

Application of Pareto Analysis and Ishikawa Diagram on Sewing Industries firm (A Case study on Gulele Garment Share Company, Addis ababa)

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ABSTRACT: This project is inspired by many unavoidable issues in rejection of huge number of finished garment products after shipment due to quality control failure in garment manufacturing. The fast changing of market conditions, such as global competition, declining profit margin, customer requirement for high quality product, product variety and reduced lead-time or OTD (On-Time-Delivery of finished goods and products) etc. play a major role on garment manufacturing industries. The demand for higher value (means Lower price at better quality) is growing and to survive, garment manufacturers need to improve their operations through producing right things at right time. This paper discusses the quality and productivity as two parallel lines for the improvement in the garment manufacturing sector by minimizing reworks that usually occur during production process. The application of this paper is to improve the process performance of the critical operational process, leading to better utilization of resources, decrease variations and maintain better quality of the Process and Product output. A general overview over the development is given in this paper that suggests how to handle these issues and bring down rejection rate to minimum by using Pareto analysis and cause & effect diagram.

Key Words:- Broken stitch, Sewing defects, Pareto chart, On time delivery, Quality, Inspection

I. INTRODUCTION

The global market condition shifting in a rapid motion, generally in an industry more focus is given on profits margin, customer demand for high quality product and enhanced productivity. In garment industries, it is accustomed that there will be a small number of rejected garments after shipment. Reasons are most of the manufacturers believed that garments are soft goods and

nonrepairable defect may occur due to low quality of raw materials or faulty process or worker casual behavior.

However, plant must have guidelines over check points to control over this problem. There is no ready-made solution that can decrease rejection percentage immediately. "Follow a rule of thumb FIRST TIME, EVERY TIME" during production process. Each order is a unique category, but this paperwork suggests an outline that how to handle such troubles and bring down rate of rejection to lowest possible range. As it identified lot of rejected garment after shipment, most of the organization termed these garments were rejected because of those can't be repaired or reworked by any means. Reworking is a common agenda in the garment industry which slows down the smooth production rate and focus low quality products having an impact on the overall factory economy.

Reduction of rework is a mandatory input leads to productivity quality and development. Reworks are a vital negative issues for a good production and focusing on such activities that customer is reluctant to pay for it. Also they won't believe in this philosophy now a days which is a non-value addition. By reacting agile & quicker in the minimization of reworks to make a product as per customer needs with expectation. The company can invest less money and yield more profit.

Therefore, a study was carried out in a garment industry named "M/S Gullele Garment Share Company located at Gullele (Asko), Addis Ababa, Ethiopia" at sewing section to identify reworks so as to eliminate them for reducing time & cost as well as better product quality. Gullele Garment Share Company is one of the famous Garment Industries found in Ethiopia and established in the year 1983 @ Addis Ababa Gullele

Sub city. It produces different clothes such as T-Shirt, Sport wear, Military Uniform for export as well as domestic sales in the country. The Industry has three main sections namely, cutting section, Sewing section and Finishing Section. This paper focuses on the sewing section of the garment to improve the productivity, production, minimizing time and increasing profit of company which highly affect the economy of the country

1.1 Problem Statement

To be effective in identifying defects lead to rejection, it is essential to establish and maintain clear, complete Pre-planned records of inspection and assessed procedures for each operation. These records should identify & Set criteria for acceptance/rejection. In the garment Manufacturing Industry, the main raw material is fabric; others include different types of trimming accessories. Operational wastages in the garment industry's processes are top surface rework, printed label rework, sewing defects, pinhole rework, fabric defects, improper fly shape, and other reworks. To achieve the overall objective, minimizing defects and rejection of finished products it is compulsory to establish document and maintain a system capable of ensuring that products conform the Set specifications. This will be mandatory at every stage of manufacture. Those errors and defects lead to failures which again effect badly in future marketing of goods

II. LITERATURE REVIEW

The quality competition in the current global market is an issue translating into a vast need for the continuing growth of the industry. Therefore, world business is continually in search for the competitive frame due to the growing demands of customer requirements and expectations. Quality has an important role in the business process across the entire organization, to be more efficient and effective in the global promote, thus improving productivity and customer loyalty as well as increase in market share.

