**Faculty of Engineering**

**Department of Textile Engineering**

# REPORT ON

# Study on Capacity Study of Sewing and Finishing Section of a Garments Industry

**Course Title: Project** **Course Code: TE-4214**

**SubmittedBy**


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This Report Presented in Partial Fulfillment of the Requirements for the Degree of **Bachelor of Science in Textile Engineering.**

**Advance in Apparel Manufacturing Technology**
**Summer, 2018**

# Letter of Approval

July 29, 2018

To

The Head

Department of Textile Engineering

Daffodil International University

102, Shukrabad, Mirpur Road, Dhaka 1207

Subject: Approval of Project Report of B.Sc. in TE Program

Dear Sir

I am just writing to let you know that this project report titled as "**Study on Capacity study of Sewing and Finishing Section of a Garments Industry"** has been prepared by name Md. Ariful Haque ID 152-23-4378 is completed for final evaluation. The whole report is prepared based on the proper investigation and interruption through critical analysis of empirical data with required belongings. The students were directly involved in their project activities and the report become vital to spark of many valuable information for the readers.

Therefore it will highly be appreciated if you kindly accept this project report and consider it for final evaluation.

Yours Sincerely

**Md. Mominur Rahman**

Senior Lecturer

Department of Textile Engineering

Faculty of Engineering

Daffodil International University

# DECLARATION

I hereby declare that, this work has been done by me and not copied from elsewhere; I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree.

**Signature of Students:**

**Md. Ariful Haque** **ID: 152-23-4378**

**………………..**

Signature

# ACKNOWLEDGEMENT

At the beginning, I would like to thank the Almighty Allah for giving me the ability to complete this report. Then I would like to take the opportunity to express us gratitude to my honorable supervisor,**Md Mominur Rahman**, **Assistant Professor, Department of Textile Engineering, Daffodil International University** for providing us with guidelines and suggestions to complete this Project. His thoughtful advice assistance logical direction & efforts have made it possible to implement the project faithfully.

Our grateful thanks also go to **Professor Dr. MahbubulHaque, Head of the Department of Textile Engineering,** for his support and continuous guidance throughout our long journey in Daffodil International University and the industrial training.Special thanks goes to **Md.Abul kalam Azad, Managing Director of the Tajir Apparels Ltd.** who arrange the Permission letter for doing the project work in that Industry & variable advice to carry out the project work. Last but not the least, thanks go to all the workers, supervisors who have assisted, helped and inspired us to complete this task at various stages.

# DEDICATION

# TO MY BELOVED & RESPECTED PARENTS

# ABSTRACT

Industrial engineering is an important and essential part of any apparel industry. The productivity and efficiency of the sewing lines has been increased. The thesis is **“Study on Capacity study of Sewing and Finishing Section of a Garments Industry”** is properly many knowledge is achieved of This project and results is found that in **back rise top stitch process the actual production is 150 pieces per hour. But after doing capacity study we found calculated production of back rise top stitch is 164 pieces per hour. Found that in hangtag process the actual production is 110 pieces per hour. But after doing capacity study we found calculated production of hangtag is 136 pieces per hour.** We worked hard with the patient to complete the project. The proper handling of our supervisor helps us to complete our project properly. So we are grateful to our supervisor. However from this project we gathered a vital experience about line balancing, SMV, productivity, line efficiency, manpower, machine, cycle time, time study, sewing line etc. It can be said that without arranging a proper line balancing on the sewing floor of a garments factory optimum productivity & efficiency cannot be gained. So productivity can be achieved by allocating skill & semi-skilled workers to the right place and unskilled operator should be trained properly.  At last, the noticeable achievements of line balancing are-: improvement of productivity, smooth work flow, balanced cycle time, easy fault finding, reduced bottleneck, balanced line efficiency, reduction operation breakdown, equal distribution of work, skilled, semiskilled & unskilled co-ordination and easy way to supervise.

