EMPIRICAL STUDY BASED ON DEFECT ANALYSIS TO ENHANCE QUALITY AND PREVENT REWORK- A CASE STUDY

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Abstract

In order to lessen down defect, every company must implement a quality control system. This paper represents process flowchart and application of Defects per Hundred Unit (DHU) in the sewing line of Garment Export house. There sewing section is to identify defects and rework so as to eliminate them for saving time, cost and improve product quality. And the evocative tool established covers an inclusive series of aspect in lowering down of sewing defects in garment industry. It should be kept in a mind, 1%defective product of organization is 100% defective for consumer who buy defective product. Therefore study clearly indicates that non-productive activities like rework kill the profit margins of the company so, implementations concluded that; before experimental work overall DHU are 7.73% and after making corrections in 4M 'S (men, material, machine, method). The number of faults found to be reduced and the post DHU% declined to 5.43%.

Key words: Quality control, sewing defects, fabric defects, productivity.

1. Introduction

Garment industry is found to be the gulf of global markets and is being famous for the quality, permanence and beauty. In other words, Quality is the set of product features and its freedom of deficiencies. Quality plays an important role in building-up of any business. It gets integration and reliability among consumers as it is considered as the nucleus of a business. It is the merit of something, Quality must be built-in; it cannot be scrutinized into the product or term as, the path to avail proficiency. A product, service, method or experience is a high quality; if it is fit for purpose [9]. Knowledge of high quality is meant to be invaluable and low-quality knowledge is expressed as futile. . Some of the adjectives used to define quality are: Standard, Worth, Reliable, Defect-free, Sustainable, Reusable, Relevant, and Profitable.

1.1.4 Seven tools of Quality (tools to measure quality)

They are called basic as proper teaching in statistic can make one to use it properly. It is being used to solve the giant majority of quality related issues. The seven tools are:

1. Histogram
2. Cause and effect diagram
3. Check sheet
4. Control chart
5. Pareto chart
6. Scatter Diagram
7. Stratification

1.2 Problem Identification

Research work conducted in Garment Export house; where the observation enlighten defects of inline sewing production department which hamper the quality of various garments which were being manufactured.

- Lacks of quality checkpoints and audits.
- Inline Sewing defects.
- Un-skilled operators hired for critical operations.
- Insufficient Information provided to inline manufacturing operators.
- Rework was more, which leads to a production delay.

1.2.1 Objectives of study

- Collecting and analyzing most occurring defects.
- To study how to reduce the sewing defects percentage.
- To study Improvement in quality, by using Defects per Hundred Units tool.

3. Research Methodology

Methodology means the procedures to obtain the result. For this study, we have conducted the following procedures to minimize the defects.

Aim: the aim of the work, i.e. overall purpose of the study, should be clearly and curtly defined.
Objective: pinpointing the very specific outcome.
Data collection: collection of information through relevant sources to find answer to research problem, test hypothesis and calculate the outcome.
Data analysis: it includes inspection, transformation and modeling of data.
Identification: through questionnaire or survey the information is gathered.

Problem detection: with the help of the collected data the problem is detected.

Brainstorming: is done to find the root cause of the problem.

Identifying solution: the solution is finding, for the problem.

Implementation: it is implemented in the area, where a problem is found.

Result: finally we reach to the outcome of the entire research is known as result.

Department wise quality checkpoints in garment manufacturing industry: [3]

Table-3.1 Department wise quality checkpoints

Fabric store	Fabric goes through 100% inspection
Trims & Accessories	Trim quality and quantity inspection
Cutting Room	To scan Marker and its efficiency , Cut parts and Audit bundle checking
Embroidery/printing	inspecting printing panels 100% inspection of embroidery
Sewing section	Check points in line where critical operations are being processed arbitrary checking 100% final (line checking) Auditing checked pieces
Finishing section	primary finishing inspection (after being washed) Last finishing inspection(after being pressed) Auditing internal shipment

D.H.U. – It stands for Defect per Hundred Units. It means number of defects found or detected per 100 garments. This is also known as DHU (Defects per Hundred Units). [3]

1. Defects per Hundred Units and

2. Percent Defectives

DHU = Total defects detected*100/total pieces inspected

Percent Defectives = Defective Pieces /Total pieces X100

To measure DHU, one needs to record number of total pieces checked and number of total defects are detected in the inspected garments. It is number of defects not the defective garments. One defective garment may have more than one defect.

