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Performance improvement of manufacturing industry by reducing the Defectives using Six Sigma Methodologies

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Abstract:

Studies have investigated how quality management can be employed in lean manufacturing to improve the performance of various issues in the whole business processes of various industries. This research work develops an application guideline for the assessment, improvement, and control of wastes in garment industry using six-sigma improvement methodology. 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 Sun garment industry located in Coimbatore.

Define Phase

- **Research Case**: As quality plays a pivotal role in all aspects of life, reducing the number of defectives in garment industry is an important function. Garment industries in India are facing stiff competition from Sri Lanka, Bangladesh and China. At this critical juncture, it is paramount for the manufacturers to reduce defects in their products and become competitive.
- **Problem Statement**: The garment industries are suffering from high rate of rejections of their products.
- **Goal Statement :**
    - To reduce the defect% to minimum level and thereby improve quality, reduce wastes and increase productivity
- **Team :** 3 members
- CTQ (Critical to Quality Characteristic) : Defective % of shirts
- SIPOC:

  The SIPOC Table.1.1 is developed to identify the requirements of the customers and other processes.

Table.1.1: SIPOC flow at Sun Garments

Supplier	Inputs	Process	Output	Customer
Madura Coats	• Unstitched cloth. • Machinery • Threads • Needles	• Cutting • Fabric components • Stitching • Pressing • Packaging	Stitched shirt	Indigo

Measure Phase:

In this phase, after discussions with the managers and supervisors data is collected with the help of team members.

1. Data Collection Period

Table.1.2: Data collection period

Period	Variables (CTQ)	Responsibility
May-December 2009	Total Checked Defectives	Team

2. The company manufactures variety of garment products like shirts, pants and Jackets. 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.1.3: Inspection of Shirts.

Batch Number	Checked pieces	Defectives
1	237	15
2	525	23
3	626	33
4	757	26
5	754	35
6	807	38
7	1064	33
8	719	26
9	363	20
10	310	17

11	315	16
12	242	15
	Total = 6719	Total = 297

3. Capability Study:

The analysis is carried out using MiniTab Software. The results are evident from the Figure.1.1