Quality is a concept that definition has changed within a time. Quality meant "conformance to valid customer requirements" i.e. long as an output are within acceptable limits, called specification limits, around a preferred value, called the nominal value, or target value, it was deemed conforming, good, or acceptable. (Deming, 1950).

According to Montgomery (2005), quality is one of the most important decision factors in the selection of products and services. Therefore, quality leads to business success, growth, and increases competitiveness, as well as improves the work environment. Additionally, it involves the employee in achieving the corporate goals and brings a substantial return on investment (ROI)

The study and the analysis of quality must be aimed to understanding, meeting, exceed and surpassing customer requirements and expectations (Kolarik, 1995). Statistical tools allow measurement and evaluation of the performance in a process to develop its quality. The tools frequently used to help decision making. According to Montgomery (2005), Statistical tools can be supportive in developing activities previous to manufacturing, in the measurement process variability, in analyzing this fluctuations relative to product requirements or specifications and in eliminating or greatly reducing variability in process. These tools allow the interpretation of the process by detecting when the variables change and experimentation? by knowing how the variables can vary by experimental designs. (Ott et al., 2000).

III. METHODOLOGY

This stage contains all methods use to improve the quality of garment industry at Gullele Company depending upon the results of imperfect items recorded during two consecutive months. It also deals about the way to control the improper defects to reduce reworks, manage time, increase productivity and helps to sustain the development of the company concerning global market. Also need to appoint a management representative preferably independent of other functions to be responsible to supervise the total control system and inspection at each stage of manufacture.

The person selected should have the necessary authority to execute any action related to achieving the desired standard of product. To be effective the system requires planned periodic review by senior management to ensure that its effectiveness is maintained. The general methodology followed to minimize defects rate is given in the following steps as FLOWCHART/Diagram-01