Steps and processes followed to reduce DHU:

i. Review of the existing working system in the industry
ii. Targeted sewing department due to majorly occurring sewing defects
iii. Working within the sewing department to collect data on the basis of various types of sewing defects, focusing on frequently occurring defects, developing check sheets. Formats to maintain records.

Conducted DHU analysis and report was prepared on daily basis to calculate the percentage of defects occurring in sewing line, Defects per Hundred Unit.

Table: 3.2 Defective DHU Percentage on daily basis

Days/ Defect type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
cut &damage	1		3	4	1		1	2	3		3		4		5
Puckering		6	1		3		6	5		7	1	8		1	1
Label-attachment	1	2	4			3	5		5		4		3		2
measurement out			1	1	2		4			2	3		3	2	1
Roping	4	2			3			3	2			3			
uneven top stitch	8	3	1			4		2		4		1	2		3
button attachment	2			4		3			4	2		3		4	2
Overlooking	3	6	2		3		1	2			1		2	4	
slip stitch		1		6		3			1	3	7		4		1
Stains	6	4		3			1	4			2	1		2	1
Pico stitch	2		4		5			3		2		3		1	
Others	4	2		7		1		2		3		5	4		4
total pieces checked	90	85	50	80	90	75	70	110	85	98	72	100	110	45	83

total defective pieces	31	26	16	25	17	14	18	23	15	23	21	24	22	14	20
DHU%	34.4	30.5	32	31.2	18.8	18.6	25.7	20.9	17.6	23.4	29	24	20	31	24

The most occurring defects found in the sewing line were: Cut & damage, loose stitch, measurement out, wrong-label attachment, puckering, open seam, neck unbalance, Uneven S.P.I.

Table 3.3 Assortments of Defects

	MAN	MACHINE	MATERIAL	METHOD
Cut and Damage	✗	✗	✓	✓
Uneven S.P.I	✓	✓	✗	✗
Wrong Label	✓	✗	✗	✓
Loose-Stitch	✓	✓	✗	✗
Broken Stitch	✗	✓	✗	✗
Missing Part	✓	✗	✗	✗
Neck Unbalanced	✓	✗	✓	✓
Measurement Out	✓	✗	✗	✓
Puckering	✓	✓	✗	✗
Open Seam	✓	✓	✗	✗

Table show the causes of different types of defects due to man, machine, material and method.

Pre- defective %

Table: 3.4: Man Causing Defects

	MAN DEFECTS									
	Cut and damage	**Wrong label**	**Loose stitch**	**Missing part**	**Neck unbalance**	**Measurement out**	**Puckering**	**Open Seam**	**Total Defect No.**	**Total Pieces**
STYLE 1	19	29	12	18	14	14	22	12	140	210
STYLE 2	17	21	11	7	18	23	14	18	129	220
STYLE 3	11	16	17	18	16	13	10	15	116	190
Total	47	66	40	43	48	50	46	45	385	700
DHU %	6.7	9.4	5.7	6.1	6.8	7.1	6.5	6.4	6.8	

Table show :Cut and damage, wrong label attachment, loose stitch, missing parts, neck unbalance, measurement out, puckering, open seam were the defects caused by the unskilled operators and the total DHU % of the defective pieces was found to be 6.8.

Table 3.5 Machine defects:

MACHINE DEFECTS							
	Cut and damage	Uneven balancing	Open Seam	Puckering	Loose Stitch	Total Defect No.	Total Pieces
STYLE 1	9	9	12	8	24	62	220
STYLE 2	17	21	14	17	18	70	185
STYLE 3	11	16	17	9	6	59	254
Total	37	46	43	34	48	191	660
DHU %	5.6	6.9	6.5	5.1	7.2	5.7	

Table 3.5 show different types of sewing defects caused due to improper settings of a machine in a sewing line, which resulted in generation of defects like cut & damage, uneven balancing, open seam, puckering, loose stitch and the total DHU % of the defective pieces was found to be 5.7.

