A Major Project Report
On

“COST ANALYSIS OF POOR QUALITY IN APPAREL MANUFACTURING – A Case Study”

Submitted for the award of the degree of

Master of Business Administration (Executive)

by

ABHIJEET GOKHALE

2K13/MBA/501

Under the guidance of

Dr. R. S. Walia, Associate Professor and

Mr.Mohit Tyagi, Assistant Professor

Delhi School of Management
Delhi Technological University

Session – 2013-2015

CERTIFICATE

This is to certify that the project entitled “Cost Analysis of Poor Quality Apparel in Apparel manufacturing - A case study” has been successfully completed by Abhijeet Gokhale, Roll No – 2K13/MBA/501

This is further certified that this project work is a record of bonafide work done by him under our guidance. The matter embodied in this report has not been submitted for the award of any degree.

(Supervisor)
Dr. R.S. Walia
Associate Professor
Dept. Mechanical and Production Engineering
Delhi Technological University
Bawana Road, Delhi-110042

(Supervisor)
Mr. Mohit Tyagi
Assistant Professor
Dept Mechanical and Production Engineering
Delhi Technological University
Bawana Road, Delhi-110042

DECLARATION

I hereby declare that the project report entitled “Cost Analysis of Poor Quality in Apparel manufacturing -A Case study” is submitted by me to Delhi School of Management, Delhi Technological University in partial fulfillment of the requirement for the award of the degree Master of Business Administration (Executive) is a record of project work carried out by me under the guidance of Dr. R.S.Walia (Associate Professor) and Mr. Mohit Tyagi (Assistant Professor). I further declare that the work reported in this project has not been submitted for the award of any other degree in this institute or any other institute or university.

Abhijeet Gokhale
Roll no. – 2K13/MBA/501
Student – Master of Business Administration (Executive)
Delhi School of Management
Delhi Technological University
Bawana Road, Delhi - 110042

ACKNOWLEDGEMENT

It is great pleasure for to acknowledge a debt of gratitude to Dr. P.K. Suri, Professor and Dean – Delhi School of Management, Delhi Technological University for his valuable contribution to the project.

As is the role played by an anchor in the ship, the same has been played by Dr. Rajan Yadav, Associate Professor and Coordinator, EMBA program of Delhi School of Management, Delhi Technological University without whom the project would not have been in the present state. So, my sincere regards to him as well.

I would like to thank my guides for the project work Dr. R.S.Walia and Mr.Mohit Tyagi for their tireless support throughout this project. This research work would not have seen the light of the day without their sincere efforts and guidance.

Last but not the least, I would like to thank my office colleagues Mr. Kuldeep Sharma and Mr. Mukesh Maurya to have worked with me day in and day out to make this project a grand success. My sincere thanks to them.

Abhijeet Gokhale
Roll no. – 2K13/MBA/501
Student – Master of Business Administration (Executive)
Delhi School of Management
Delhi Technological University
Bawana Road, Delhi - 110042

Abstract

Indian apparel industry is going through tough times due to uncertainty in global markets. The competition from neighboring apparel manufacturing countries like China, Bangladesh, and Vietnam is ever increasing and thus it is very important to be price competitive. The buyer's are squeezing exporters in quality parameters, delivery lead times and prices. Unfortunately Indian apparel industry is plagued not only by low productivity levels but also because of losing lot of money on account of poor quality. on an average the organizations lose about 25-30% of manufacturing cost due to poor quality .In the organization understudy it is observed that the cost of poor quality is as high as 30%. In Apparel industry the objective of reducing quality related costs can only be achieved if the organizations reduce their rejection rates and eliminate expenses on rework/ repair. As quality is one of the least understood subjects in Apparel Industry, the problem lies in the fact that this money spent is hidden and due to delivery pressures only a handful of organizations are able to focus on reducing such expenses .In such a situation it thus becomes very important for the organizations to focus on improving quality standards and reduce quality costs. This research paper is an attempt to make the industry aware about the implications of poor quality on their respective organizations and in the industry as a whole and suggests ways to reduce the cost of poor quality. This research paper focuses on calculating the cost of poor quality and addresses the areas with major quality failures and provides suggestions to reduce such failures with simple yet effective measures.

Index

Chapter 1

1.1 Introduction

Indian apparel industry is amongst the most important industries in focus these days .The apparel and textiles industry plays a very important role in the Indian economy. Textile & apparel industry contributes to about 4% of country's GDP. This industry plays an important role in Indian industrial scenario because it provides employment to less educated strata. It has unique job creation ability and the direct and indirect manpower associated with the industry is in excess of 90 million. Due to the announcement of "Make in India " policy by our prime minister, most of the buyer nations are eagerly looking towards India for exploring further business opportunities.

The industry however is going through serious challenges due to low productivity and poor quality standards. Indian apparel industry is losing out on competition to its rivals like China, Bangladesh and Vietnam. It is high time that the industry learns from its mistakes quickly and a serious thought is given to improve efficiency and quality. The customer is pushing for price reduction and squeezing lead times. The lead times have gone down from 120 days till a few years back to 60 days now. Apart from squeezed lead times the input costs have increased drastically in last few years. In such a situation, to be competitive the managers have to find a mechanism to produce better, faster and at a lower cost as compared with their counterparts. As the government is also not providing any major benefits to the exporters as compared with the other countries like Bangladesh, Vietnam etc, the industry is in immense pressure to deliver results. Due to this it becomes imperative for the exporters to improve their internal work environment and focus on productivity improvement techniques.

It has been observed that industry is plagued by its “chalta hai” attitude where the employees are not aware and those who are aware are least bothered about the serious challenges the factory faces. The manpower is largely un-educated to understand the requirements of the customer, also there are no training programs in the organizations to improve the awareness. In light of this it becomes very important for the plant managers to take responsibility in their own hands and lead from front to bring about change in the mindsets of the employees. Factory owners should give immense importance to quality and it is high time it is treated as an important parameter to be considered as key result area.

Quality is one of the most ignored subjects in the industry. It will not be wrong to say that Quality control department is an eyewash in majority of organizations and it prevails more to please buyers and buying houses rather than for a serious role. Quality team in most organizations report to factory managers, who are bothered about deliveries and completing orders on time and are least bothered about the product quality Unfortunately most of these managers and factory do not really know the money that gets drained away due to poor quality. The cost of poor quality starts from fabric stage and goes up till packing. Factories are losing out money on air freights and short shipments on account of delays due to poor quality.

Another very critical factor that is ruining the factory is the “Chalta hai “attitude and “ Unnis Bees “.Chalta hai attitude is especially prevalent in the factories located in north India .The employees are not proactive and think that whatever they produce will get shipped irrespective of how bad it is. This psyche is in everybody’s mind and is the main cause of the poor shape of industry. The first reply to every question is “Itna to chalna chahiye” .Another thing that is killing industry prestige is the attitude about working as per own whims and fancies. There is a mass attitude about tolerance level and the

first thing people do in case of not meeting standard is saying " sir chalna chahiye , yeh to unees bees hai ".

Time has come when the industry as a whole goes through a complete makeover and an industry wide quality revolution is triggered. On one hand other industries are targeting Six Sigma and following Taguchi's philosophy, we are struggling to achieve basic standards like AQL 2.5. Time has come when the employees of this industry take quality seriously and improve their mindsets and think afresh about quality and its importance, else there is a possibility that the apparel business will get wiped out from India in years to come.

1.2 OVERVIEW OF INDIAN TEXTILE INDUSTRY

India Textile Industry is amongst the leading textile industries of the world. It was largely an unorganized industry till a few years back, but the scenario has started to change after the liberalization of Indian economy in the year 1991. The opening up of economy has given the much- needed thrust to the Apparel and textile industry, which has become one of the biggest in the world.

Table 1.1 Top Ten Textile Exporting Countries

TOP TEN TEXTILE EXPORATERS TO THE US IN JAN-APRIL 2014			
COUNTRY	**APRIL 2013**	**APRIL2014**	**% CHANCE**
CHINA	11,412	11,490	0.68
VIETNAM	2,667	3,081	15.51
INDIA	2,215	2,347	5.96
INDONESIA	1,917	1,838	-4.11
BANGLADESH	1,781	1,778	-0.21
MEXICO	1,473	1,487	0.97
PAKISTAN	982	1,006	2.44
CAMBODIA	873	891	2.12
HONDURAS	725	745	2.87
SALVADOR	544	568	4.31
WORLD	31,464	32,894	3.23

India textile industry depends a lot on textile and apparel export. It also plays a pretty important role in the Indian economy. The country earns about 27% of its total forex through textile and Apparel exports. The textile and Apparel industry of India contributes to about 14% of the industrial production of the country. It contributes to around 4% to the GDP of the country. India textile and Apparel industry is also the second largest in the country in terms of employment generation. It also generates job avenues for the other ancillary sectors. India textile industry currently generates employment to more than 45 million people.

Current Scenario

The Indian Textiles and Apparel Industry has immense presence in the economic life of the country. It not only provides the basic necessities of life, but also plays a key role by contributing towards industrial output, employment creation, and the export earnings for the country.

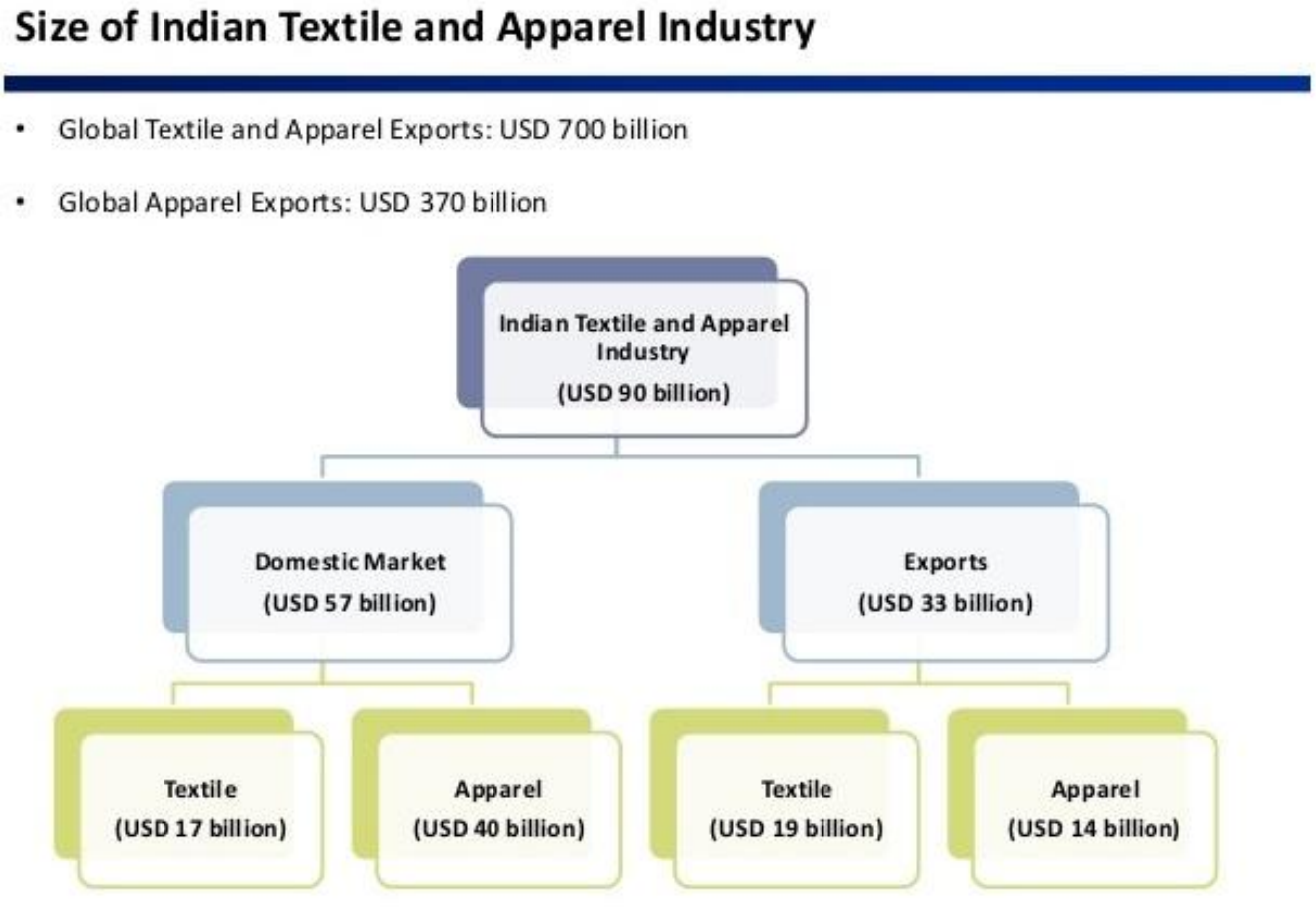

Figure 1.1 Indian Textile Market

The sector contributes to about 14 per cent of industrial production, 4 per cent to the gross domestic product (GDP), and 17 per cent to the country's export earnings. It provides direct employment to over 45 million people. The textiles sector is the second largest provider of employment after agriculture. Thus, the growth and all round development of this industry has a direct bearing on the improvement of the economy of the nation.