FLOW CHART-01

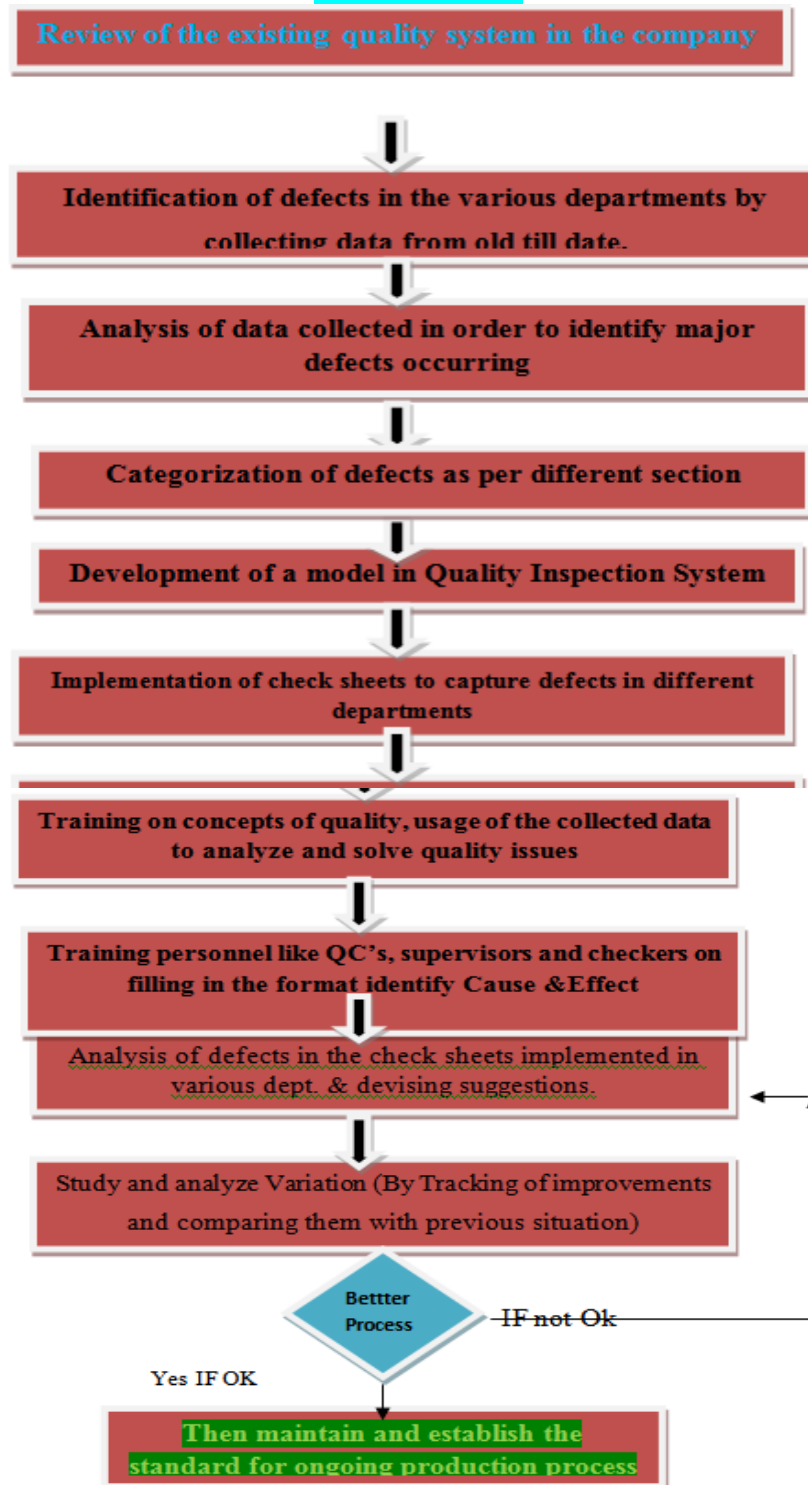
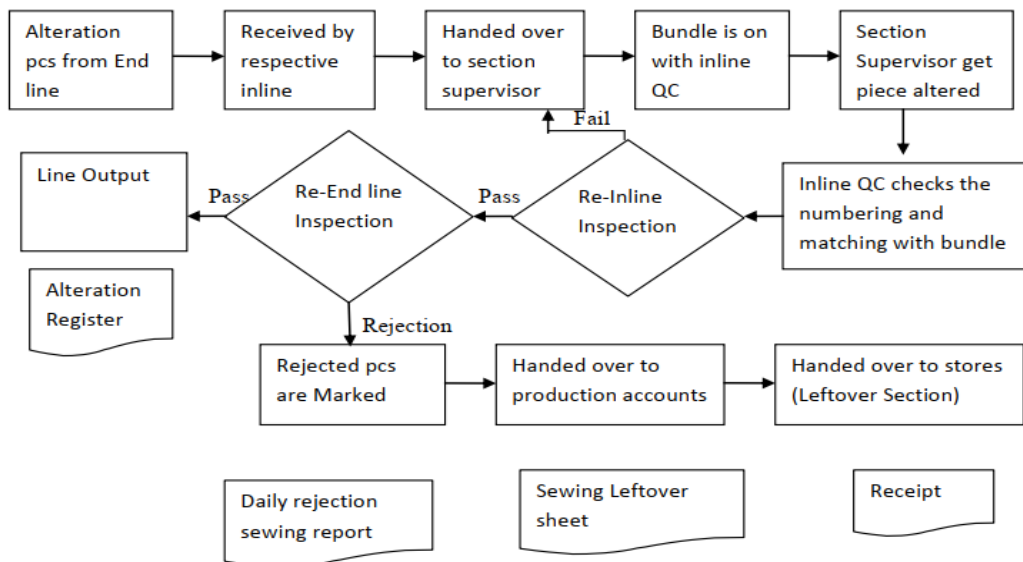


Figure-1 Methodology approach in defects and reworks minimization



Figure: 2.(Right side)the real photo taken from Sewing section (Line production and Sewing Room Repair Standard Operation Procedures (SOP))