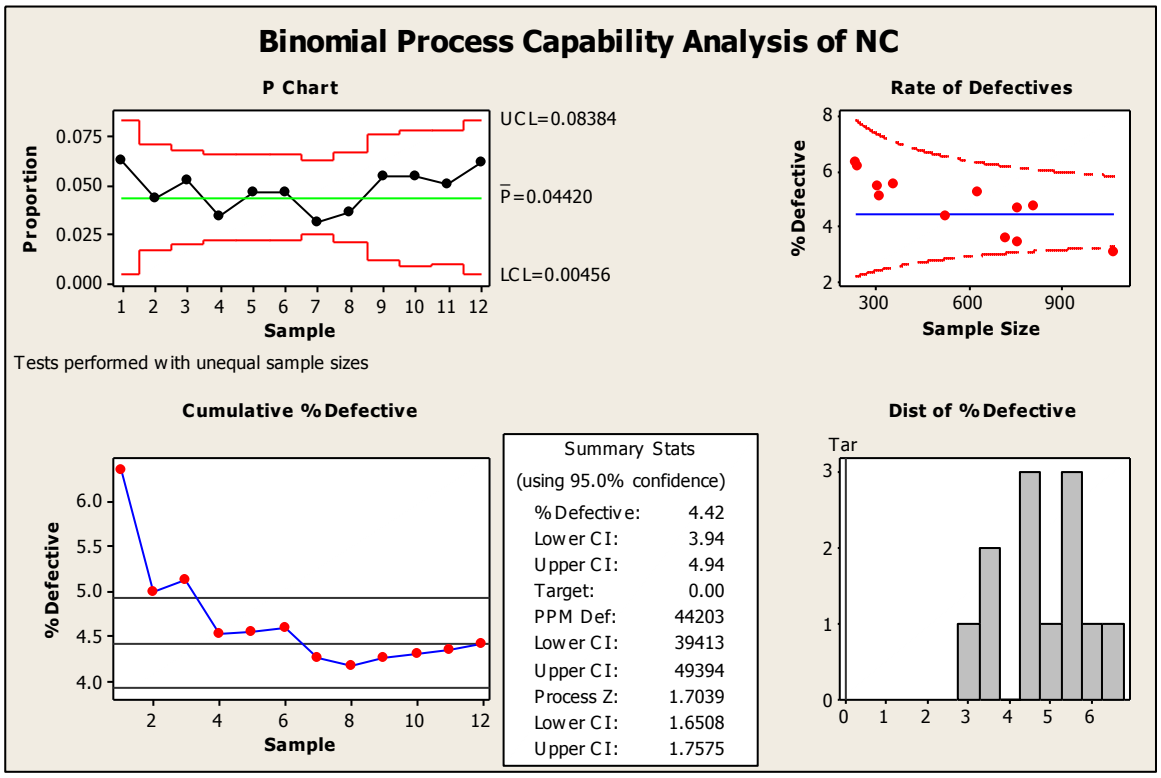

Figure 1.1: Capability study

4. Analysis:

The outcome is given in the Table.1.4. Showing % defectives as 4.42.

Table 1.4: calculation of dpmo

Sl.No	Total Checked	6719
1	No. of Defectives	297
2	% Defectives	4.42%
3	dpmo	44203.0064
4	Sigma	3.20
5	dpo	0.044203

Analyze Phase

The past data was collected on the causes or type of defects and is given in Table 1.5

Table 1.5: Types of defects

Sl.No	DEFECTS	Occurrence	% Occurrence
1	UNEVEN	13	4.32%
2	RUNDOWN	64	21.26%
3	BROKEN	139	46.18%
4	CUFF UP& DOWN	16	5.32%
5	SIDE SEAM UNEVEN	5	1.66%
6	FRNT PLKT UP& DOWN	6	1.99%
7	WCL BTN MISS	13	4.32%
8	OPENSEAM	11	3.65%
9	BTN 2 HOLE	7	2.33%
10	RAW EDGE	12	3.99%
11	0THERS	15	5.0%
	Total	301	

The major causes or types of defects were identified through Pareto Chart

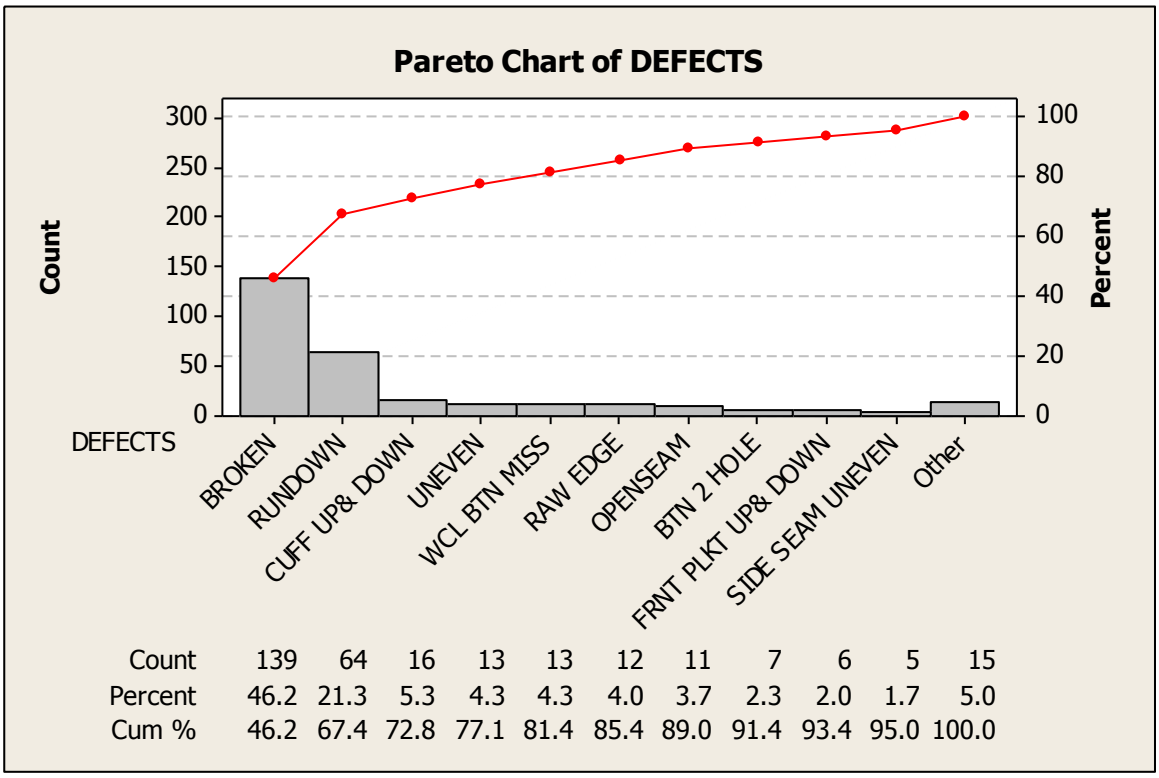

Figure 1.2 Pareto chart for types of defect

The major defects from Pareto Chart is considered for analysis and the defects are listed in Table: 1.6.