India has the potential to increase its textile and apparel share in the world trade from the current level of 4.5 per cent to 8 per cent and reach US$ 80 billion by 2020.

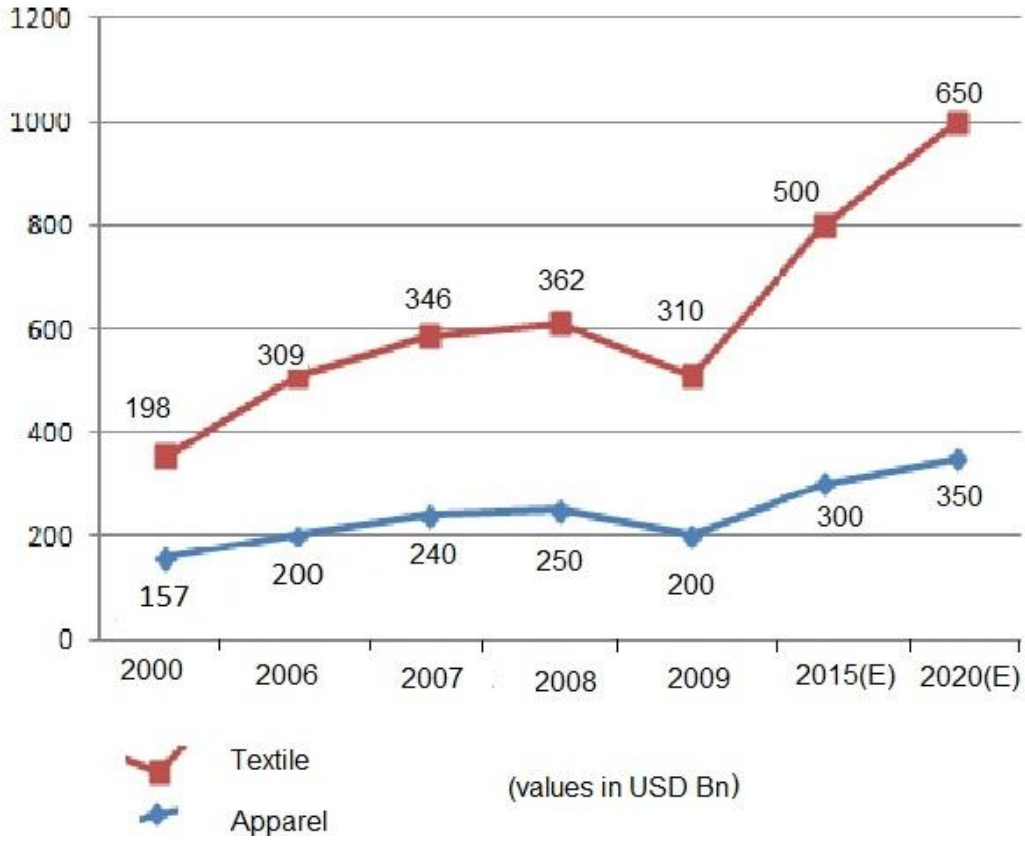

Figure 1.2 Textile Apparel Progress

1.3 Government Initiatives and Regularly Framework

Initiatives

The Government of India is promoting the industry by implementing numerous export promotion policies for Textile & Apparel sector in the Union Budget 2014-15 and the current Foreign Trade Policy. This includes the various incentives provided under Focus Market Scheme and Focus Product Scheme. The government is adopting various measures for textile products like extension of Market Linked Focus Product Scheme etc. to increase the Indian shares in the global trade of textiles and clothing. The various schemes and promotions by the Government of India are as follows -

It has allowed 100 per cent Foreign Direct Investment (FDI) in textiles.

Welfare Schemes*:* The Government has offered health insurance coverage and life insurance coverage to 161.10 million weavers and ancillary workers under the Handloom Weavers' Comprehensive Welfare Scheme,

Around 7 lac artisans were provided health coverage under the Rajiv Gandhi Shilpi Swasthya Bima Yojna.

E-Marketing*:* The Central Cottage Industries Corporation of India (CCIC), and the Handicrafts and Handlooms Export Corporation of India (HHEC) have developed a number of e-marketing platforms to simplify marketing issues. Also, a number of marketing initiatives have been taken up to promote niche handloom and handicraft products with the help of 600 events all over the country

Skill Development*:* As per the 12th Five Year Plan, the Integrated Skill Development Scheme aims to train over 2,675,000 people within the next 5 years (this would cover over 270,000 people during the first two years and the rest during the remaining three years). This scheme would cover all sub sectors of the textile sector such as Textiles and Apparel; Handicrafts; Handlooms; Jute; and Sericulture. Credit Linkages: As per the Credit Guarantee program, over 25,000 Artisan Credit Cards have been supplied to artisans, and 16.50 million additional applications for issuing up credit cards

have been forwarded to banks for further consideration with regards to the Credit Linkage scheme.

Financial package for waiver of over dues: The Government of India has announced a package of US$ 604.56 million to waive of overdue loans in the handloom sector. This also includes the waiver of overdue loans and interest till 31st March, 2010, for loans disbursed to handloom sector. This is expected to benefit at least 300,000 handloom weavers of the industry and 15,000 cooperative societies.

Textiles Parks*:* The Indian Government has given approval to 40 new Textiles Parks to be set up and this would be executed over a period of 36 months. The new Textiles Parks would leverage employment to 400,000 textiles workers. The product mix in these parks would include apparels and garments parks, hosiery parks, silk parks, processing parks, technical textiles including medical textiles, carpet and power loom parks.

Policy and regulatory framework

The Ministry of Textiles is responsible for policy formulation, planning, development, export promotions and trade regulation in the textile sector. This includes all natural and manmade cellulosic fiber used to make textiles, clothing, and handicrafts. National Textile Policy, 2000 -the policy was introduced for the overall development of the textiles industry. The key areas of focus Include Technological upgrades, Enhancement of productivity, Quality consciousness, Strengthening of raw material base, Product diversification , Increase in export and innovative marketing strategies ,Financing arrangements, Increasing employment opportunities, Integrated human resource development.

1.4 Organization Profile

Super Overseas Private Limited

Company Overview:-

Super Overseas Private Limited (SOPL) traces its roots back to 11 years, Established in 2004, it was amongst the first in India to manufacture Mercerized Garments, largely considered to be one of the toughest product categories. Company has since expanded its repertoire to a wide spectrum of Ladies', Men's and Children's fashion knitted garments Specialty in garment dyes, washes, knit/woven mixes and embroideries

Over the years, SOPL has attained a reputation for uncompromising quality in 'top of the line' knitwear, employing the best available fabrics/yarns SOPL has learnt to harness its design expertise, strong infrastructure base and focused product profile to deliver a high quality product that reflects the strong commitment of our company to our clients

Company prides itself on its long-term relationships with several customers that have shown sustained growth over a period of time

This is a testament to organizations strong focus on client servicing, quality, product development, and adherence to timelines

Company supports community based projects that are environmentally friendly, such as providing waste paper & fabric to recycling projects

Currently operating out of two units situated proximal to one another, in the Hosiery Complex in Noida

Unit I has been approved for manufacture by several buyers, including Target Corporation, VF Corporation, Esprit (ITS), Miss Selfridges (ITS), George - Asda (Bureau Veritas) and Guess? Inc. (Bureau Veritas), Li & Fung among others. Unit II is completely on-line and compliant since 2011 and approved by Li & Fung

Company is compliant with all generally accepted Environmental, Technical & Social requirements, and is a member of Sedex

SOPL has Monthly capacity of 120,000 pieces, Operations: 300 sewing machines, 2 washing & dry cleaning plants

In-house testing Lab Capacity scheduled to double by June 2015

Key Customers:-

Figure 1.3 Key Customers

Products:-

Fashion

We cater to customers in the United States and Europe where we contend with quick deliveries and rapid changes in order to meet the requirements of trend-setting labels. Constant input from our in-house design team and support from the merchandizing department helps ensure complete client servicing throughout the product development cycle

Retail

Years of catering to major retailers in the United States / Europe has honed our expertise in sourcing the right fabric at competitive prices with optimum efficiency in sewing to make market-relevant product for major retailers worldwide

Specializations:

Embellished Products: Sequins/Beads, Handwork, etc.

Garment Dyeing & Washes: Pigments, Acid, Snow, Cold Pigment, Sulfur Dyed Acid, Bleach, Pigment Enzyme, Stone, Discharge Spray, Chemical spray etc.

Others

Jacquards

Stripes

All Over Prints

Textures (Popcorns, Rice Knits, Thermal, Waffle Knits)

Solids

Blends, Natural and Man-Made Fibers

Interlocks

Double Faced Jerseys

Mercerized Fabrics

Products-

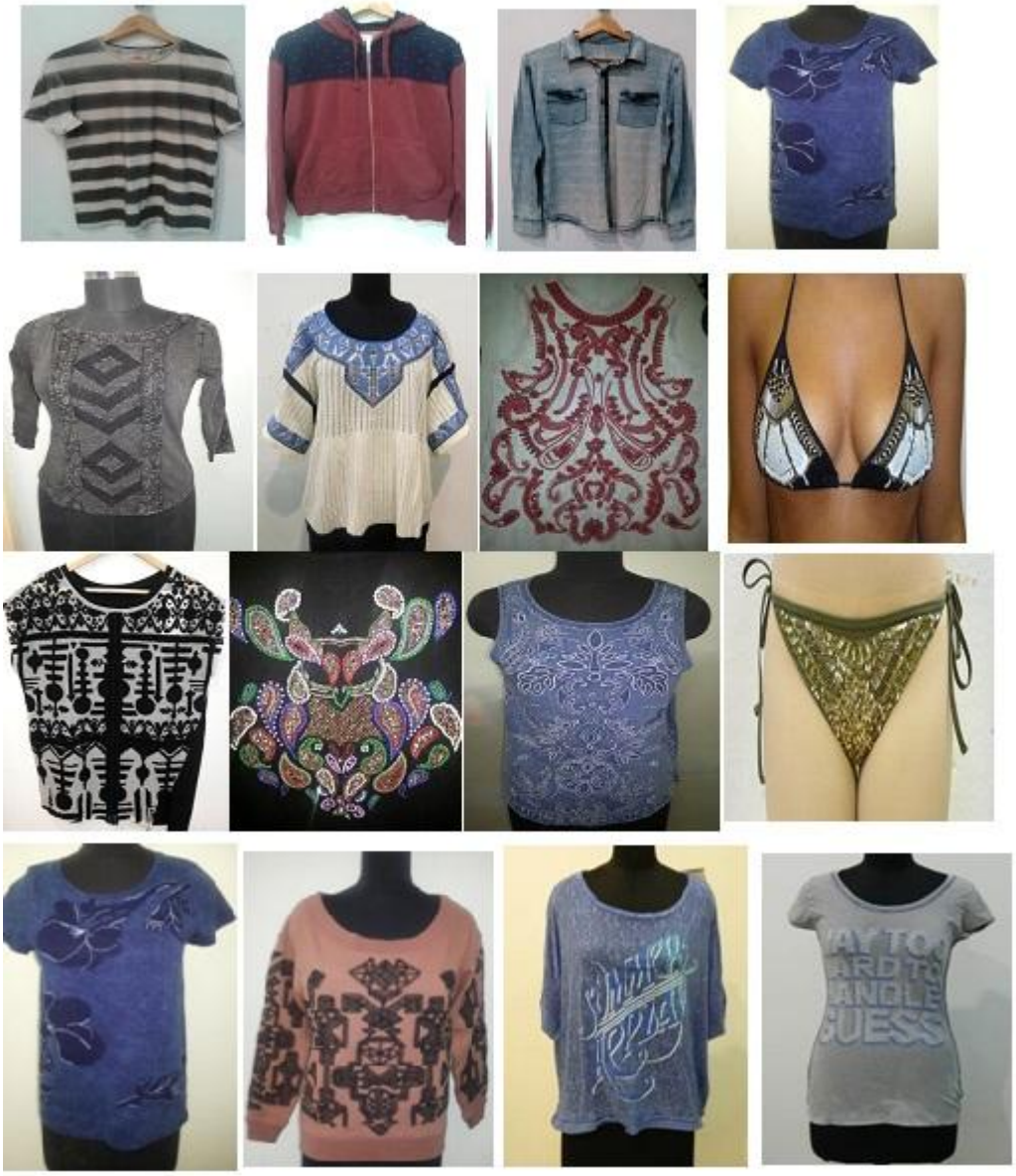

Figure 1.4 Products

Chapter 2

2.1 Background of Research Work

For this research work I have selected a mid-sized apparel export organization manufacturing readymade garments in fine knits. The organization has sales turnover of $ 10 million USD and is dealing with top notch global customers. The organization has decent manufacturing set up but lack in quality orientation. The organization is facing lot of quality related issues in last one year and the business owner is getting lot of flak from buying agencies on account of quality failures. The organization does not have any statistical quality control measure and is not at all aware of the DHU levels. The QA's are literally working as final checkers and are most of the times involved in rechecking of goods. The organization is surviving because of their design inputs and good marketing skills of business owner.This research work is carried out to assess the quality related issues with the organizations like SOPL and try to improve the quality levels and cut down poor quality related expenses .