Sewing section in gulalle garment)

Above Flow Chart 3. Sewing Room Repair SOP

Sewing Section

Gullele garment industry has different processing section such as Cutting Section, SewingSection and Finishing section. In this

project we have focused on sewing section since it is essential and critical for the production process of the industry. Hence it was found for many defects at this section. Sewing is the process of attaching different fabric parts by using stitches which is made with a needle and thread. Sewing is one of the basic Ladders and Core operation of

garment manufacturing process. Also sewing section is the most important section of a ready-made garments industry. Different types of imperfections or defects arise in the sewing section which must be addressed to maintain the required amount of quality of apparel.

For every industry or business organization, to get increased sales and acceptable brand amongst consumers and fellow companies it is important to maintain a level of quality. In the garment industry the quality control is rightly practiced from the initial stage of sorting raw materials up to the finished goods or product.

For textile and apparel industries product quality is calculated in terms of quality and standard of fibers, yarns, fabric construction, colour fastness, surface designs and the final output. However quality expectations for export are interconnected to the type of customer segments and the retail outlets. There is a figure of factors on which quality fitness of garment industry is based such as performance, reliability, durability, visual and perceived quality of the item of clothing. Quality needs to be defined in conditions of a particular framework of cost. Here some of major fabric properties those are taken into consideration for garment manufacturing for export basis:

Overall view of the garment

- ❖ Right formation of the garment
- ❖ Feel and fall of the garment. (Durability case)

Physical properties

- ❖ Color fastness of the garment (Color and Design Structure)

Sewing defects

Types of Defects Found in Sewing Section:

Sewing Defects: (1 upto 9)

1. Needle damage: for example, thread drawn-off from the fabric or making of large hole to the fabrics.
2. Skipped stitch.
3. Thread drawn-off.
4. Seam puckering.
5. Wrong stitch density.
6. Uneven stitch.
7. Staggered stitch.
8. Defected stitch.
9. Oil spot or stain.

Seaming Defects: (1 upto 10)

1. Uneven width.
2. Uneven seam line.
3. Not secured by back stitch.

Seaming Defects Continued)

4. Twisting.
5. No matching of check or stripe.

Finishing properties

- ❖ Presentation of the final produced garment (Aesthetic Appearance)

There are certain quality related problems in garment manufacturing that should not be over

- ❖ **Sewing defects** - Like open seams, wrong stitching techniques used, same colour garment, but usage of different colour threads on the garment, miss out of stitches in between, creasing of the garment, erroneous thread tension and raw edges are some sewing defects that could occur so should be taken care of.
- ❖ **Colour effects** - Color defects that could occur are – difference of the colour of final produced garment to the sample shown, accessories used are of wrong colour combination and mismatching of dye amongst the pieces.
- ❖ **Sizing defects** - Wrong gradation of sizes, difference in measurement of a garment part from other, for example- sleeves of 'XL' size but body of 'L' size. Such defects do not occur has to be seen too.
- ❖ **Garment defects** - During manufacturing process defects could occur like faulty zippers, irregular hemming, loose buttons, raw edges, improper button holes, uneven parts, inappropriate trimming, and difference in fabric colour.

The following are the three various types of defects identified and Coorrective action required on these in these sewing section:

6. No matching of seam.
7. Unexpected materials are attached with the sewing.
8. Not sewn by matching face side or back side of fabrics.
9. Use of wrong stitch type.
10. Wrong shade matching of sewing thread.

Assembly Defects: (1 upto 9)

1. Defected finished components by size i.e. imperfect size and shape of finished components.
2. Imperfect garments size.
3. Use of wrong ticket.

Assembly Defects:(Continued)

4. Missing of any parts or predetermined design of garments.
5. Imperfect alignment of components i.e. (button, hook and so on) in proper place.
6. Wrong placing or creasing of interlining.
7. Looseness or tightness of interlining.