Table 3.6 Material and Method defects:

	Cut and Damage	Uneven SPI	Wrong label	Neck unbalance	Measurement out	total defect no.	total pieces
STYLE 1	15	23	2	13	4	57	100
STYLE 2	13	21	6	26	12	78	150
STYLE 3	17	15	17	14	16	79	150
Total	45	59	25	53	32	214	400
DHU	11.25	14.75	6.25	13.25	8	10.7	

Table 3.6 shows different types of sewing defects caused due to inappropriate methods of material handling and the total DHU % of the defective pieces was found to be 10.7.

Table 3.7 Pre- defective percentage under four M's

Defect type	Man	Machine	Material/method
Pre-defective%	6.8	5.7	10.7

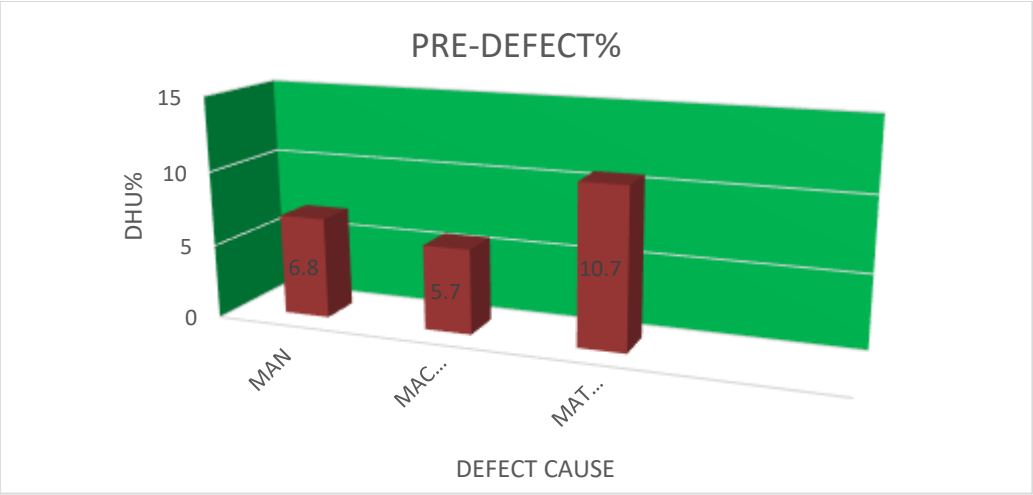


Fig: 3.1 Pre- defective percentages under four M's:

Fig: 3.1 graphically show comparison between DHU% of man, machine, material /method.

The DHU analysis and fishbone diagram would enhance company to explore the root cause of the problem identified