2.2 Research Methodology

A comprehensive literature review was carried out on Cost of Quality.

1. Selecting an apparel manufacturing organization to carry out research work.
2. Study of the current quality system in factory.
3. Data collection from end of the line stage of cutting, sewing & finishing departments.
4. Analysis of the data for one style.
5. To carry out Pareto analysis to understand major contributors to the problem
6. To carry out root cause analysis
7. To calculate cost of poor quality

8. To suggest methods to reduce quality failures and manufacture product right the first time

Research Methodology

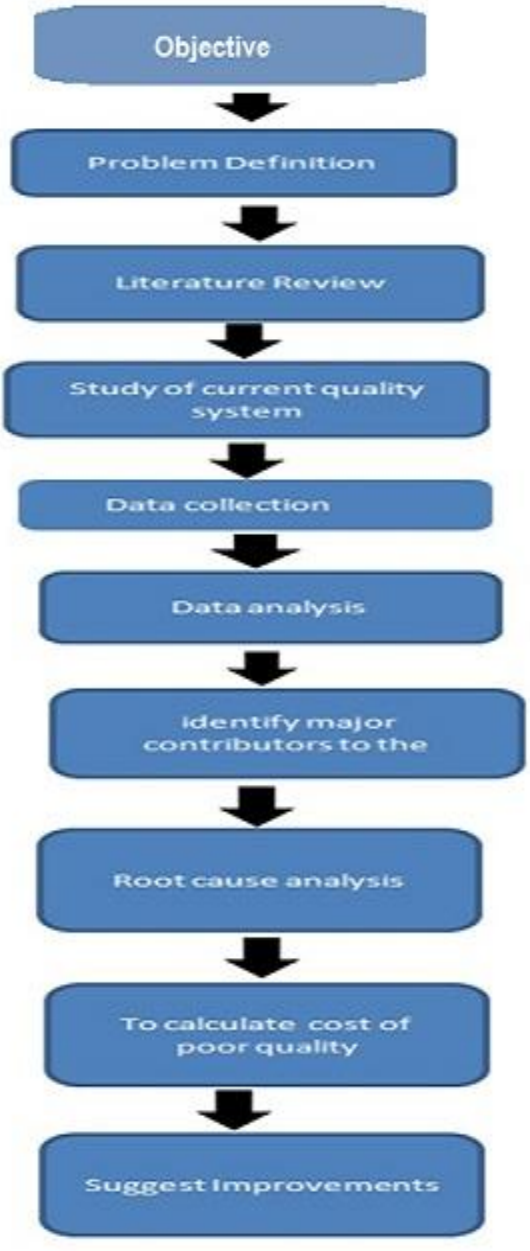

Figure 2.1 Flow chart for Present Research

Chapter 3

Literature Review

"Managers and workers speak the language of things but senior leaders speak language of money..

….COPQ allows us to translate the things into money (JURAN), 1970

Quality can be defined as meeting the requirements of the customer or customer satisfaction. Quality can also be termed as fitness of use. Quality concept talks about delivering a product or service which fulfills the requirement of the customer as stated by him.

As per Garvin, the eight dimensions of quality are performance, conformance, reliability, durability, serviceability, aesthetics, features,

Some of the definitions given by quality Gurus are

"Quality is fitness for use"…..Joseph Juran,(1988)

Joseph Juran ,(1988) suggested that Quality is fitness of the desired product or service which the customer is buying or availing for its use. Joseph Juran,(1989) suggested management involvement, Quality planning, Quality control and quality improvement as methodology for improvement..

"Quality is conformance to specifications"….Edward Deming,(1986)

In this definition Edward Deming talks about meeting the buyer's set specifications with regards to products dimensions and features, durability and aesthetics, reliability and performance. Deming has suggested use of statistics, process orientation, driving out fear and reduction of variation in the processes as suggested methodology for achieving Quality.

"Quality is conformance to requirements"…..Philip Crosby(1979)

Philip Crosby,(1979) focuses on the concept of quality with regards to the customer focus. He talks about meeting or delivering the product or service which meets the requirements of the customer. Philip Crosby talks about Zero Defects, Cost of quality and hidden factory in his book Quality is free.

“Quality is what customer says”…….Feigenbaum,(1961)

Feigenbaum,(1961) has also stressed on the customer focus and he says that quality is what customer desires. Fiegenbaum ,(1961) suggest total quality system and to design quality in customer orientation.

Another famous scientist Ishikawa has suggested use of statistics, quality circles and Involvement of employees to achieve quality objective.

Definition of Quality as per ISO is “Quality is the totality of features or characteristics of a product or a service that bear on its ability to satisfy stated or implied needs of the customers”

Internal and external Customers

As the entire quality concept is centered on customer, it is important to know that the customer is not always the final customer. The customer in quality means anyone who is has an effect or impact by the service or the product. In manufacturing of Apparels for example Sewing Department is a customer for Cutting department as poor cutting quality will directly impact the sewing quality, similarly for sewing department, finishing department is the customer as poor sewing quality will directly impact finishing quality. All these are called as internal customers. To achieve good quality it thus becomes imperative for each department to satisfy their immediate customer. Also it is important to note that the poor quality does not only impact the department which is receiving the product; it impacts other department as well. If sewing department passes on poor quality to finishing than it may lead to alterations and obviously will require more material and labour, which will impact HR, Purchase and finance departments.

External customers include the final customer, buying agencies, third party auditors or the inspecting authorities including the government bodies. These are the people who inspect goods and make a final call on product quality.

Cost of Quality

The cost which an organization incurs on producing an acceptable quality product is called as cost of quality. The organization in order to produce good quality develop an internal system or internal control mechanism like quality audit procedures, internal performance labs, building a quality team etc. There is obviously an expense on all these events. On the other hand in manufacturing of apparel industry there are certain defects which arise during manufacturing. All these defects are required to be rectified to make the garment shippable or acceptable. The costs incurred on repair of these goods like material cost, labour cost, power costs, etc.

Cost of quality can be categorized as

Internal failure cost – These are the costs which are related with various defects that are detected before handing over the product to the buyer. These are the expense which would become zero if there are no defects in the products being shipped. The main areas of such costs are

Rejects/Scrap – The expense on producing something which cannot be shipped is called as Rejects/scrap. These cost a lot of money as due to poor quality practices in the industry it is observed that the rejection is found out at a stage when most of the manufacturing work is already carried out. In apparel industry maximum rejection is found out in the finishing area, after entire good are cut and stitched. Obviously this leads to major drainage of money. The prime expense due to repair work include material cost, labor cost, electricity, overtime and other overheads.

Rework/Repair cost – This is the cost which the factory bears on repairing/alteration work or to make product shippable. This cost involves labor cost for repair work and cost spent on material and overheads.

Down Grading – Downgrading means that the material cost for making the product is the same but due to poor manufacturing quality the product cannot be sold as fresh and is downgraded as second quality or seconds.

Inspection costs – This includes cost for rechecking, inspection, repacking.

Air freights – This is the cost which is incurred as the shipments fail to meet the deadlines due to poor quality and are required to be shipped by much more expensive airways. The airfreight costs amount to more than 5% of the total costs in unorganized set ups.

External Failure Costs

External failure costs are the costs which a organization has to bear due to poor quality on account of failures in DC inspections. These are the costs for the defects found by the customer. The customers levy discounts or claims due to bad quality of goods. The main elements of such costs are

Claims / Return to vendor costs

Discounts

Loss of reputation and losing out on future business

Appraisal Cost

These are the costs incurred on account of finding defects or checking. These include

Review of specifications

Inspections and audits

Maintain quality related records

Prevention Cost

These are the costs which an organization spends on initiatives to improve the standards. These costs are on account of

Imparting training for better understanding of the product requirement

Quality drives and programs to reduce defectives

Implementation of tools and techniques for reducing manufacturing flaws and improve processes.

Hidden Costs –

Traditional cost of poor quality comprise of wastes, rejects, and testing costs, rework cost, customer returns, inspections costs and cost due to recalls. One would be astonished to know that such costs are just the visible costs but in reality these are just the tip of the iceberg. The major amount of the spending goes on areas like Excessive overtime, excessive field and services expenses, shortfalls and losses due to short shipping, unused capacity and late start of future orders also affects future orders, excessive employee turnover, high premium freight costs and delay in receipt of payments are the other hidden expenses which are killing for an organization.

Juran(1988) in his book" Quality planning and analysis" has written about the hidden quality costs.

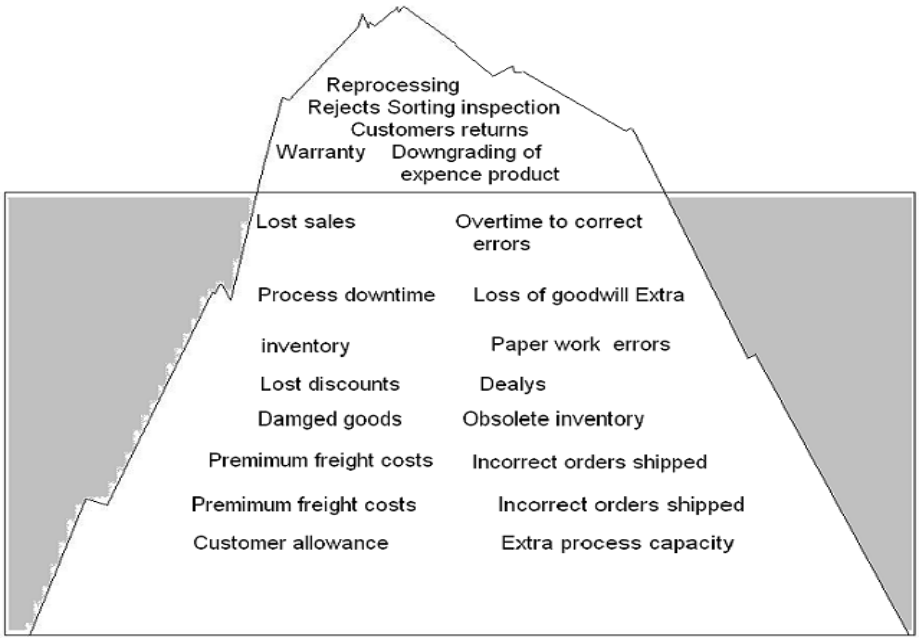

Figure 3.1 Hidden Quality Cost as per Juran(Qualiy Planning and Analysis)

Md. Mazedul Islam, Adnan Maroof Khan and Md.Mashiur Rahman Khan (2012) in their research article “Minimization of reworks in quality and productivity improvement in the apparel industry” have carried out research work to review the defect rate in sewing department of apparel industry. In their research work they observed that initially the DHU level was as high as 60% to 80% in the initial period when no quality system prevailed. As soon as the quality systems came in place the DHU levels reduced up to 10 % over a period of one month. Also they carried out root cause analysis and suggested improvements in the sewing area. This paper gives insights above methodology to reduce rejections and reduce repair work. They have also suggested to have employee awareness program for the employees as understanding quality standard should be there. The requirements must be understood by each employee in order to improve quality .The outcome of their research suggests that industry can better their productivity and improve profits by reducing their rework activities.