Table.1.6: Major defects identified from Pareto chart

Sl.No	Defect Types
1	BROKEN
2	RUNDOWN
3	CUFF UP& DOWN
4	UNEVEN
5	WCL BTN MISS

Through brainstorming with the shop supervisors, all potential causes were identified. The identified causes are given in Figure 1.3 Cause & Effect diagram. Only the major types of defects are considered for the cause and effect diagram

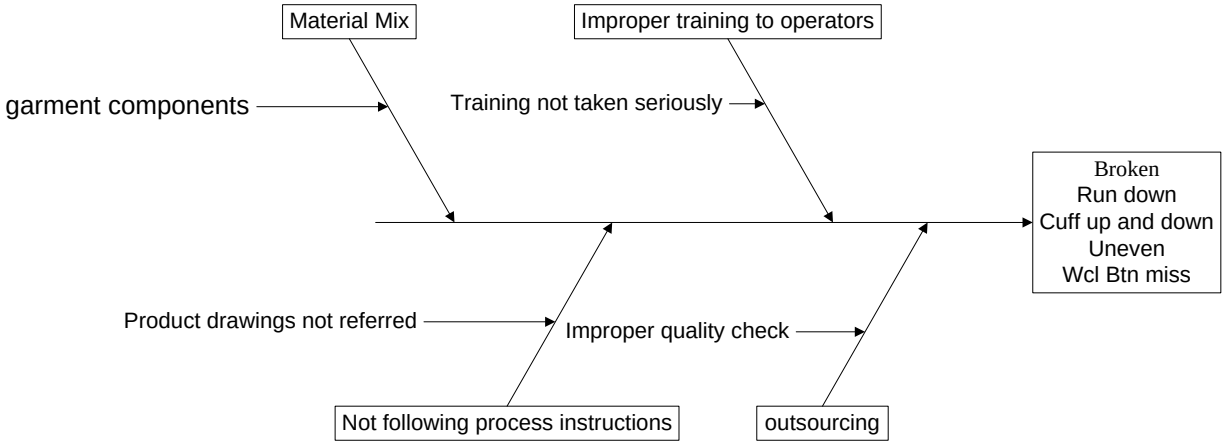

Figure.1.3: Cause and Effect diagram

Improve Phase

Through discussions with the managers and supervisors the following remedial actions were implemented for the each cause which is indicated in the Table.1.7

Table.1.7: Defects and remedial actions

DEFECTS	Action
BROKEN	The broken threads are due to the fabric and the initial swatch test is tightened so that wrong fabric does not roll out.
RUNDOWN	The stitches are extended than required and the operators are trained to control the speed of the machine
CUFF UP& DOWN	The operators are compelled to refer to the drawings whenever they are stitching Cuffs.
UNEVEN	The operators are trained to check for unevenness by using a sample fabric pattern
BTN MISS	Operators are trained to check for the total number of buttons exhausted before passing the product

Implementation

Based on the Cause and Effect diagram, the operators are trained in all aspects of their job and after the remedial actions are taken, the products are checked for defects. The details are indicated in Table.1.8

Table.1.8: Number of defectives for each batch

Batch Number	Checked Pieces	Defectives	% Defectives
1	243	4	1.65%
2	489	10	2.04%
3	655	11	1.68%
4	723	15	2.07%
5	769	17	2.21%
6	807	18	2.23%
7	932	15	1.61%

After remedial actions are taken to reduce the defects, the results are encouraging as shown in the Table.1.9

Table: 1.9: Types of defects and % Occurrence

DEFECTS	Occurrence	% Occurrence
UNEVEN	3	2.50%
RUNDOWN	15	12.50%
BROKEN	42	35.00%
CUFF UP& DOWN	7	5.83%
WCL BTN MISS	5	4.17%
Total	**72**	

Capability Study: Based on the Data recorded the capability study is conducted and is as shown in the Figure. 1.4