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# Chapter-1

# Introduction

# 1. Introduction:

Higher productivity brings higher margin in an industry. And increment in Production efficiency level reduces garment manufacturing cost. Hence factory can make more profit through productivity improvement. For this comes the significance of Industrial Engineering in the Apparel Industry .That is why I have selected the topics (**"Significance of Industrial Engineering in the Apparel Industry of Bangladesh").** In this topics we have discussed the importance of some IE tools such as capacity study, SMV, line balancing etc. In this thesis I have used IE tools and techniques in Sewing and finishing section of the industry for increasing productivity**. [1]**

The main objective of this project know the importance of industrial engineering in apparel industry .For increasing productivity in industry IE plays a vital role. Here using capacity study, SMV, line balancing I will learn how this tools are used in sewing and finishing section of the industry to get desired productivity.

Now a day's IE section is mostly important for RMG sector. By using IE tools & techniques production can be increased. IE is most demanded in RMG sector nowadays. An IE section of a factory can be improved day by day. It can increase productivity of an industry and attracts new buyer to invest.

IE has a great scope because of available Garments industries in Bangladesh. There are huge opportunities to do some things in IE department of a garments industry. Now a day the IE is demanded for increasing production. Almost all of RMG factories now understand the role of IE for increasing production. RMG industries are giving so much opportunity for developing IE techniques and developing IE techniques and methods for increasing production. It is an interesting topics so that, almost all industries are giving chance for researching about IE to increasing productivity. RMG industries authority can realize the actual demand for IE section for increasing their productivity.

There are some limitations of IE. Some topics are friction with management. Some tools can't possible to apply in practically for restrictions. Workers don't understand directly what I instructed them as theory.

# Chapter-2

# Literature Review

# 2. Literature Review:

## 2.1 **Literature Review**:

Present techno economic scenario is marked by increasing competition in almost every sector of economy. The expectation of the customers are on the rise and manufacturers have to design, and produce well in as many variety as possible (concept of economicsof scale is no more talked off) to cater to the demands of the customers. Thus there is a challenge before the industries to manufacture goods of right quality and quantity and at right time and at minimum cost for their survival and growth. This demands the increase in productive efficiency of the organization. Industrial Engineering is going to play a pivotal role in increasing productivity. Various industrial engineering techniques are used to analyze and improve the work method, to eliminate waste and proper allocation and utilization of resources. Industrial engineering is a profession in which a knowledge of mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop the ways to utilize economically the materials and other natural resources and focus of nature for the benefit of mankind**. [1]**

The prime objective of industrial engineering is to increase the productivity by eliminating waste and non-value adding (unproductive) operations and improving the effective utilization of resources.