Prof Rajesh Bheda (2005) in his article “Cost of quality in Apparel Industry” has explained about cost of poor quality and how badly it affects in profitability of the organization and industry as a whole. As per him quality is one of the most neglected and least understood areas in apparel organizations. The organizations are losing more than 25% of manufacturing costs due to poor quality. As per him the biggest problem lies in the poor understanding of quality parameters and awareness amongst the employees and managers. As per him it is of prime importance to produce products right the very first time. As per him most of the factories are not aware about the total expenses due to poor quality as they do not maintain any quality cost records. As per him each time repair work is carried out, the cost of quality increases. He also writes that the exporters are not aware of the implications of neglecting quality. He also suggests that the large no workforce hired for rework can used effectively for producing goods right the first time. His study suggests that reducing cost of poor quality can improve productivity by more than 50%.

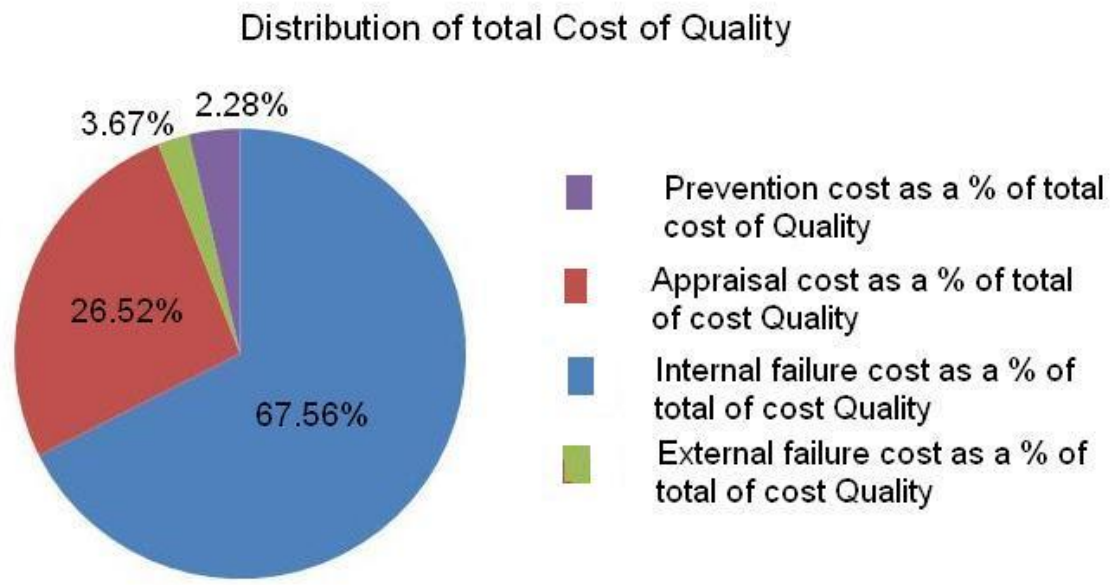

Figure 3.2 Distribution of cost of quality as per Bheda(2005)

Prof Rajesh Bheda(2005) in his article “Chalta hai attitude” discuss about callous attitude that prevails in the industry. Quality department is total eyewash and how employees are playing with business owner’s money. The Chalta hai attitude or Unees Bees attitude prevails at every level of the organizations. The operatives are not at all educated and lack awareness about the expected product quality. Inconsistent quality and unpredicted delivery is prime reasons which cause all such problems .As per him another big problem associated with poor quality is over booking by the factory owners. As an attitude of the employees the objective is to meet the tolerances and not the basic spec. As per him when the aim is to achieve the tolerance level, most of the times the factory will end up with out of tolerance specs.

Prof Rajesh Bheda(2005) in his article “cost of quality in apparel industry” has given some basic thumb rules for the garment exporters. As per him in the international market, buyers are ruthless and excuses for poor quality are not at all entertained. The buyers raise claims or discounts for poor quality. In today’s business scenario it is extremely important to give product as per buyer’s requirement otherwise it creates very poor impression and gives organizations a bad name and loss of business.

K.N Ningegowda and Venkatesa babu(2014) in their article “leveraging cost of poor quality to enhance competitiveness in apparel industry” have described quality costs as the investment in the prevention of non - conformities. As per him the quality costs are classified into controllable poor costs and uncontrollable poor costs. As per his study the appraisal costs contributed to 13.5% and the investment in prevention cost is very minimal. The internal failure cost contributed to above 18% and the major contributors are stitching repairs, rejected or left over garments due to poor quality and air freights. As per their study cost of poor quality is contributing to 40% of the conversion cost and is having major impact on the Indian apparel industry.

They have suggested that by reducing cost of poor quality the cost of manufacturing can be brought down drastically.

Juran(1988) suggests that there is a root cause for every defect and the defects can be prevented. He also suggests that it is always cost effective to prevent defects rather than correcting defects. As per him inspections and testing should be reduced and process capability should be improved.

Juran in his famous book “Quality Planning and Analysis” has termed as internal failure costs as those costs which are related to defects which are detected prior to delivering product to the customer. He suggests that these costs would not exist if the product is defect free. As per him the main subcategories of internal failure costs are cost of scrap(something which cannot be repaired),Rework (this is the cost of repairing or correcting goods in order to make them shippable),Failure analysis(this is the cost of analyzing defects),Scrap and rework,100% sorting inspection (this is the cost spent to check each and every piece in the lots with high percentage of defects),re-inspection and retesting(this is the cost to recheck the products which have been repaired) and Downgrading.

Juran in his book “Quality Planning and analysis” has categorized external failure cost with warranty charges, complaint adjustment, return of material and allowances.

He categorizes appraisal cost as costs associated with incoming inspection and testing, in-process inspections, final inspections, product quality audits, maintaining accuracy of equipment for testing, costs associated with testing of various materials and services and evaluation of stock.

In the same book he categorized prevention costs as the costs associated with quality planning ,new product review, process control measures, quality audits, supplier review and training.

As per him the contribution of internal and external failures is more than 79% of the total quality costs. The cost of appraisal is around 17% and cost of prevention is only a miniscule 4%.This suggests that the spending on prevention as very less and if proper strategy is made than the cost of failures can be drastically reduced.

Chapter 4

Review of Current Quality System

Factory consists of a separate quality team and primarily involved in detecting defects and their repair work. The factory Quality assurance manager is reporting to the production manager. Quality team is involved in getting quality audits done from the buying house QA's. Factory carries out following processes in quality area

Size set review – This is done to check the original pattern against the approved specs

Sewing audits – The quality assurance team is involved in setting of lines and end of the line audits. Factory is not maintaining any consistent data and not using statistical tools.

Washing – Factory QA is involved in approving the hand feel and setting washing cycle of the product. It was however observed that washing unit did not have the approved standard.

Finishing – Factory QA is involved in conducting hourly audits and setting of finishing processes like ironing and checking. Factory is however not maintain any statistical data.

Packing – QA team is responsible for conducting packing audits before final inspections.

Outsourcing – factory QA is responsible for giving approvals for outsourcing works like printing, dyeing, embroidery etc.

Flow Chart of current Quality System

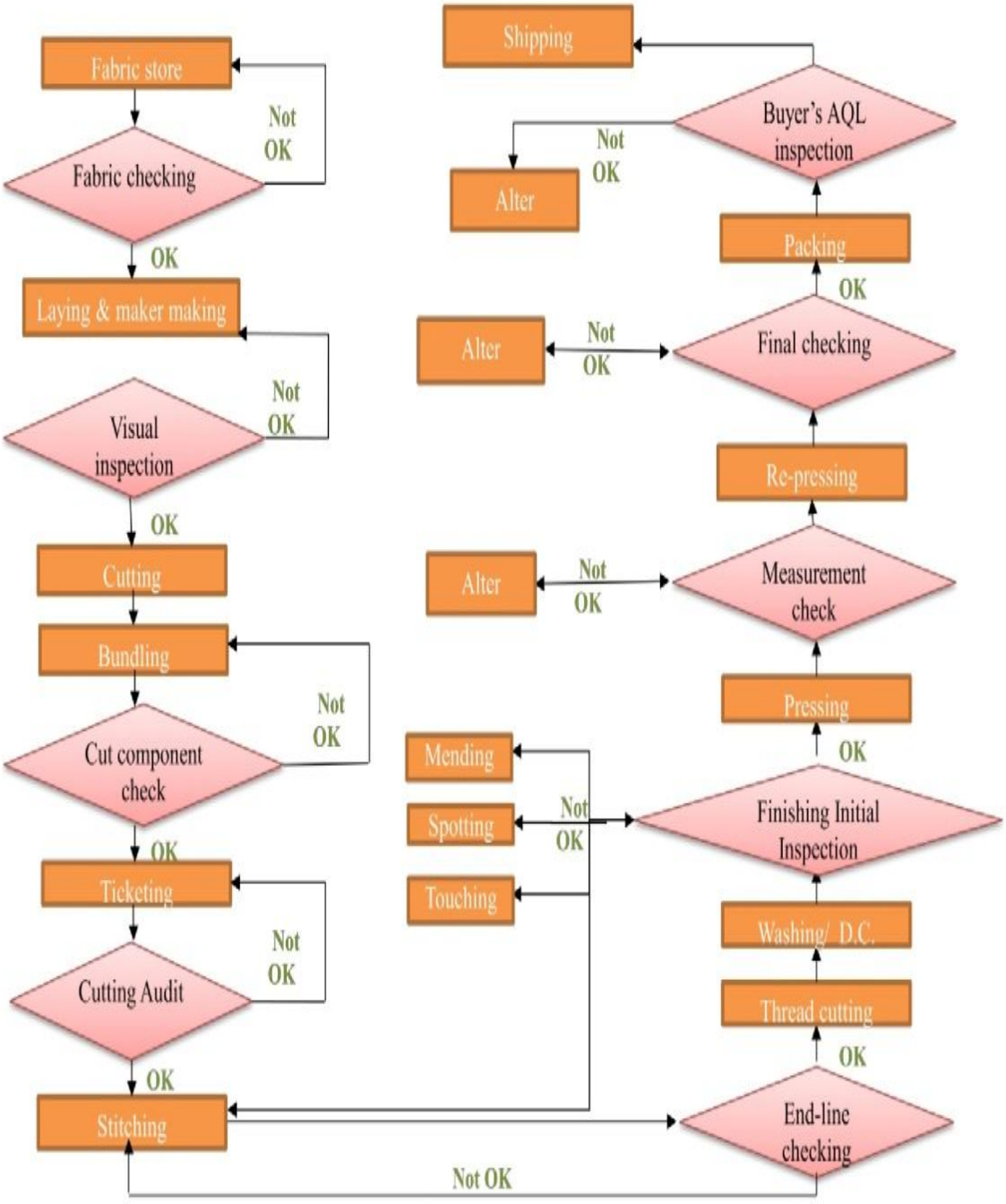

Figure 4.1 Flow Chart Current Quality Process

Chapter 5

Data Collection

The studied for the research work was style# 7W 61969.The style selected was Ladies embroidered top. The order size was 20,000 units. The data was recorded at various department by industrial engineers and quality checkers. Specific format for data recording was made and the format consisted of information like output ar end of the line stage on hourly basis. The pass pcs after audit by the QA and the defects encountered. The data was recorded till the completion of the style. The summary of the data recorded is as follows.