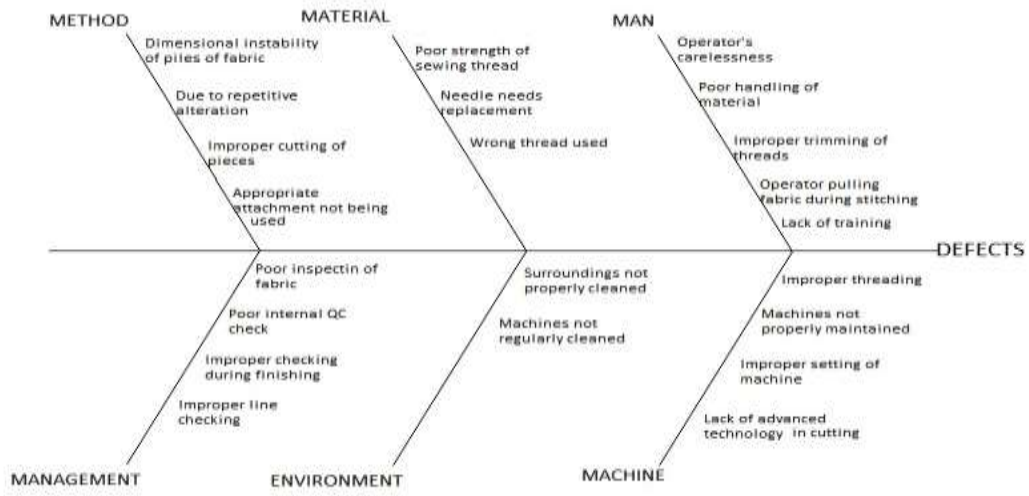


Fig: 3.2 Causes and Effect Diagram

3.1. Recommendations

Recommendations and suggested solutions to problems by failure modes and analysis

Table-3.1.1 Failure Modes and Analysis

Areas	Failure modes	Causes	Effects	Suggested solutions
MAN	Manufacturing technology is outdated. Maintenance timing is not correct. Documentation in various departments is not proper and organized.	Operator's carelessness	Poor quality results in rework and waste of time. Efficiency obstructed.	Improve supervision
		Poor handling of material		Hand should be neat and clean before starting work
		Lack of training		Trained operator sufficiently

Table-3.1.2 Failure Modes and Analysis

Areas	Failure modes	Causes	Effects	Suggested solutions
MATERIAL	.	Poor strength of sewing thread.		Thread should be of good quality.
		Needle needs replacement		Replace old the needle with the new one.
		Thread of low quality.		Check the quality of thread with approved thread

Table-3.1.3 Failure Modes and Analysis

Areas	Failure modes	Causes	Effects	Suggested solutions
MACHINE	.	Improper threading		Rethread machine and make sure, the thread passes through the tension discs.
		Machines were not clean.		Machine should be cleaned regularly
		Thread tension is not correct.		Maintain proper thread tensions

Table-3.1.4 Failure Modes and Analysis

Areas	Failure modes	Causes	Effects	Suggested solutions
METHOD	.	Dimensional instability in piles of fabric.		Reduce gap between presser foot and hole of needle plate.
		There is repetitive alteration		Provide adequate training to operators so alteration doesn't occur.
		Not proper cutting of pieces		Advanced technology should be used for cutting

4. Result and discussions

4.1 Corrective Actions

- ✓ For reducing machine sewing defects the maintenance format recommended.
- ✓ The format was implemented on a number of machines, as trial basis
- ✓ The format so compiled was filled by concerned supervisors and production managers

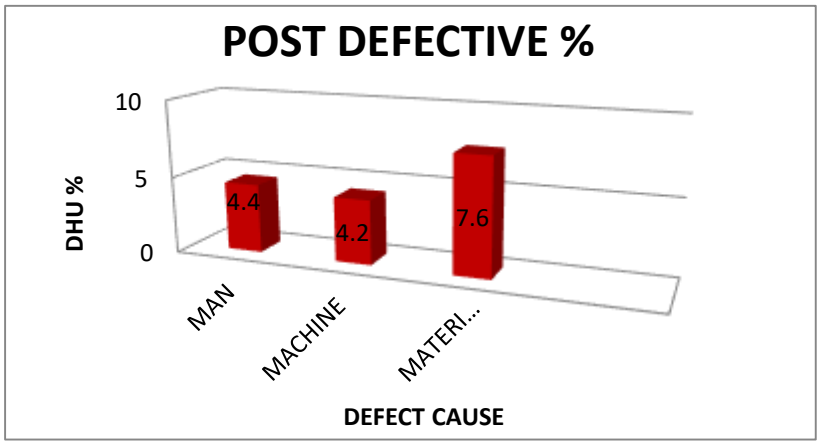
4.2 Solutions to Problem Causing Defects

In order to reduce the occurrence of various defects regular checkup formats, training formats and required folders were implemented. Training was basically provided to make the labor learn new tools and techniques of stitching in order to reduce the time and rework. A sample area was decided to consist of a fixed number of labors from the sewing section.