## 2.2 History of Industrial Engineering:

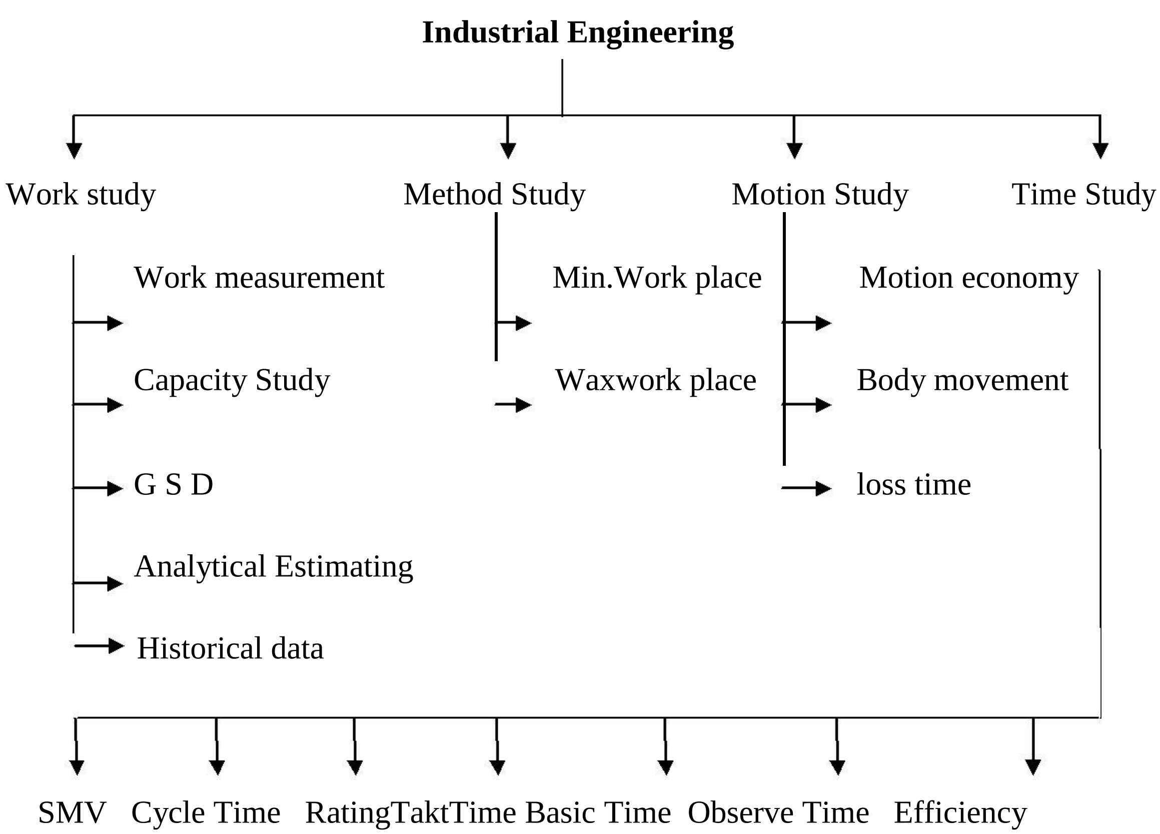
Efforts to apply science to the design of processes and of production systems were made by many people in the 18th and 19th centuries. They took some time to evolve and to be synthesized into disciplines that we would label with names such as industrial engineering, production engineering, or systems engineering. For example, precursors to industrial engineering included some aspects of military science; the quest to develop manufacturing using interchangeable parts; the development of the armory system of manufacturing; the work of Henri Fayola and colleagues (which grew into a larger movement called Fayolism); and the work of Frederick Winslow Taylor and colleagues (which grew into a larger movement called scientific management).

Industrial engineering courses were taught by multiple universities in Europe at the end of the 19th century, including in Germany, France, the United Kingdom, and Spain. In the United States, the first department of industrial and manufacturing engineering was established in 1909 at the Pennsylvania State University. The first doctoral degree in industrial engineering was awarded in the 1930s by Cornell University.**[3]**

## 2.3 What is Industrial Engineering:

Industrial engineering is the branch of engineering that involves figuring out how to make or do things better. Industrial engineers are concerned with reducing production costs, increasing efficiency, improving the quality of products and services, ensuring worker health and safety, protecting the environment and complying with government regulations.

They "work to eliminate waste of time, money, materials, energy and other commodities," according to the Institute of Industrial Engineers. For example, industrial engineers may work to streamline an operating room, shorten a roller-coaster line, make assembly lines safer and more efficient, and speed up the delivery of goods**. [4]**



**2.3.1 Latest utilization of IE**:

- Computers and Simulation
- Robotics and Automation
- Materials Handling
- Logistics and Distribution
- Management Information Systems
- Advanced Manufacturing Processes
- Quality Control
- Facilities Layout and Location
- Artificial Intelligence
- Production and Inventory Control
- Ergonomics and Human Factors
- Operations Research
- Reliability and Maintainability
- Engineering Economic Analysis
- Scheduling
- Transportation Systems **[4]**
-

**2.3.2 Responsibilities of an Industrial Engineer:**

- Operation breakdown & Machine Layout.
- Buyer & Style wise operation breakdown & Layout.
- Prepare Man machine report.
- Buyer & style wise capacity study & line balancing.
- Bottleneck process monitoring & do the lines balance.
- Train up production staff on efficiency.
- Production Monitoring &Achieve the line Target.
- Daily line wise Target setup.
- Wastage control at the production floor.
- Prepared production report for cutting, Sewing & finishing.
- Arrange trims & accessories just in time.
- Prepared daily Crisis report& SMV calculation.