Defect Classification – Various defects were classified as per industry terminology and each defect was assigned a specific code .The defect codes are as under,

Table 5.1 Defects codes table

Name of Defect	**Code**
Skip Stitch	A
Broken Seams	B
Damage/holes	C
Puckering	D
Specs out of tolerance	E
Needle holes	F
Drop Stitch	G
Uneven gather	H
Raw Edges	I
Shade variation	J
Joint out	K
Balancing out	L
Ropping	M
Loose/tight tension	N
Wrong Size label	O
Wrong panel attach	P
Wrong Spi	Q
Stain	R
Others	S

Summary of daily report of quality inspections

Table 5.2 Defects summary of Cutting Department

Department - Cutting								
	Panels	Pass pcs	Reject/	Defects clacification				
	Checked		Alter	Hole	Barre	Shading	Needle holes	Others
Day 1	1400	1250	150	60	35	28	20	7
Day 2	1300	1165	135	52	29	25	18	11
Day 3	1600	1436	164	72	38	26	21	8
Day 4	1500	1352	148	70	26	22	17	15
Day 5	1350	1215	135	58	24	18	21	14
Day 6	1400	1260	140	65	29	21	14	11
Day 7	1450	1306	144	58	32	26	19	9
Day 8	1600	1433	167	78	36	23	18	12
Day 9	1450	1305	145	72	24	23	14	12
Day 10	1500	1347	153	68	31	25	18	9
Day 11	1600	1436	164	70	35	27	19	13
Day 12	1700	1526	174	82	36	30	17	9
Day 13	1600	1432	168	81	33	26	18	10
Day 14	1600	1438	162	79	31	27	17	8
Day 15	1550	1392	158	75	29	25	20	9
				1040	468	372	271	157

Pareto analysis of Cutting defects

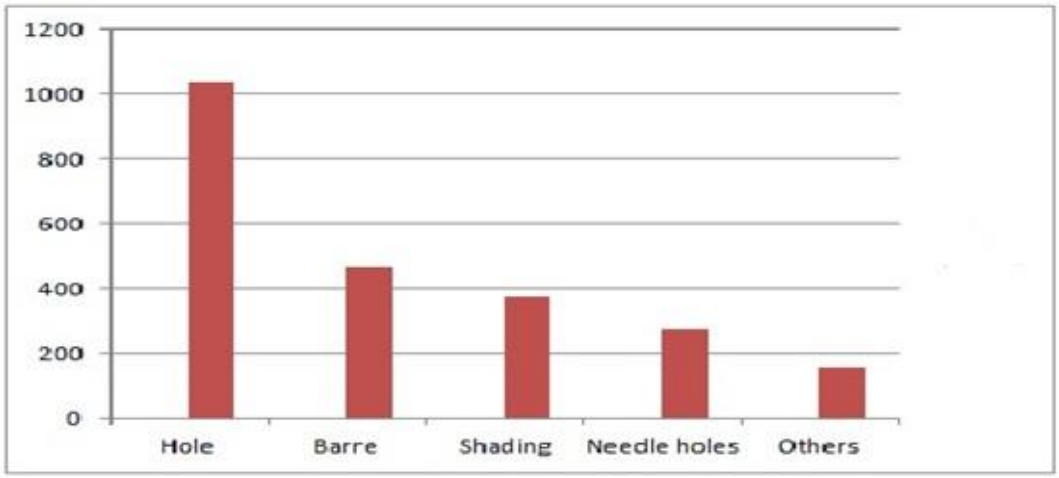

Figure 5.1 Cutting Department Pareto graph

Fabric Holes – It was observed that due to poor fabric checking holes in fabric contributed to 45% of defects.

Fabric barre contributed to about 20% of the defects.

Department –sewing

Table 5.3 Defects Classification in Sewing Department

Department - Sewing																											
Date	Pcs	PASSED	REJECT		Defects Classification																						
	Checked		/DEFECT	DHU	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S				
Day 1	1100	860	240	21.82	70	57	35	18	15	4	3	5	3	2	5	2	5	4	2	2	3	4	1				
Day 2	1050	820	230	21.90	56	52	32	15	14	7		5	3	6	5	8	5	4	5	3	3	4	3				
Day 3	1020	792	228	22.35	72	47	32	21	13	1	2	3		4	3	5	5	4	5	2	3	4	2				
Day 4	1150	900	250	21.74	76	61	40	19	14	2	3		3	2	5	2	5	4	2	2	3	4	3				
Day 5	1200	920	280	23.33	85	69	43	22	17	5	2	1	6	4	3		5	4	2	2	3	4	3				
Day 6	1150	880	270	23.48	82	67	49	18	13		3		3		5	6	5	2	6	3	5	1	2				
Day 7	1150	885	265	23.04	65	77	42	8	21	6	5	2	5	3	4	2	3	3	1	5	6	4	3				
Day 8	1200	925	275	22.92	88	66	41	13	16	2	4	4	3	5	5		4	2	3	7	5	5	2				
Day 9	1050	825	225	21.43	57	54	32	15	14	7		5	3	4	5	4	7	3	5		3	3	4				
Day 10	1200	945	255	21.25	82	59	39	17	14		2	7	4	3		5	4	2	2	3	4	3	5				
Day 11	1020	786	234	22.94	58	48	34	19	17	9	5	5	3		5	8	5	4	5	3	3		3				
Day 12	1050	830	220	20.95	56	42	32	15	14	7	5	3	6	5	3	3	4	4	5	4	5	4	3				
Day 13	1200	914	286	23.83	90	75	44	19	14		5	2	1	6	4	3	5	4	2	2	3	4	3				
Day 14	1060	840	220	20.75	70	55	33	21	12		3		3	2	5	2		4	2	3	3		2				
Day 15	1050	822	228	21.71	60	57	44	25	18	1	2	3		4		3	2	1	1	2	3		2				
Day 16	1150	905	245	21.30	70	56	40	23	21	2	3		3	2	5	2		4	2	2	3	2	5				
Day 17	1200	945	255	21.25	71	72	38	19	12	5	2	6	4	4	3		5	4	1	1	3	4	1				
Day 18	1200	966	234	19.50	57	53	33	16	14	7		5	3	6	5	8	5	4	5	3	3	4	3				
Day 19	1200	970	230	19.17	56	76	32	15	14		2	3	7		1		5	4	2	3	3	4	3				
Day 20	1200	960	240	20.00	63	67	31	18	16	4	3	5	3	2	5	2	5	4	2	2	3	4	1				
			4910		1384	1210	746	356	303	69	54	64	66	64	76	65	84	69	60	54	70	62	54				

DHU Trend

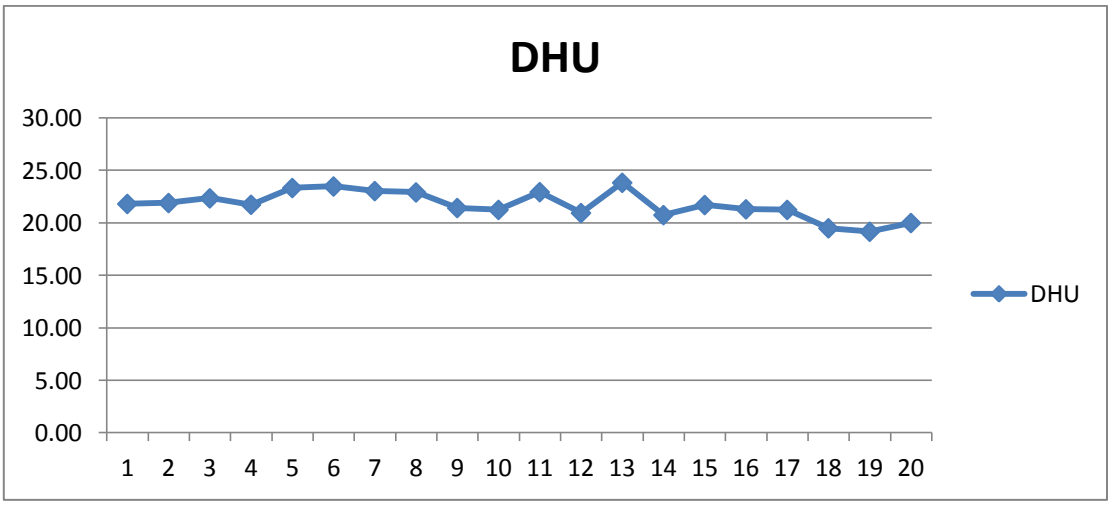

Figure 5.2 DHU Trend

The DHU (Defects Per Hundred Units) trend shows that the sewing defects were between 18% and 25%.

Pareto analysis of sewing defects

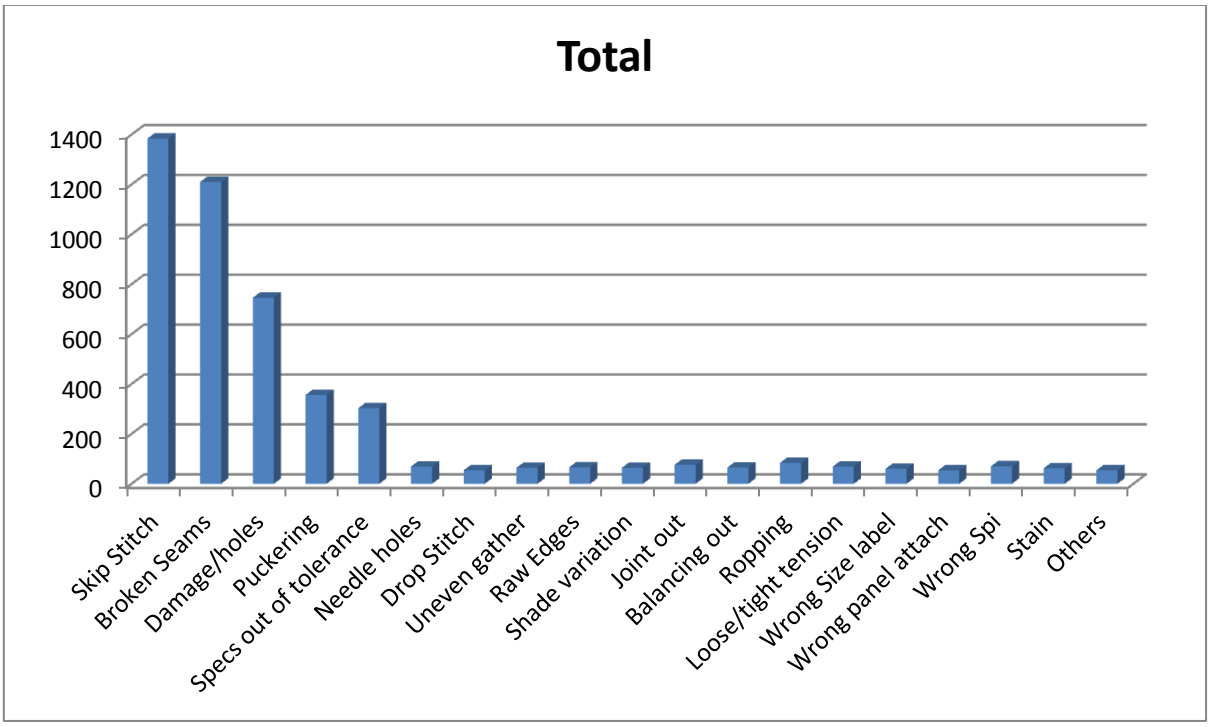

Figure 5.3 Pareto analysis of Sewing Defects

Root Cause Analysis of sewing Defects

1. Skip Stitches

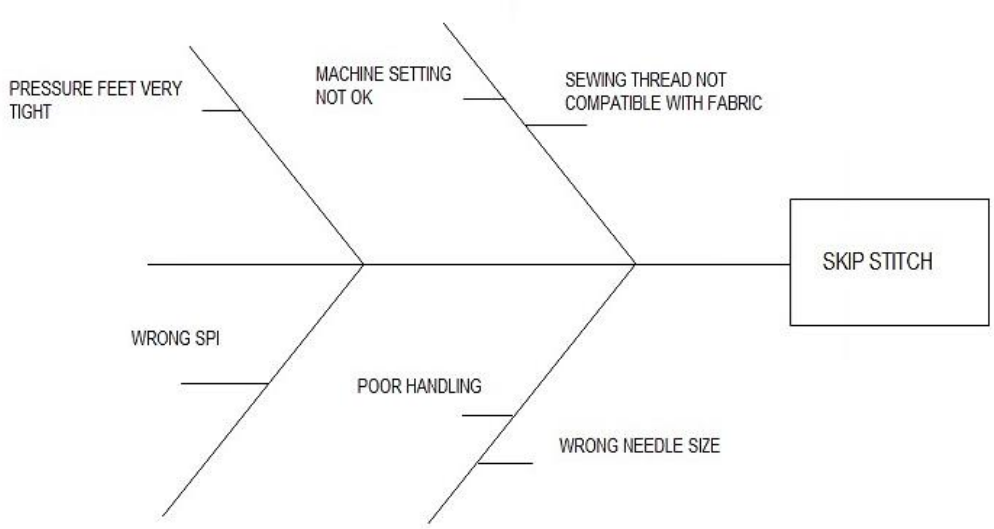

Figure 5.4 Root causes for Skip Stich(defect)

Causes

The root cause identified for skip stitch in the garment are

I. Wrong needle size, needle size found to be thicker.
II. The sewing thread not compatible with the needle.
III. Sewing machine setting not proper.
IV. The presser feet adjustment was not proper and was found to be very tight, leading to skip stitch.
V. The SPI was too high.
VI. Poor Operator handling .

