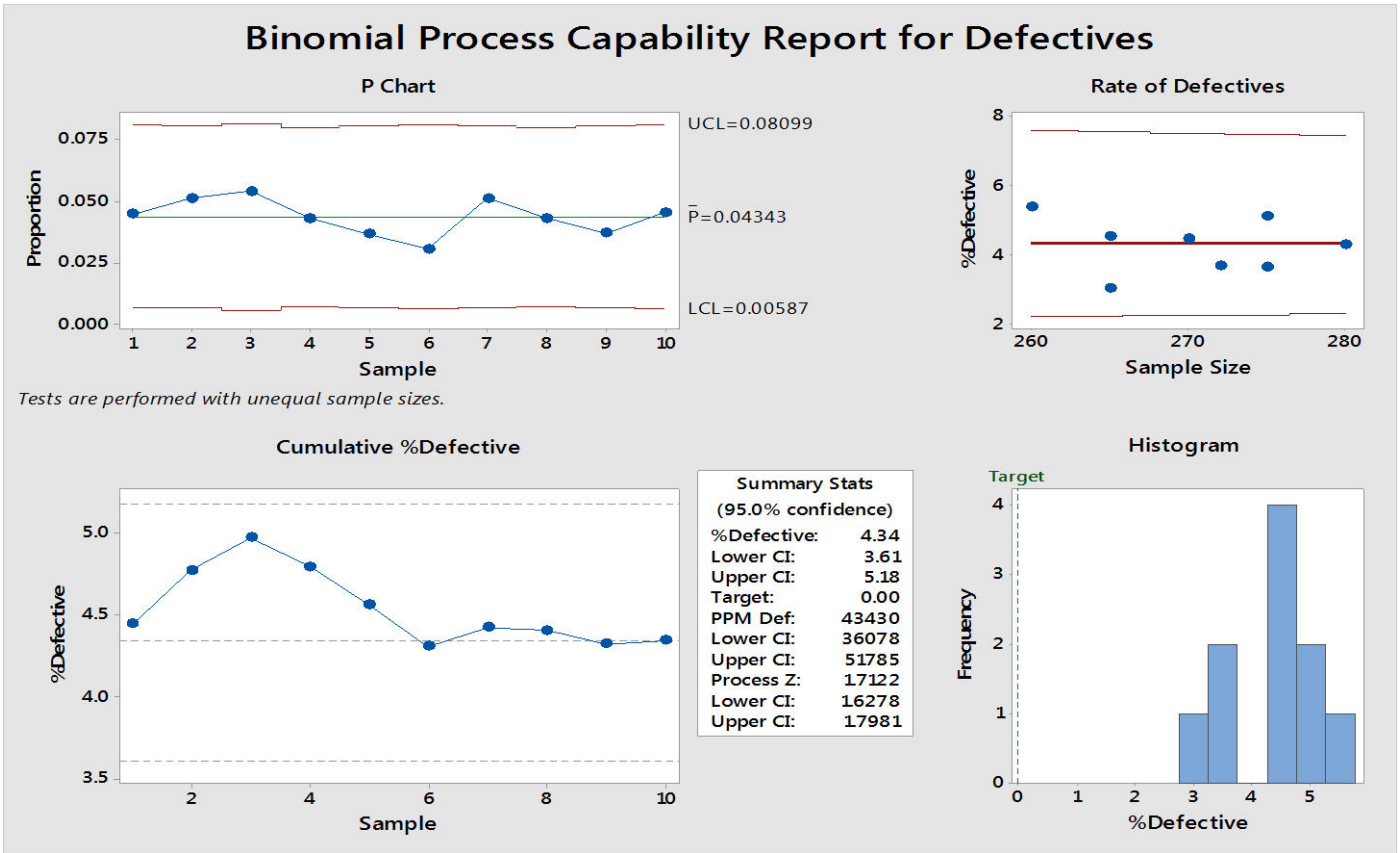

Fig 5: Capability study

Table: 10 Calculations for defect per million opportunities

Sr no.	Total Checked	2717
1	No. of Defectives	118
2	Percent Defective	4.34
3	Dpmo	43400
4	Sigma level	3.2

- **Control Phase**

The control stage is the last and final stage and its sole Purpose is to preserve the optimized response obtained from the study. The positive results after implementing six sigma were discussed with the managers of the garment industry. The major defects were reduced. The further challenge is to have continuous improvements of provisions made in improving the process.

Control Plan

The following are the action that should to be taken by the management to improve the results after six sigma implementation.

1) Layout should be change for higher productivity.
2) The raw material dealer should supply quality raw material without any Defect.
3) The workers of garment industry must be given training on a continuous basis on the issue of quality.
4) The final garment pattern should be referred by all the operators for quality purpose.
5) The management should give higher payments for high quality performance.
6) The focus should be on preventing defects rather than correcting defects

IV. Conclusion

In an effort to remain competitive in highly globalized world, process improvement has become an area of concern for companies. The Six Sigma used on the shop floor has improved the production process of garment industries. First the garment industry was operating at a percentage defective of 6.85%. After implementing six sigma DMAIC methodology the percentage defective is reduced to 4.34%. The same approach can be utilized to different products of the other companies which will reduce defects in large number. If the number of defectives are reduced and converted into money flow, the company will be surely benefited through increased production and customer satisfaction. Many small and medium scale garment industries in India are not aware of the six sigma concepts and proper implementation of six sigma will lead to a positive effect across the garment industries.

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