- Follow up daily output per production line & Achieve the line
- Every day morning calculate the WIP of the line.
- Bottleneck process monitoring & do the lines balance.
- Method study & Motion Study.
- Data collect & efficiency report
- Prepare skill inventory & grading of the operator
- Nonproductive time (Lost Time) record. .
- Daily target & monthly efficiency, intensive list.
- Ensure optimum use of machine.
- Machine servicing report follow-up.
- Monitoring and optimize rented machine.
- Daily production, efficiency and manpower report.
- Daily quality statistical report presentation.
- Monthly production and shipment closing report.
- C.M calculation
- C.P.M calculation
- Production planning
- Department and factory inventory
- Research to improve all department of factory **[4]**

**2.3.3 Objectives of Industrial Engineering:**

- To establish methods for improving the operations and controlling the production costs.
- To develop programmers for reducing costs.

**2.3.4 Tools and techniques for Industrial engineering:**

**Tools:**

- Magnitude of operations
- Labor:
- Industrial machinery

**Techniques:**

- Method analysis
- Capacity studies and strength analysis
- SMV
- Line balancing**[4]**

**2.3.5 Process Flow Chart of IE:**

Industrial Engineer

↓

Negotiation with Merchandiser

↓

If in-house accessories & fabric then do the preproduction meeting

↓

Planning

↓

Line balancing

↓

Go for production based on planning

↓

Production continuous meeting

↓

To achieved production as planning

↓

Production continuing (follow up)

↓

Shipment/Delivery

### 2.3.6 IE job profile:

It was a couple of year back that demand of an industrial engineer has increased many times. Reason, an industrial engineer can do a lot to improve performance of the company. But the fresh student passed out form educational institute acquired limited knowledge about the job profile of an industrial engineer. Maximum works are learnt in factory by working. There is number of tools and technique which in by industrial engineers to establish an effective production system in the company. Without having such tools earlier production managers and line supervisors faced difficult to finalize orders. Out team has work to find out important tasks those are important for an engineer, and needs detailed understanding of production fields, included in the following list.

- Time study (cycle time)
- Work sampling
- Work aid, guide and attachment
- WIP control
- Line set up
- Line balancing
- Performance rating
- Preparation of OB (operation bulletin)
- SAM calculation
- Operation break down
- Motion analysis of the operations
- Knowledge of all type of sewing machine necessary for the company
- Knowledge about various sewing production systems
- Cost estimation of a garment
- Capacity study
- Calculating thread consumption**[4]**

## 2.4 Capacity study:

Capacity study is similar to time study where the operator will be timed, but the purpose is not to arrive at a time standard, rather to find out the operator'spotential/performance level.Here we are measuring the performance and potential that an operator should attain; if he works on the operation continuously at same pace and same method as observed during the study. It means that the operator is capable of achieving the performance measured by the study.

### 2.4.1 How to perform capacity study?

1. Get necessary details of the operation like job and machine.
2. Once the best method is implemented, take ten single cycle (SC)
Observations with the help of stop watch.
3. Once the readings are noted, calculate the average SC observation and
arrive at the capacity of the operator.
4. The cycle consisting of breakdown times, such as machine delay,
Handling bundles, etc., should not be considered for calculating average
SC time during capacity study..
6. However these delays will definitely reduce the operator's actual performance for the day.**[5]**

### 2.4.2 Benefits of capacity study:

- Check targets
- Motivate operators
- Measure section production capability

### 2.4.3 Check targets:

- When the operation bulletin is prepared, the targets are set based on a planned efficiency, say 65%. But it would be impossible to expect all theoperators in a line to work at same efficiency.
- Once capacity study is done, the targets of every operator on an operation can be checked with the capacity and proper balancing decisions can be taken to ensure the daily target.