Suggestions

I. Sewing machine to be set properly. The machine needs to be properly oiled.
II. Sewing thread and needle should be compatible with the fabric
III. Operators need to be properly trained for better handling.

2. Broken Stitch –

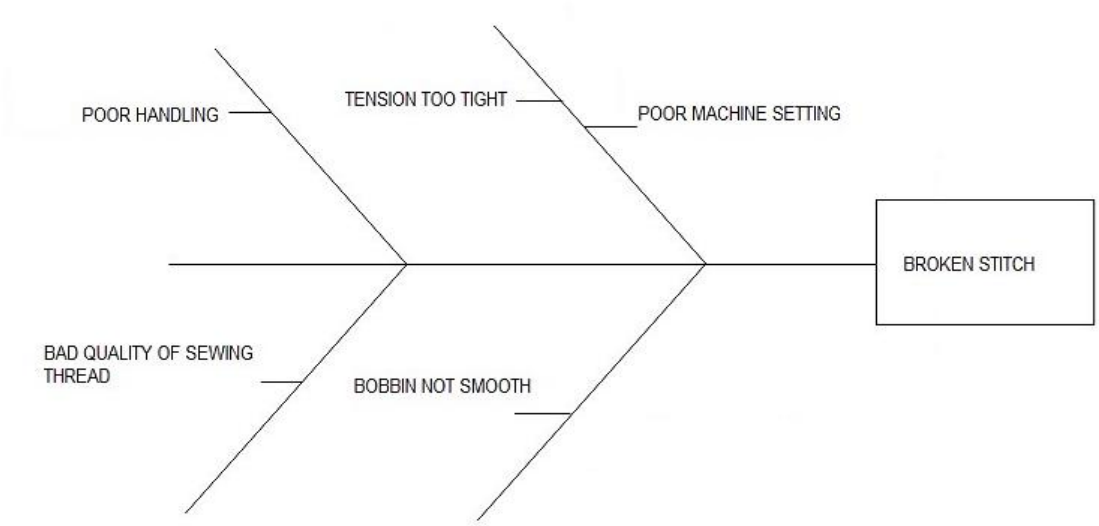

Figure 5.5 Root causes for Broken Stitch (Defect)

Causes

I. Poor machine setting, poor lubrication.
II. Bobbin not smooth in a few machines,
III. Sewing thread not of good quality and has poor tensile strength.
IV. Machine tension to tight
V. Poor handling

Suggestions -

I. Machine setting to be checked on a daily basis before sewing
II. Operators need to be trained for improving handling.
III. Current sewing thread to be replaced with good quality sewing thread.
IV. SPI to be kept between11-12 stitches per inch.
V. Machine lubrication to be proper.
VI. New bobbins to be replace old ones.

Damages Holes

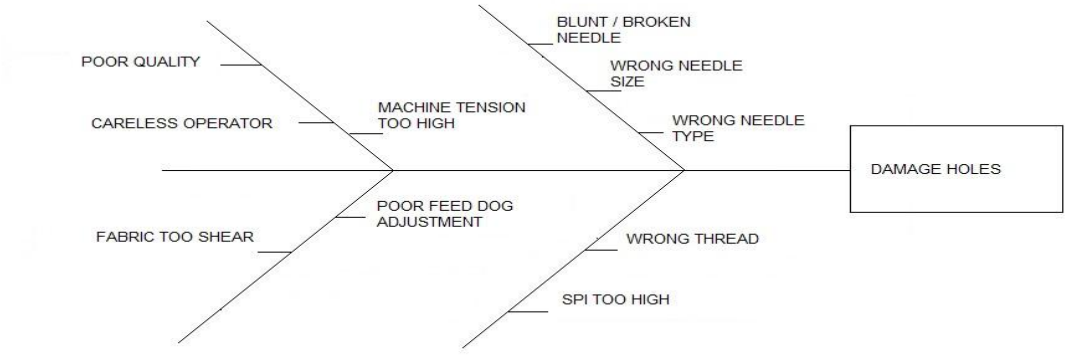

Figure 5.6 Root causes for Damage & Holes (defect)

Causes-

I. Poor machine setting, feed dog adjustment not proper.
II. Machine tension to tight.
III. SPI too high.
IV. Wrong needle type used.
V. Incorrect needle size.
VI. Needle puncture due to blunt needle.
VII. Thread and fabric not comestible.

Suggestions-

I. Needle size to be kept as per fabric. In this case suggested needle size is 9 for lock stitch and no 8 for over lock
II. Needle type should be medium ball point (SES or SUK)
III. Needle needs to be replaced after every 2 hours.
IV. SPI to be maintained between11 – 12 stitches per inch.
V. Machine tension to be reduced and machines are required to be set regularly.
VI. Operators should be motivated to improve handling.

Puckering -

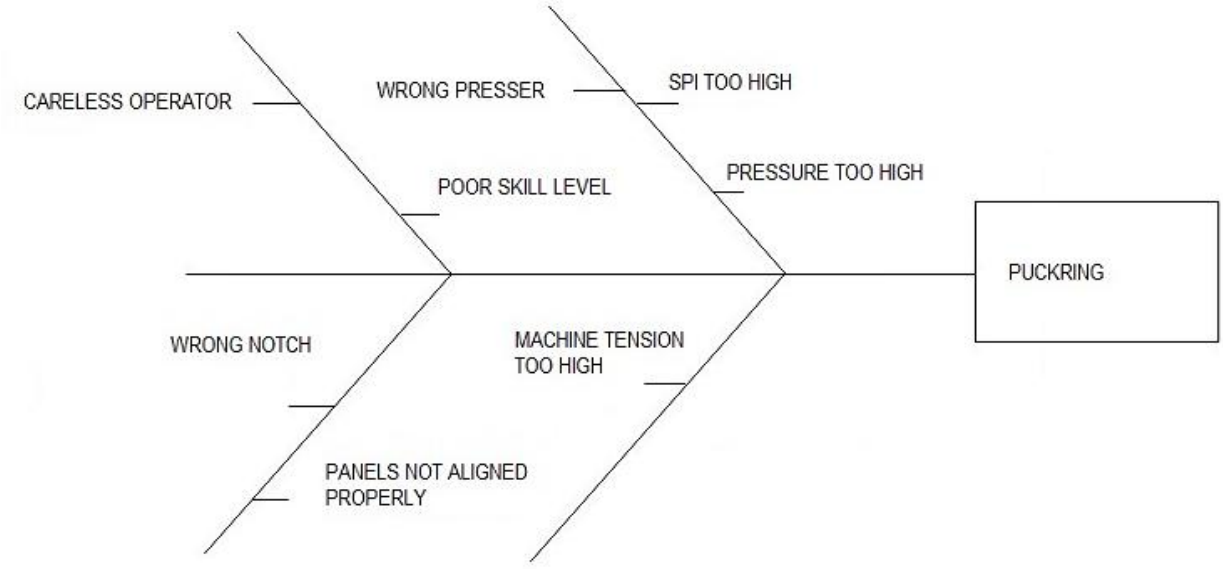

Figure 5.7 Root causes for Puckering (defect)

Causes

I. Machine setting not ok
II. Wrong presser feet used & very high pressure.
III. The SPI used is very high.
IV. Untrained and careless operators
V. The panels to be attached not aligned properly

Suggestions-

I. Proper machine setting, reduce machine tension.
II. Panels to be matched properly. The notches to be checked before attaching.
III. SPI to be kept between 11-12 stitches per inch.
IV. Operators to be trained and motivated.

Specs out of tolerance –

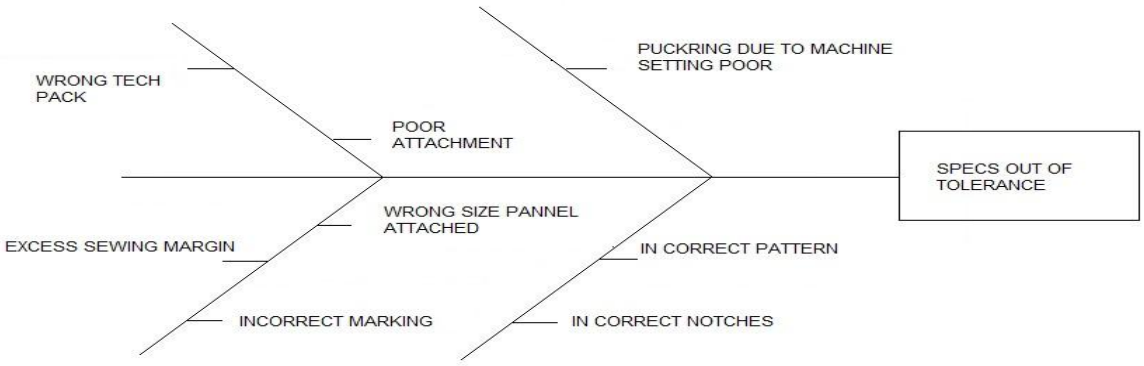

Figure 5.8 Root Causes for Specs Out of Tolerance (defect)

Causes

I. The biggest concern was that the “How to measure” guide was not clear and the factory was using wrong tech-pack.
II. The attachment by the operator was not correct.
III. The marking for making plackets was not as per specs & operator was using incorrect pattern.
IV. The notches were not correct.
V. Machine setting not proper due to which there was major puckering .This was leading to out of tolerance measurements.
VI. Excess sewing margin taken by operators.

Suggestions-

I. Notches to be properly checked by the QA.
II. Pattern for marking to be approved by the QA.
III. Machine to be set by the line mechanic to avoid puckering.
IV. Magnetic guides to be provided to present operators from taking extra margin.
V. Notches should be deep and should not be more than 1/16”.

Department finishing-

Table 5.4 Finishing Defects Classification

Department: Finishing														
Day	Total pcs checked	Pass Pcs	Total Alter / defects	Defect Clasification										
				Stain	Holes And Damages	Open seam	Poor Ironing	Garment look/shape	Measure ment oot	Shade variation	Pukering/ gathering	Raw / frayed edge	Uncut Thread	Others
Day 1	1100	750	350	92	82	65	42	13	12	6	13	4	9	12
Day 2	1050	716	334	98	69	58	39	9	9	12	7	9	13	11
Day 3	1000	640	360	88	78	59	61	7	13	9	12	14	7	12
Day 4	1150	770	380	98	102	83	20	9	7	11	9	8	15	18
Day 5	1200	825	375	107	93	87	19	11	9	11	9	6	9	19
Day 6	1150	830	320	97	96	45	17	10	8	7	16	9	8	7
Day 7	1150	852	298	102	98	41	9	5	11	10	5	7	4	6
Day 8	1200	855	345	110	92	66	11	9	7	6	4	15	14	11
Day 9	1050	700	350	98	76	75	23	13	15	9	13	7	9	12
Day 10	1060	739	321	97	96	45	17	10	8	7	15	9	8	9
Day 11	1020	718	302	88	78	75	21	13	8	6		4	5	4
Day 12	1050	745	305	107	86	45	17	10	5	7	6	9	8	5
Day 13	1170	869	301	87	106	45	17	10	8	7	6	3	5	7
Day 14	1091	771	320	105	90	55	12	8	6	9	5	9	11	10
Day 15	1080	770	310	109	88	45	9	9	11	10	9	7	7	6
Day 16	1150	805	345	98	103	56	13	10	8	9	6	15	14	13
Day 17	1150	852	298	97	104	44	10	5	10	9	4	6	4	5
Day 18	1100	795	305	111	82	49	14	9	5	7	6	9	8	5
Day 19	1090	770	320	100	93	43	16	10	8	10	16	9	8	7
Day 20	1120	795	325	96	67	60	32	9	9	12	7	9	13	11
				1985	1779	1141	419	189	177	174	168	168	179	190