8. Folding of any parts of garments that is seen to bad appearance.

9. Shade variation of garments.

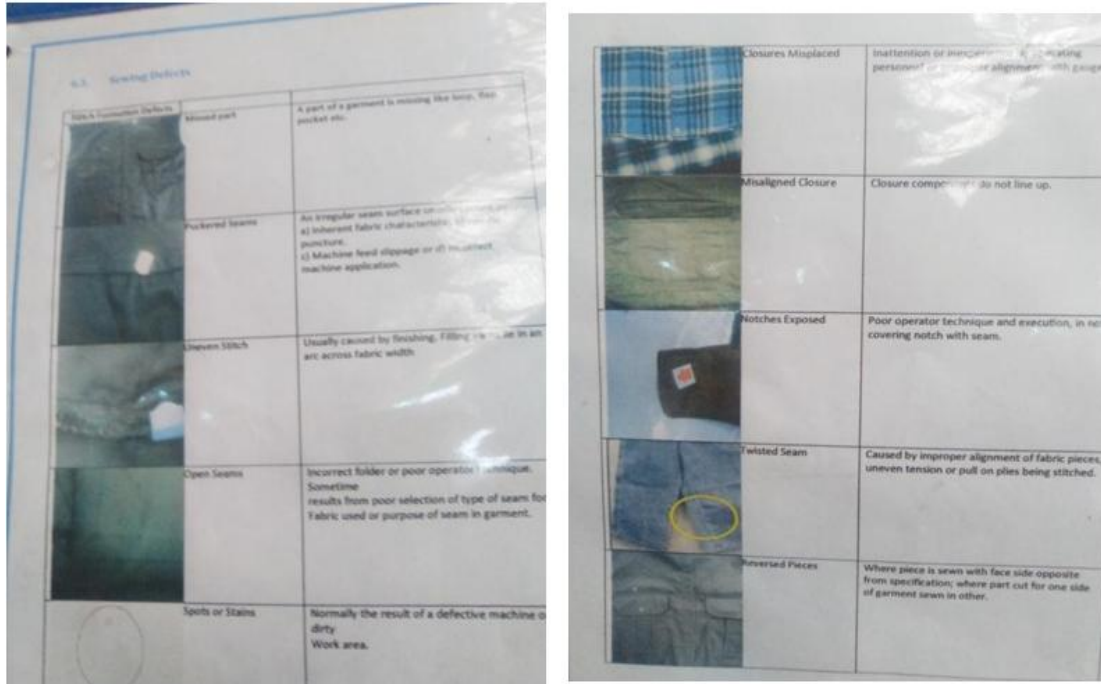


Figure 4 some of defects and their causes (photo taken from Gullele Garment, Addis Ababa, 2018)

Date	Broken Stitch	Skip stitch	Puckering	Uneven stitch	Hole/Damage	Button	Raw edge	Up and Down parts	Shape out	Wrong size	Twisting	Shading	Total Pcs Checked	No of Accepted Pcs	Defective pcs/Rectified Pcs
8-Oct-19						4							41	37	4
11-Oct-19	1												27	26	1
13-Oct-19													23	23	0
17-Oct-19													94	94	0
18-Oct-19	3	2						2					61	54	7
20-Oct-19	2			13							3		220	202	18
21-Oct-19	1			10					3				246	232	14
22-Oct-19	4				3			12			7		588	562	26
23-Oct-19	9		9						1	5			623	599	24
24-Oct-19	6				1		1	20	1	6			579	544	35
25-Oct-19	6							14			9		355	326	29
27-Oct-19	3				2			22					503	476	27
28-Oct-19	6				1			28	1	4			588	548	40
29-Oct-19	6	1			3			9					1012	983	19