**2.4.4 Motivate operators:**

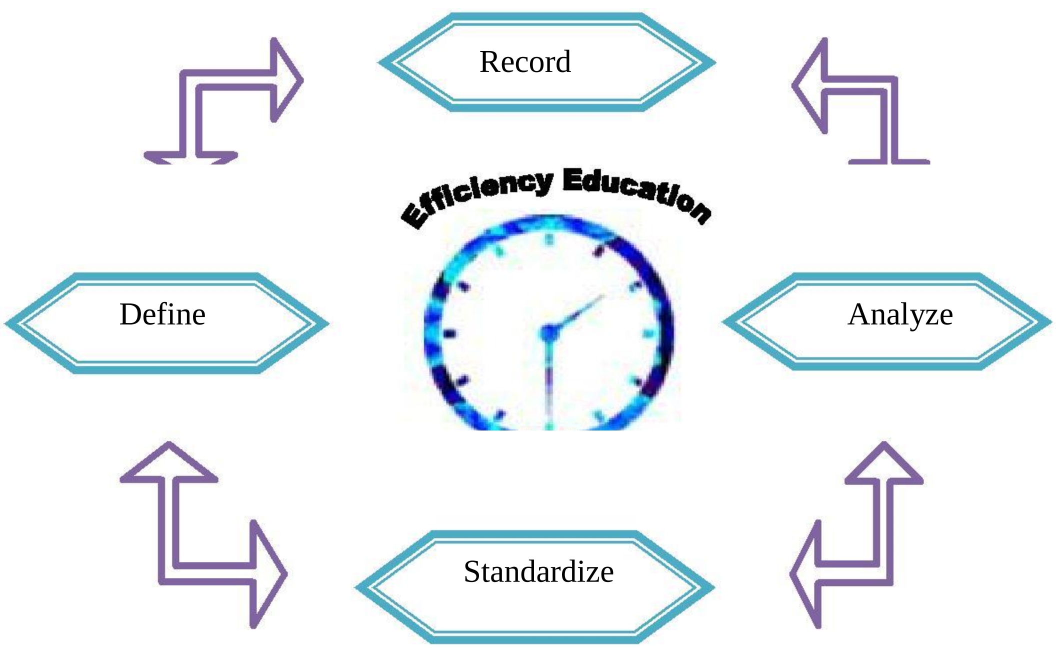
- The operators should be motivated to perform at the highest level possible based on the capacity study data.
- Most of the operators perform low because they do not realize/knowtheir strength in the work.
- The operators should be told about their capacity and motivate in achieving this.**[5]**

**Capacity per hour is = Capacity per day/No. of working hour.**

## 2.5 Time study:

Frederick W. Taylor and his followers Developed and defined the Time Study "A work measurement technique for recording the times and rates of working for the elements within specific conditions, and for analyzing the data so as to determine the time necessary for carrying out a job at a defined level of performance"

- The work flow into the operation is normal
- Amount of work in the section is normal
- The size of the work available are normal **[6]**



### 2.5.1 Techniques of time study:

- Asses the performance of the worker
- Understand the flow of work
- Time study person should not disturb the operator
- Should inform to the operator that he is going to do sometimes study
- Enter every detail on study papers by a pen as it cannot delete. **[6]**

### 2.5.2Time study tools:

1 A stop watch
2 Time study format
3 One pen or pencil

### 2.5.3 Application of Time study:

- Determining schedules and planning of work.
- Determining standard costs of a particular work.
- Estimating the cost of a product before manufacturing it.
- Determining machine effectiveness **[6]**

### 2.5.4 How to conduct Time Study:

An operation cycle consists of material handling, positioning and aligning parts, sewing, trimming threads and tying and untying a bundle. So in the time study format, divide whole task into various elements according to the motion sequences of the operation.