Pareto analysis of Finishing Department

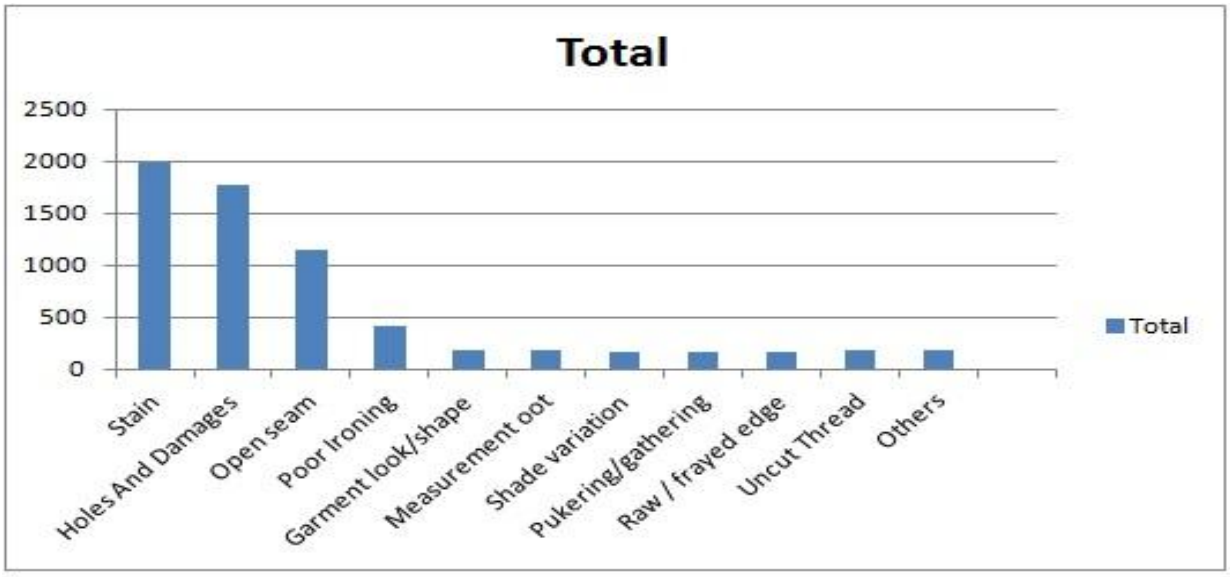

Figure 5.9 Pareto analysis of finishing defect

Root cause analysis of finishing defects

Open seams

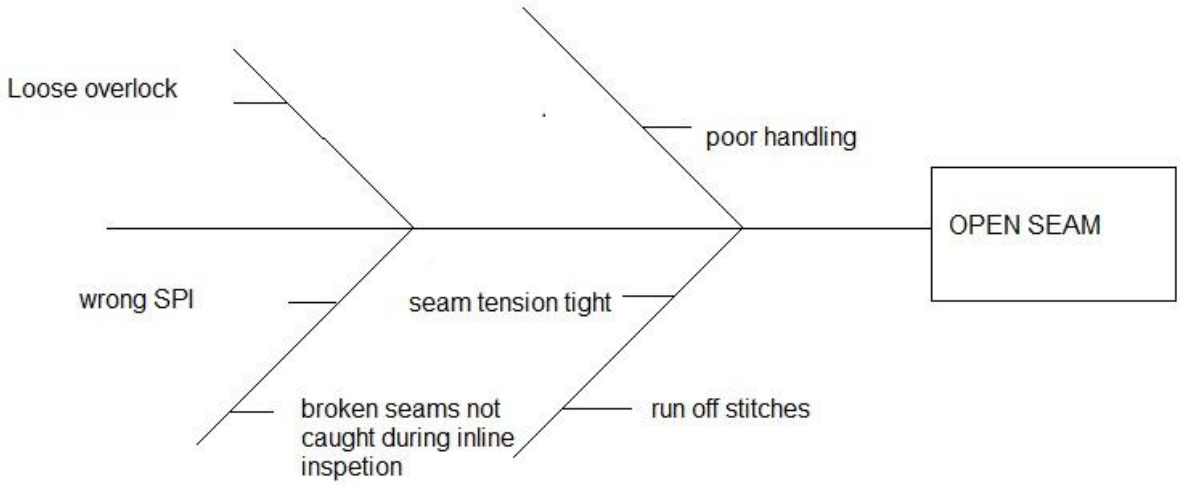

Figure 5.10 Root caused for Open Seam (Defect)

Suggestions

1. Use correct stitches per inch , ideally keep it between 11-12 SPI

2. Provide guides for sewing top seams

3. Reduce machine tension and set machines properly before sewing

4. Train operatives for better handling

5. Improve lighting

Defect – Holes and damages

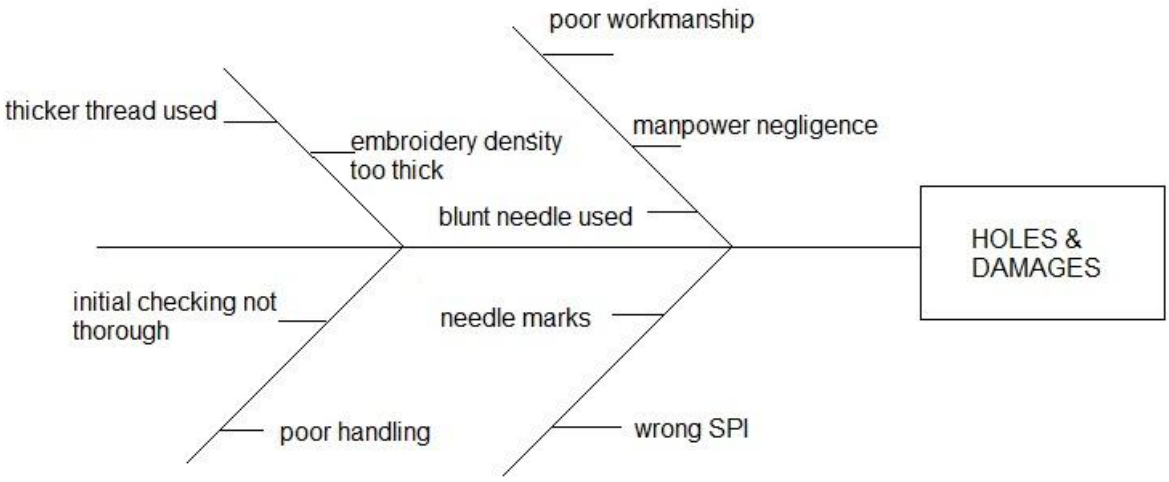

Figure 5.11 Root Causes for Damages & Holes (Defect)

Suggestions

1. Monitor thread trimming area
2. Train thread trimming helpers
3. Strictly control SPI
4. Change blunt needles after every two hours
5. Check thread and needle compatibility
6. Improve workmanship

Defect – Stains

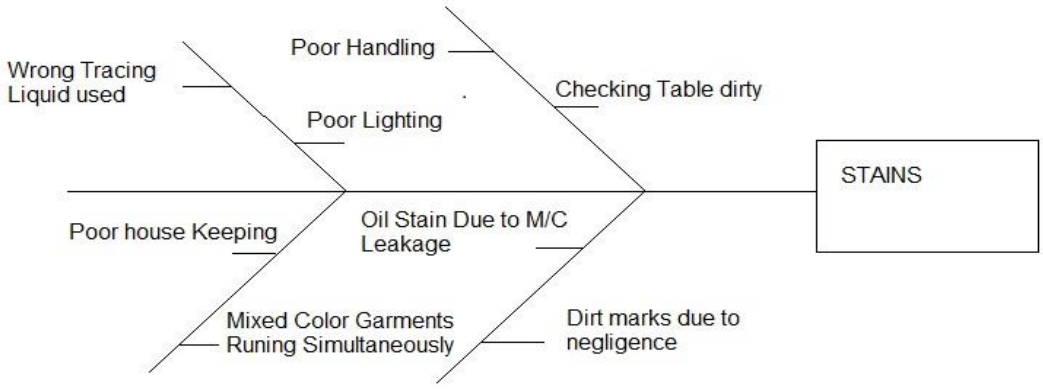

Figure 5.12 Root causes for Stain (defect)

Suggestions

1. Keep finishing floor very clean at all times

2. Checking and packing tables to be cleaned every hour

3 .Improve lighting at the checking area

4. Never run multi colors in one line

5. Cover all the garments carefully with a plastic sheet before leaving home

6. Provide hand gloves to all checkers.

Chapter 6

6.1 Impact of cost of poor quality on the organization

Cutting Department

Table 6.1 Cost of poor quality in Cutting Department

Department - Cutting													
	Panels	Pass pcs	Reject/ Alter	Panels changed	Fabric Used in kgs	Fabric cost	Manpower Used			Manpower Cost			Total Cost
	Checked						Checker	Helper	Cutting master	Checker	Helper	Cutting master	
Day 1	1400	1250	150	150	22.5	9000	1	1	2	400	300	1000	10700
Day 2	1300	1165	135	135	20.25	8100	1	1	2	400	300	1000	9800
Day 3	1600	1436	164	164	24.6	9840	2	1	2	800	300	1000	11940
Day 4	1500	1352	148	148	22.2	8880	2	1	2	800	300	1000	10980
Day 5	1350	1215	135	135	20.25	8100	1	1	2	400	300	1000	9800
Day 6	1400	1260	140	140	21	8400	1	1	2	400	300	1000	10100
Day 7	1450	1306	144	144	21.6	8640	1	1	2	400	300	1000	10340
Day 8	1600	1433	167	167	25.05	10020	1	1	2	400	300	1000	11720
Day 9	1450	1305	145	145	21.75	8700	1	1	2	400	300	1000	10400
Day 10	1500	1347	153	153	22.95	9180	1	1	2	400	300	1000	10880
Day 11	1600	1436	164	164	24.6	9840	2	1	2	800	300	1000	11940
Day 12	1700	1526	174	174	26.1	10440	2	1	2	800	300	1000	12540
Day 13	1600	1432	168	168	25.2	10080	2	1	2	800	300	1000	12180
Day 14	1600	1438	162	162	24.3	9720	2	1	2	800	300	1000	11820
Day 15	1550	1392	158	158	23.7	9480	2	1	2	800	300	1000	11580
													166720

Sewing Department

Table 6.2 Cost of Quality in Sewing Department

Department: Sewing																	
	PCS		Alter	Reject	Rejection	Manpower used				Manpower Cost				Material	Other Overhead		Total
	CHECKED	PASSED	DEFECT		cost	Helper	Checker	Tailor	Super-visor	Helper	Checker	Tailor	Super-visor	cost	Electricity	Over-time	Cost
Day 1	1100	860	240	20	6400	4	2	4	1	1600	600	2000	700	360	240	1225	13125
Day 2	1050	820	230	22	7040	4	2	4	1	1600	600	2000	700	345	230	1225	13740
Day 3	1020	792	228	18	5760	5	2	4	1	2000	600	2000	700	342	228	1325	12955
Day 4	1150	900	250	24	7680	5	2	4	1	2000	600	2000	700	375	250	1325	14930
Day 5	1200	920	280	21	6720	5	2	4	1	2000	600	2000	700	420	280	1325	14045
Day 6	1150	880	270	27	8640	5	2	4	1	2000	600	2000	700	405	270	1325	15940
Day 7	1150	885	265	21	6720	5	2	4	1	2000	600	2000	700	397.5	265	1325	14007.5
Day 8	1200	925	275	18	5760	5	2	4	1	2000	600	2000	700	412.5	275	1325	13072.5
Day 9	1050	825	225	23	7360	4	2	4	1	1600	600	2000	700	337.5	225	1225	14047.5
Day 10	1200	945	255	25	8000	5	2	4	1	2000	600	2000	700	382.5	255	1325	15262.5
Day 11	1020	786	234	24	7680	4	2	4	1	1600	600	2000	700	351	234	1225	14390
Day 12	1050	830	220	29	9280	4	2	4	1	1600	600	2000	700	330	220	1225	15955
Day 13	1200	914	286	24	7680	5	2	4	1	2000	600	2000	700	429	286	1325	15020
Day 14	1060	840	220	22	7040	4	2	4	1	1600	600	2000	700	330	220	1225	13715
Day 15	1050	822	228	23	7360	4	2	4	1	1600	600	2000	700	342	228	1225	14055
Day 16	1150	905	245	28	8960	5	2	4	1	2000	600	2000	700	367.5	245	1325	16197.5
Day 17	1200	945	255	23	7360	5	2	4	1	2000	600	2000	700	382.5	255	1325	14622.5
Day 18	1200	966	234	26	8320	4	2	4	1	1600	600	2000	700	351	234	1225	15030
Day 19	1200	970	230	25	8000	4	2	4	1	1600	600	2000	700	345	230	1225	14700
Day 20	1200	960	240	26	8320	4	2	4	1	1600	600	2000	700	360	240	1225	15045
	22600	17690	4910	469	150080	90	40	80	20	36000	12000	40000	14000	7365	4910	25500	289855