30-Oct-19	3							4			2		750	741	9
31-Oct-19	7		2		4					3			1004	988	16
1-Nov-19	3									2		1	350	346	6
3-Nov-19	2				1					1		6	129	118	10
4-Nov-19	2												124	122	2
5-Nov-19	10												630	620	10
6-Nov-19	11			11								1	712	689	23
7-Nov-19	6												54	48	6
19-Nov-19	3	3										4	140	130	10
20-Nov-19	1	3											99	95	4
21-Nov-14													12	12	0
22-Nov-19		1											77	76	1
24-Nov-19	1	6			1				1				121	112	9
25-Nov-19	2	2						1					76	70	5
26-Nov-19		1											40	39	1
29-Nov-19						1	1	2					110	106	4
Total	98	19	11	34	16	5	3	114	10	17	25	8	9388	9018	360

The data collected numbers of defected over the past 2 months (October-November, 2019)

Data collection and analysis

Table-2 Defect category-wise and percentage defectives in the sewing department

Types of Defects	Sewing cumulative Defects	Percentage defects (%)
Broken Stitch	98	27.20
Skip Stitch	19	5.28
Puckering	11	3.06
Uneven stitch	34	9.44
Hole/damage	16	4.44
Hook & Bar/Button	5	1.39
Raw edge	3	0.83
Up and Down parts	114	31.70
Shape out	10	2.78
Wrong size	17	4.72
Twisting	25	6.94
Shading	8	2.22
Total	360	100%

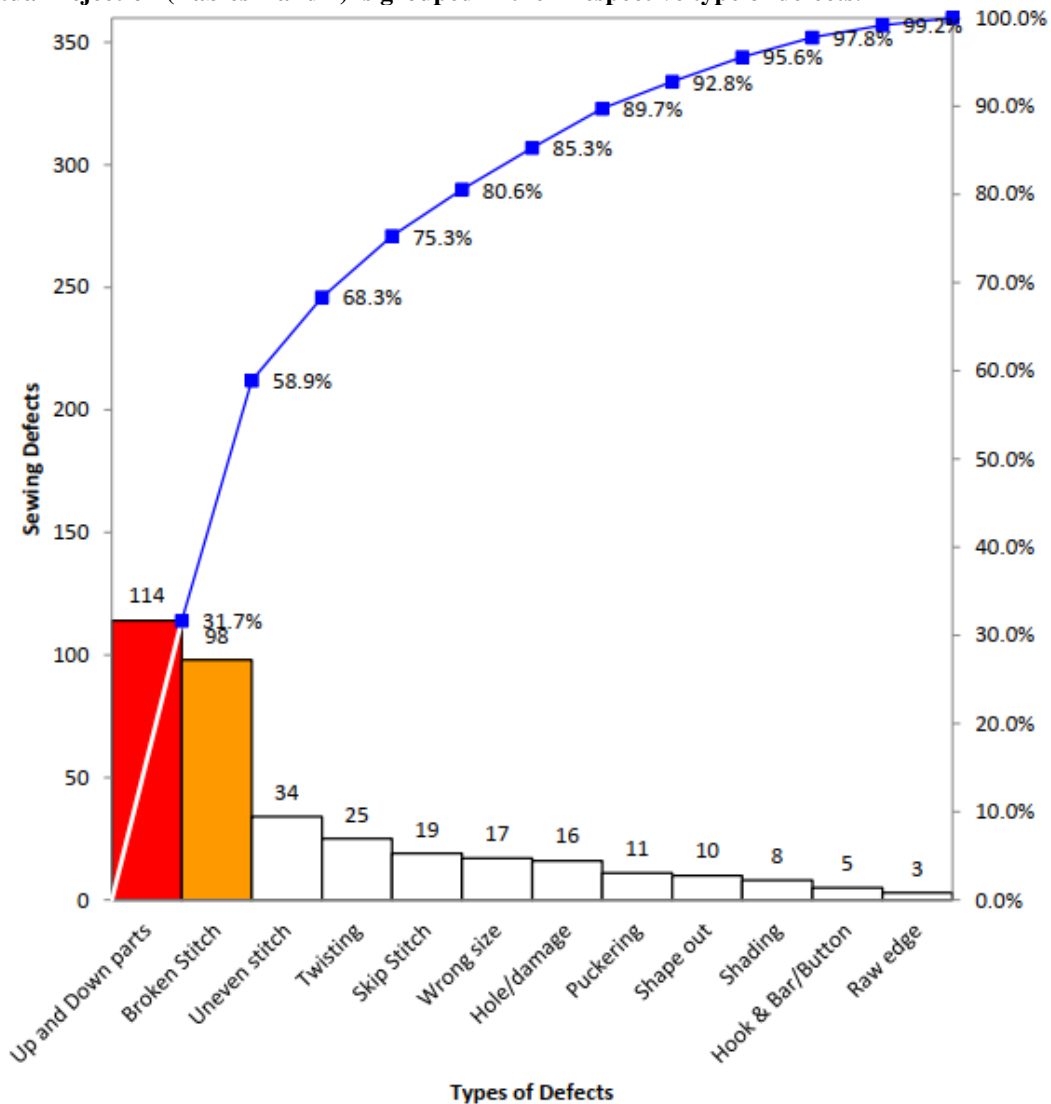
Pareto Analysis and Cause & Effect Diagram
Pareto chart