4.3 Post Defective % under 4M's

Table: 4.1 Percentage Defective under

DEFECT TYPE	MAN	MACHINE	MATERIAL/METHOD
POST-DEFECTIVE%	4.4	4.2	7.6



Graphically showing post defective % of man, machine, material and method after implementation of the suggested solution.

4.4 Comparative Analysis

Table shows Defects per Hundred Units under 4 M's

Table 4.2 Pre-Post Data Comparison

DEFECT TYPE	MAN	MACHINE	MATERIAL/METHOD
PRE-DEFECTIVE%	6.8	5.7	10.7
POST-DEFECTIVE%	4.5	4.2	7.6

After the implementation of the suggested solutions to problem the reduction in the DHU% has been observed and it is found that for man it has reduced up to 2.3, for machine it is reduced by 1.5, and for material and method it has reduced by 3.1.

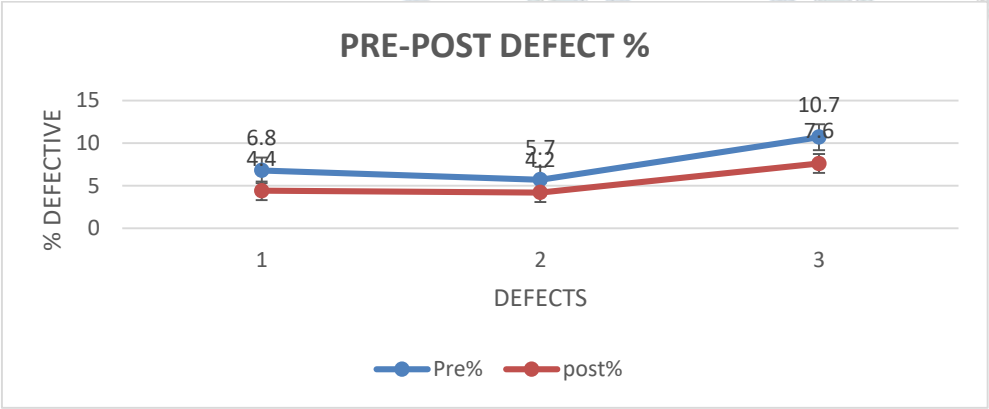


Fig: 4.2 Defects per Hundred Units (Pre-Post):

Fig: 4.2 show graph the comparison between pre and post defective percentage after implementation of the suggested solutions.

5. Conclusions

The work done during this project concluded in the reduction of defects per hundred units from 7.73% to 5.43%which lead to a reduction in various factors like labor requirement got reduced, rework reduced, extra raw material cost got reduced, and finally, wastage of rejected production decreased. These all resulted in the enhancement of productivity and reduced shipment delays. And over all it would raise the profit margin of the company.

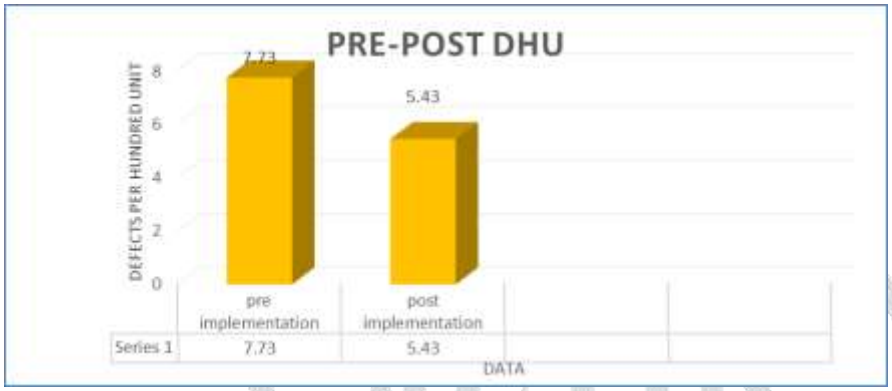


Fig: 5.1pre-post DHU implementation

Fig: 5.1 show graph the comparison between pre and post DHU implementation which has been significantly reduced from 7.73% to 5.43%.

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