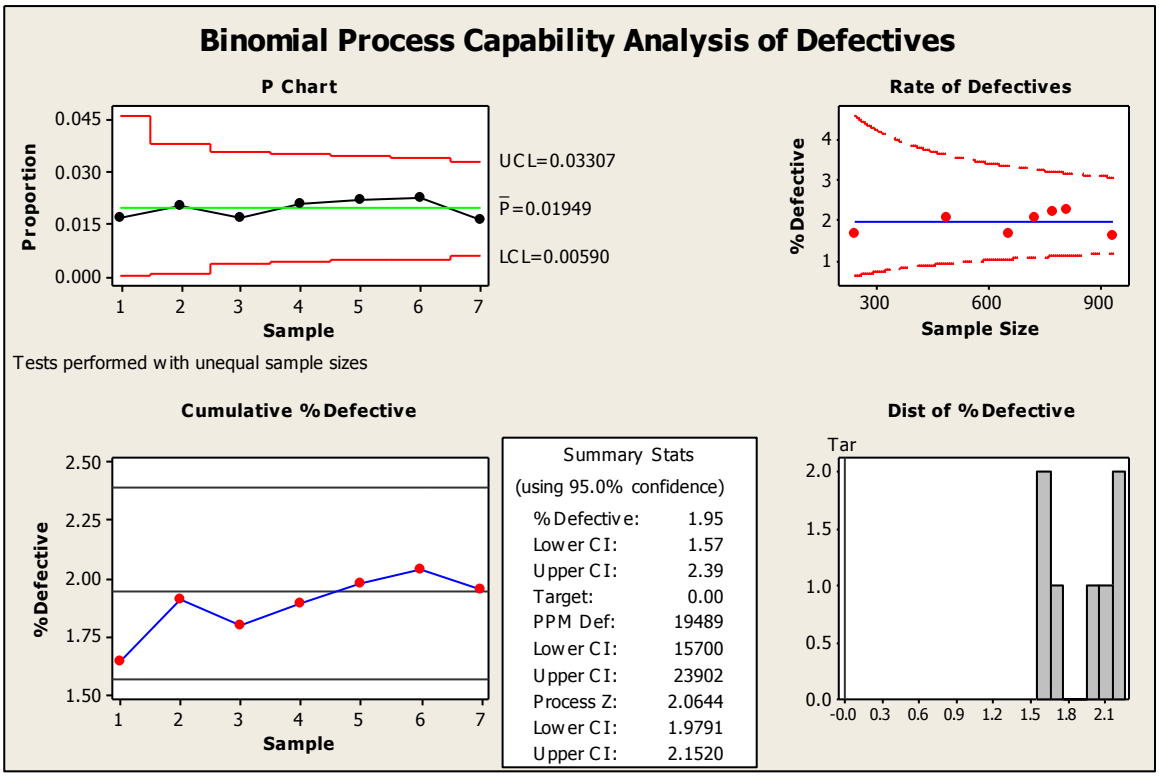

Figure.1.4: Capability Study after implementation

The results are indicating that the % defectives has been reduced to 1.95% as indicated in Table 1.10

Table.1.10: calculation of dpmo

Total Checked	4618
No. of Defectives	90
% Defectives	1.95%
dpmo	19488.96
Sigma	3.56

Control Phase:

The positive results are discussed with the managers of the garment industry. The major defects are identified and reduced. The real challenge is to sustain the improvements made in improving the process.

Control Plan: The following are the mandatory actions that has to be taken by the management to sustain the results after lean sixsigma implementation.

- The operators of garment industry must be given training on a continuous basis on the issue of quality.
- The drawings of the product must be made available at all the machines. The final garment pattern should be referred by all the operators.
- The management should give incentives for high quality performance.
- The focus should be on preventing defects rather than correcting defects.
- Tight quality controls should be enforced on those products coming from subcontractors.
- Training the subcontractors on the importance of quality on continuous basis.

Conclusion:

The garment industry in focus was exporting the final product to European countries. It was operating at a percentage defective of 4.42. After implementing the DMAIC methodology the percentage defective is reduced to 1.95. The same approach can be utilized to other products of the company which will reduce lots of defects. If the quantum of defectives are reduced and converted into cash flows, the company will benefit through increased revenues.

Many medium scale garment industries in India are not aware of the lean sixsigma concepts and this implementation will trigger a positive wave across the garment industries and become more competitive.

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