Quality problems appear in the form of loss, imperfection or defective items and their cost. It is extremely important to clarify the distribution pattern of the loss. Most of the loss will be due to a very few types of defect, and these defects can be attributed to very smaller number of causes. Thus, if the causes of these vital few defects are identified, we can eliminate almost all the losses by concentrating on these particular causes, leaving aside the other trivial many defects for the time being. By using the Pareto diagram, we can solve this type of problem efficiently. Pareto chart

isa special type of bar chart where the plotted values are arranged from largest to smallest. A Pareto chart is used to highlight the most frequently occurring defects, the most common causes of defects, or the most frequent causes of customer complaints. Juran was the first person to point out that the Pareto Principle could be used to quality improvements. The basis is to identify the important vital few from the trivial many.

In this paper to identify the main problems which cause frequent defects of sewing process of Gullele garment, a two months data had been collected (viz., October and November, 2019).

The Actual Rejection (Tables 1 and 2) is grouped in their respective type of defects.



PARETO ANALYSIS (Above Fig)

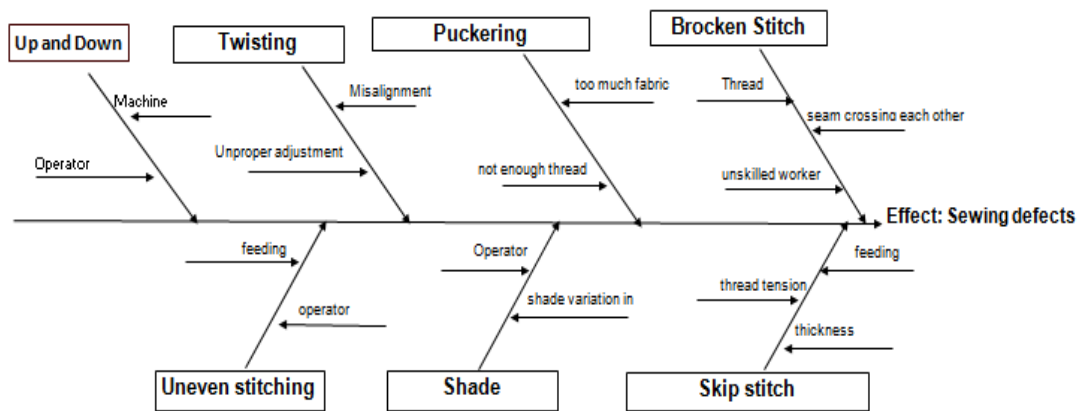
Upon viewing to the above Pareto diagram it shows us the vital views of Gullele Garment were identified. The Process quality of this company has been significantly affected by **Up and down** parts which cover overall 31.7% defects. Consequently, the broken stitch which is 27.2% is thesecond most defects observed from the result. Those two critical issues should be discussedbelow by Cause and Effect Diagram.

According to the above Pareto diagram the Up and down parts are the most frequent defects with asmuch as 31.70% of the total as shown in Figure 3. Among other defects contribution of brokenstitch is 27.20%, uneven stitch is 9.44%, twisting defect is 6.94% and skip stitch covers 5.28%.