For example, in operation „collar run stitch‟, task elements may be

1. Pick up panel to sew first seam,
2. Turn collar to sew second seam,
3. Turn collar to sew third seam
4. Check work and dispose and
5. Waiting for next pieces**[6]**

**Step 1: Preparation:**

- ✓ Ready with stationeries like time study format, stop watch (digital one) and pencil
- ✓ Select one operation for Time study
- ✓ Tell the operator that you are going measure time he/she taking to do the job.
- ✓ Observe the operation carefully and break down operation into elements.

**Step 2: Time capturing:**

Now measure the time taken for completing each elements of the operation cycle by the operator. Time should be captured in seconds. Similarly, capture element timing for consecutive 5 operation cycles. During data capturing only note down reading of the stop watch and later calculate element timing. If you found any abnormal time in any elements record time during time study and later discard that reading. Or you capture time for one more cycle. Abnormal time may be occurred due to bobbin change, thread break, power cut or quality issues

**Step 3: Calculation of Basic time:**

From the Reading (R) calculates time taken for each element for all five cycles just by deducting previous Reading from elemental reading. Sum up times of five cycles for each element. Note, if you discard any reading than in that case no. of cycles will be four. Calculate average element times. This average time is called basic time.**[6]**

### 2.5.5 Analysis of Time Study:

- To calculate time study, first I have to take at least five readings of each worker of all process.
- Then I have to calculate the average value of these five readings
- After then, the average value is divided by 3600 to get actual capacity per hour.
- It helps for line balancing and maintains process layout of sewing operation. **[6]**

## 2.6 Cycle Time:

Cycle time" can mean the total elapsed time between when a customer places an order and when he receives it.

It can also express the dock-to-dock flow time of the entire process, or some other linear segment of the flow. The value stream mapping in learning to see calls this "production lead time" but some people call the same thing "cycle time."**[6]**

**Cycle Time = 60 / Team target**

## 2.7 SMV:

Standard minute value is defined as the time which is allowed to perform a job satisfactorily. Normally it is expressed in minute value. The full elaboration of SMV is Standard Minute Value. SMV term is broadly used in the garments manufacturingindustry. SMV is also known as Standard Allocated Minute (SAM). For smooth and timely shipment an export order a merchandiserneed to proper SMV set up in garments production floor.**[6]**

### 2.7.1 SMV Calculation in Garments Industry:

In garments industry, SMV calculation differ accounting to the number of operations, seams length, types of fabric, number of workers, machine efficacy etc.

General formula of SMV is given below-

**SMV= Basic time + Allowance**

**Where,**

**Basic time**= Observed time X Rating/ 100

**Allowance**= Relaxation allowance + Contingency allowance + Machine Delay Allowance.

**Rating**= the pace or speed of operationat which the operator is performing the job.**[6]**

## 2.8 Line balancing:

A line is defined as a group of operators under the control of one production supervisor. Balancing is the technique of maintaining the same level of inventory at each and every operation at any point of time to meet the production target and to produce garments of acceptable quality.**[5]**

### 2.8.1 Need for balancing:

1. Keeping inventory cost low.
2. To enable the operator to work at the optimal pace.
3. To enable the supervisor to attend other problems.
4. To enable better production planning.
5. Balancing production line results in on-time shipments, low cost, and Ensures reorders.**[5]**

### 2.8.2 Goals for balancing:

1. Meet production schedule
2. Avoid the waiting time
3. Minimize over time
4. Protect operator earnings**[5]**

### 2.8.3 Rules for balancing

1. Have between 3 and 5 bundles of WIP at each operation
2. Solve the problem before they become larger
3. Meet production goals by keeping every operator working at maximum capacity and make sure he has constant feeding to ensure his capacity is high. **[5]**