Finishing Department

Table 3.3 Cost of quality in Finishing Department

Department: Finishing																	
	PCS	PASSED	Alter /	Reject	Rejection	Manpower used			Manpower Cost			Material	Other Overhead			Re-Checking	Total
	Checked		Defect		cost	Helper	Checker	Tailor	Helper	Checker	Tailor	cost	Electricity	Over-time	epressing	cost	Cost
Day 1	1100	750	350	60	19200	2	2	4	800	600	2000	525	1100	850	1500		124500
Day 2	1050	716	334	67	21440	2	5	4	800	1500	2000	501	1050	950	1432		29673
Day 3	1000	640	360	55	17600	2	5	4	800	1500	2000	540	1000	940	1280		25660
Day 4	1150	770	380	72	23040	2	5	4	800	1500	2000	570	1150	830	1540		31430
Day 5	1200	825	375	45	14400	2	5	4	800	1500	2000	562.5	1200	1050	1650		23162.5
Day 6	1150	830	320	56	17920	2	5	4	800	1500	2000	480	1150	1100	1660		26610
Day 7	1150	852	298	58	18560	2	5	4	800	1500	2000	447	1150	1230	1704		27391
Day 8	1200	855	345	62	19840	2	5	4	800	1500	2000	517.5	1200	1125	1710		28692.5
Day 9	1050	700	350	68	21760	2	5	4	800	1500	2000	525	1050	990	1400		30025
Day 10	1060	739	321	45	14400	2	5	4	800	1500	2000	481.5	1060	890	1478	97925	22609.5
Day 11	1020	718	302	63	20160	2	5	4	800	1500	2000	453	1020	1035	1436		28404
Day 12	1050	745	305	56	17920	2	5	4	800	1500	2000	457.5	1050	1075	1490		26292.5
Day 13	1170	869	301	65	20800	2	5	4	800	1500	2000	451.5	1170	1140	1738		29599.5
Day 14	1091	771	320	48	15360	2	5	4	800	1500	2000	480	1091	1165	1542		23938
Day 15	1080	770	310	50	16000	2	5	4	800	1500	2000	465	1080	980	1540		24365
Day 16	1150	805	345	65	20800	2	5	4	800	1500	2000	517.5	1150	1075	1610		29452.5
Day 17	1150	852	298	74	23680	2	5	4	800	1500	2000	447	1150	1235	1704		32516
Day 18	1100	795	305	85	27200	2	5	4	800	1500	2000	457.5	1100	970	1590		35617.5
Day 19	1090	770	320	87	27840	2	5	4	800	1500	2000	480	1090	995	1540		36245
Day 20	1120	795	325	98	31360	2	5	4	800	1500	2000	487.5	1120	1075	1590		39932.5
																	676116

6.2 Summary of Cost of Quality

Table 6.4 Summary of Cost of Quality

Internal failure cost	**Source**	**In Rs.**
Cost in Cutting department	Cutting reports	166720
In sewing Department	Sewing reports	289855
In finishing Department	Finishing reports	676116
Air cost	Shipping Deptt.	500000
Total Internal failure cost		**1632691**
External Failure Cost		
Claim	Shipping Deptt.	501250
Discounts	Shipping Deptt.	120000
Total external cost		**621250**
Appraisal cost		
Salaries - Quality	Hr records	118425
Testing Charges	Lab	60000
Total appraisal cost		**178425**
Prevention cost		
Research & development	R & D	150325
Training cost	Hr Records	80430
Total Prevention cost		**230755**
Internal failure cost		1632691
External Failure Cost		621250
Appraisal cost		178425
Prevention cost		230755
Total quality cost		**2663121**
Total manufacturing cost		**9000000**
Poor quality cost %age of total manufacturing cost		**29.59**

Results and Discussion

Internal failure cost contributes to 62% of the total quality costs.

External failure cost contributes to around 23% of total quality costs

Appraisal cost calculated is contributing to around 7% of the total quality cost

Prevention cost contributes to around 8 % of the total quality costs.

This finding suggests that the major contributor to the cost of poor quality is internal failure cost and the external failure cost.

The total % cost of internal failure is around 18% of the manufacturing cost.

The total % cost of external failure is around 7% of the manufacturing cost.

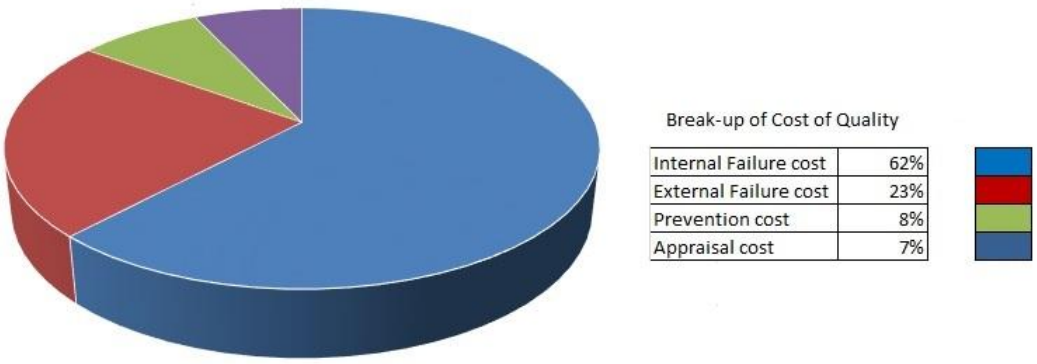

Figure 6.1 Break-up of Cost of Quality

6.3 Findings and recommendations:-

6.3.1 Poor Quality Opportunities Identified in Fabric Department

Bad practices

- × Arbitrary fabric audit procedure leading to fabric flaws and rejection of garments in the final stage.
- × Fabric store not maintaining lot continuity and issuing fabric arbitrarily leading to lot mixing in garments.
- × Fabric shrinkages not controlled in fabric processing and causing out of tolerance measurements in final product.
- × High spirality in fabric leading to appearance failures and poor balancing in the final garment.

Suggested Good practices

- ✓ Implement 4-point checking system.
- ✓ Roll wise continuity card to be maintained .Factory to check GSM of each roll.
- ✓ All light weight fabrics are recommended to be washed before cutting. This will reduce shrinkages and eliminate spirality from the fabric.
- ✓ ‘Cut panel laundry’ is recommended to be followed before cutting to control specs/measurement issues.

6.3.2 Poor quality Opportunities Identified in Cutting Department

Bad practices

- × Layer height observed to be 4 ½" leading to poor balancing and major variation.
- × No Layer relaxation before cutting leading to measurement problem
- × Random panel checking leading to rejections at final stage
- × Interlining / Fusing used without conducting compatibility checking leading to fusing marks on front.
- × Ticketing and bundling not done as per color lot.
- × Part changing process done with the naked eye and factory is not using scientific method. Lot of time is wasted due to this.

Suggested Good practices

- ✓ Layer height should not be higher than 3".This will prevent spec variation.
- ✓ Lay checking to be done by picking panels from top, mid & bottom of the lay.
- ✓ Layer needs to be relaxed for at least 8 hours before cutting. This will prevent specs issue.
- ✓ 100% panel checking process is recommended to eliminate cutting defect.
- ✓ Factory is recommended to use compatibility report to set critical parameters like temperature pressure and time.
- ✓ Factory is recommended to do bundling and ticketing strictly as per fabric lot this will help in reducing rejections due to panel variation.
- ✓ Factory is recommended to use end piece control mechanism, mentioning Lt no/Roll no and weight on each end piece and keep the end pieces separately.

6.3.3 Poor quality Opportunities Identified in Sewing Department

Bad practices

- × Machines not set before starting the day
- × Poor housekeeping and untidy machines leading to stains
- × Oil leakage / over flow
- × Needle and thread size compatible with the fabric
- × Poor operator handling
- × Lack of clarity due to poor communication
- × Poor quality sewing thread
- × Poor workmanship due to poor handling
- × Extra sewing margins leading to measurement defect
- × Garment getting damages and needle marks due to slant needle

Suggested Good practices

- ✓ Machine setting should be checked every day before and after the day's work
- ✓ Machine to be cleaned properly after every 4 hours and factory to maintain high cleaning standard to control stains
- ✓ Factory mechanic should check oil levels and keep a piece of fabric/paper below the needle after the days work. This helps to identify oil leakage in the machines
- ✓ Factory or merchandising team to arrange needle and thread compatibility report from needle and thread manufacturer
- ✓ Operator training schedule / programs to be started immediately.
- ✓ Factory should immediately start pre production meetings for all the styles.
- ✓ Factory to use good quality sewing thread from needle manufacturers like coats, vardhman and gutterman.
- ✓ Factory should provide templates & guides for sewing.
- ✓ Factory should provide notches in cutting.
- ✓ Factory should use guide in over lock machines to provide excess sewing margins.
- ✓ Factory is recommended to change needle after every 2 hours strictly.

6.3.4 Poor quality Opportunities Identified in Finishing Department

Bad practices

- × Poor lighting on the floor especially on checking tables and shop floor in general leading to checking failures.
- × Poor product handling observed in the finishing department.
- × Manual thread and margin trimming causing damages and cuts.
- × Poor garment shape and out of tolerance specs due to poor ironing
- × Observed multiple color products running simultaneously leading to cross staining and fiber transfer.
- × Packing manual not available in the packing floor leading to wrong carton ordering and wrong marking.
- × Packing material like hangtags etc kept together leading to size mixing.

Suggested good practices

- ✓ Factory to use tube light reflectors to improve lighting. Factory is recommended to maintain LUX level of 800-1100.This will help in better identification of defects.
- ✓ Factory is recommended to use lit up globes and cones especially for embroidered and garment dyed product.
- ✓ Manpower in finishing is required to be educated regarding handling of product. The factory is recommended to keep pieces in half fold or dead man fold state during movement and checking. This prevents pressing and unnecessary staining.
- ✓ Finishing checkers should avoid wearing belts and sharp ornaments to avoid damages and shine marks.

- ✓ Factory is recommended to provide surgeon's gloves and boric powder while checking white garments.
- ✓ Factory is recommended to use thread trimming and sucking machine to prevent cuts and damages.
- ✓ Factory is recommended to use under bed trimmers in sewing machines.
- ✓ Factory is recommended to use templates and mark ironing tables for pressing.
- ✓ Factory is recommended to provide pressing standard to pressmen.
- ✓ Factory is recommended to run one color at a time in one finishing line.
- ✓ Factory to provide pigeon holes and keep hang tags and other packing material style wise/ color wise/ size wise.

6.4 Limitations of the study –

The research work was carried out in only one organization and the bench mark was not available as this kind of research work is rarely conducted in the industry.

The wage records and overhead costs could not be gathered exactly and are approximation because exact remuneration for this period was not available. The cost is calculated on the basis of conversion of monthly wages into daily wage with the help of HR records. Hidden overhead expenses like over time administration costs etc is also an approximation.

Bibliography/references

1. Ninge Gowda, K.N. and Babu, Venkatesh (2014,May).Leveraging COPQ to enhance competitiveness of Indian Apparel Industry a hidden Opportunity Source International journal of research in engineering & technology (Impact Journals) Vol 2,Issue 5,May 2014
2. Islam,Md.Mazedul,Khan, Adnan Maroof, Khan, Md.mashiur rahman. Minimization of reworks in Quality and Productivity improvement in the Apparel Industry. Source International journal of engineering and applied sciences, 2012 EAAS & ARF.
3. Bheda, Rajesh (2005,June),Do you know "the cost of poor quality"in your organization. Source Internet accessed on 20th April ,2015.
4. Suarez. Gerald.J(1992, July),Three experts on Quality management :Philip B.Crosby.W. Edwards Deming, Joseph M. Juran, Department of the navy ,TQLO publication no 92-02, July1992.
5. .Crosby, Philip.B, (1980,Jan),Quality is free :The art of making quality certain, edition 5
6. Juran, Joseph,(2010,June),Juran's Quality Handbook: The complete guide to performance excellence ,edition 6.