These five types of defects are the “vital few” factors that cause 80.6% of total rejection in

thesewing process of Gullele Garment. Other reasons for defects are wrong size, hole/damage,puckering, shading, shape out, raw edge, hook & bar/button and joint stitch etc. The table 2shows the percentage of each type of factors for defects in the process with a line of cumulativepercent.

The cause-and-effectdiagrams were constructed by researcher and through brainstorming sessionsinvolving all employees taking and activities. **Figures 4, showsthe cause-and-effect** diagrams for the visual defects and physical defects. The root causes ofthese three visual defects (working method, material, operator experience) and two physical defects (Machine and Equipments)are affecting very largely the ultimate quality of Gullele garment industries.



Figures 4, Cause and Effect Diagram /Fishbone Diagram

IV. RESULT AND DISCUSSION

Based on the Pareto principle analysis of 80/20 rule, in sewing process department it is observed that the defect so called ‘**Up anddown parts**’ranked number -1of all defects by 31.70 %, then ‘**Broken stitch**’ is in the Second positionby 27.20 % ofdefects, then ‘**Uneven stitch**’ as third ranked by 9.44 % then ‘**Twisting**’ type defect isranked fourth contributing 6.94 % and ‘**Skip stitch**’by 5.28% of defects.

The above shows that the top priority defects through the CED methodology has been used to identify theroot causes in different processing steps of the production garment.Application of CED Diagram in garment Manufacturing Industry creates new chances forachieving a better quality of products (final and intermediate) and higher productioneffectiveness. This can be accomplished by extraction and

visualization of the knowledge hiddenin the recorded past data.

However, some recommendation to control defective items from the factory were suggested as follows ,

To make the workplace clean: - From fabric store, cutting section, sewing section, to washing and finishing.Place material system in proper place. This refers that sufficient numbers of inspectors, trainedcheckers, proper reporting,as well as analysis of reports and take Corrective action based onthe feedback system and reports.

To Conduct training program for the inspectors on how to check piececorrectly to capture defective pieces.

To Train personnel to make garment checking reports. To Runquality awareness program for employees. Quality standard must be understood by allemployees and everybody has to work to meet quality goal. In sewing line by not

allowing operators/Workers to keep bundles open and each bundle must be completed before forwarding to the next stages. Sometimes operators throw pieces under tables during the movement create ambiguity during process by mixing defective one with good materials moved to next stage for further operation. Nobody keeps track of

these missing pieces until they found shortage of garments in finishing. Set standard operating procedures (SOP) for each task performed by workers is necessary to maintain quality control system in each and every department.

Recommended Corrective Action for sewing defects

Defect Types	Rank	Root cause	Corrective Action
Up and Down Parts	1	<ul style="list-style-type: none"> Carelessness of operator Poorly attachment of bottom and top part of m/c 	<ul style="list-style-type: none"> Improve dimension of bottom or top stop Giving attention for the respective operation
Broken Stitch	2	<ul style="list-style-type: none"> Broken thread Incorrect thread tension Abrasive handling of pieces 	<ul style="list-style-type: none"> Training workers to handle the garment properly Thread trimming should not be done aggressively Manage the thread feed and tension
Uneven Stitch	3	<ul style="list-style-type: none"> Feeding Operator Pressure 	<ul style="list-style-type: none"> Speed control Use proper pressure with skilled human labor
Twisting	4	<ul style="list-style-type: none"> Misalignment Trimming Lack of adjustment Poor operator 	<ul style="list-style-type: none"> Sewing operator should match the front and back properly so they come out the same length. Notches might be used to ensure proper alignment. Ensure that operator does not trim off the front or back with scissors to make them come out the same length. Make sure the sewing machine is adjusted properly for uniform feeding of the top and bottom plies.
Skip stitch	5	<ul style="list-style-type: none"> In correct thread tension Use of bent needles 	<ul style="list-style-type: none"> Use reinforced needles Set the needle guard to ensure needle clearance Manage thread tension

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