**2.8.4 How to balance the time?**

1. Know work available at the start of the day
2. Plan transfer needed to compensate for any known absenteeism
3. Check attendance at the start of the day**[5]**

## 2.9Layout:

Layout means to distribute/allocate elements (Sequentially) to the individual operator in the line by considering total worker, worker experience, total machine, types of machine & mainly the estimated SMV of allocated/distributed elements in a broken down garments. A good layout is that physical arrangements which permit the product to be produced with minimum unit cost in the shortest time.

A layout is an arrangement of the space and facilities according to the type and size of activities to be carried out, Convenience of operations, Efficiency, Productivity, economy, and safety of the facilities and the users of the facilities. There can be various options for the layout within the same space, each one having certain merits or demerits. **[4]**

**2.9.1 Advantages of plan layout:**

- Bottleneck will not be found in line.
- No operator will be idle
- Can achieve the Buyer’s desire quality level easily.
- The process distribution / work content will be quite equivalent
- Can reach the optimum target with in a very short period.
- Increase worker efficiency & daily production
- Reduce wastage & loss time. **[4]**

### 2.9.2 Factors Influencing Plan layout:

- Operation requirements
- Size of operations
- Safety aspects
- Technology aspects
- Systems design
- System arrangement
- Location aspects
- Types of plant and machinery (Small or big) **[4]**

### 2.9.3 Layout Procedure:

**1st Step:**

Responsible person for layout making

1. APG Section Leader
2. Team Leader Technician
3. Work-Study Member

**2nd Step:**

1. To select line
2. To select style
3. To confirm total operator

**3rd Step:**

1. To breakdown the garments, elements by elements
2. To put estimated SMV beside each elements/operation
3. To calculate total SMV
4. To select machine type & number
5. To calculate average estimated SMV/Operator
6. To distribute/allocate elements (sequentially) to each operator by considering machine types, elements & estimated average (nearest) SMV.
7. To set up machine as per requirements. **[4]**

### 2.9.4 Different Types Of layout In Factory:

1. Flow forward layout
2. Hanger conveyor layout
3. Side flow layout
4. Batch layout **[4]**

## 2.10 Bottleneck:

The upper narrow portion of a bottle is called neck (opening side) and it is an obstruction to go to the way from large portion of a bottle through narrow portion of a neck. It is a metaphorical scene of obstruction of production sector. A garments sector is a production sector and the bottleneck used here as obstruction of normal production. In a brief the bottleneck means lost production and lost profit i.e. the lowest capacity of production.

Bottleneck in a process occurs when input comes in faster than the next step can use it to create output. The term compares assets (information, materials, products, man-hours) in a brief the Bottleneck of Production means lost production and lost profit i.e. the lowest capacity of production. The upper narrow portion of a bottle is called neck (opening side) and it is an obstruction to go to the way from large portion of a bottle through narrow portion of a neck. It is a metaphorical scene of obstruction of production sector. A garments sector is a production sector and the bottleneck used here as obstruction of normal production. **[4]**

### 2.10.1 Bottleneck in the production line:

The lowest output point in the production line is called bottleneck. That is bottleneck area, where supply gathered and production goes under capacity.**[4]**

### 2.10.2 Why arises bottleneck:

There are so many reasons to arise a bottleneck in the production line and it is described below. **[4]**

Fig 2.1: Bottleneck

### 2.10.3 Bottleneck in Production:

**Bottleneck before input in line:**

1. If issue is not supplied in time from M.C.D and sub store.
2. If issue comes delay.
3. Issues serial number mistake.
4. Bundling mistake.
5. Wrong issue supply.
6. Pattern problem**[4]**

**Bottleneck in line:**

1) Worker selection wrong.
2) Wrong works flow / sequence of works.
3) Non-balance allocation of elements.
4) Works negligence by workers.
5) Workers absenteeism.
6) Machine disturbances / out of order.
7) Lack of supply.
8) Non-serial supplies forward from workers.
9) Colorshading
10) Quality problem.
11) If anybody becomes sick. **[4]**

**2.10.4 Way of reducing bottle neck:**

- To arrange pre- production meeting in time.
- To prepare layout sheet before input in the line.
- To check fabrics and accessories before issuing in the line.
- To check pattern before supply in the line.
- To reduce excess works from workers.
- To select right workers for right works.
- To keep supply available in time.
- To maintain serial number.
- Reject garments should not forward.
- Supply should be forwarded after checking.
- To alert when bundling (maintain serial number)
- By improving method.
- By improving workers performance.
- By reducing sewing burst **[4]**

## 2.11 Some Essential Formula for Industrial Engineer:

1. Standard Pitch Time (S.P.T) = Basic Pitch Time (B.P.T) + Allowances (%)

2. $\text{Target} = \dfrac{\text{Total manpower per line} * \text{Total working minute pewr day}}{\text{S.A.M}} * 100\%$

3. $\text{Theoretical Manpower} = \dfrac{\text{Target per houre}}{\text{Process capacity per houre}}$

4. $\text{Line Labor Productivity} = \dfrac{\text{Total number of output per day per line}}{\text{Number of worker worked}}$

5. $\text{Line Machine Productivity} = \dfrac{\text{Total number of output per day per line}}{\text{Number of machines used}}$

6. $\text{Line Efficiency} = \dfrac{\text{Total output per day per line} * \text{SAM}}{\text{Total manpwer per line} * \text{total working minutes per day}} * 100\%$

7. **GSD** = (Man power × Work hour) / Target
8. **SMV** =Avg. Time + 15% allowance / 60
9. **Basic time** = Observed time ×Rating
10. **Observed time** = Total Cycle time / No of cycle
11. **Rating** = (Observed Rating × Standard rating) / Standard rating
12. **Efficiency** = (Earn minute × Available minute) × 100
13. **Earn minute** = No of Pc‟s (Production) × Garments SMV
14. **Available minute** = Work hour × Manpower
15. **Organization Efficiency** = (Basic pis time / Bottle neck time) × 100
16. **Basic pis time** = Total GMT SMV / Total Manpower
17. **Capacity** = 60 / Capacity time in minute**[7]**

# Chapter-3

# Experimental Details

# 3. Experimental Details:

My project based on primary data and secondary data. Primary data was collected from “Tajir Apparels Ltd” and secondary data was collected from books, thesis paper and internet. This report includes capacity study and SMV tools of IE.

I have performed capacity study and SMV in the sewing and finishing section of the industry. Capacity study**:** Evaluation of a factory, production process or line, or machine, to determine it maximum output rate.

- Check targets
- Motivate operators
- Measure section production capability

SMV: Standard minute value is defined as the time which is allowed to perform a job satisfactorily. Normally it is expressed in minute value. The full elaboration of SMV is Standard Minute Value.

SMV= Basic time + Allowance

Where,

Basic time= Observed time X Rating/ 100

Allowance= Relaxation allowance + Contingency allowance + Machine Delay Allowance.

Rating= the pace or speed of operation at which the operator is performing the job.

## 3.1 Capacity Study of Sewing Section:

### 3.1.1 Capacity study Table: Line A

CAPACITY STUDY(SEWING)

| Buyer: | LIWE ESPANOLA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| Style: | MAX 3 PACK CHECK | | BEFORE IE WORK | | | AFTER IE WORK | | | | COMPARISON | |
| SL | Process name | M/C | CT | SMV | ACTUAL PROD. | AVG. CT | SMV | AFTER CAPACITY | | ACTUAL PROD. | AFTER CAPACITY |
| 1 | BACK RISE TOP STITCH | FOA | 24 | 0.44 | 150 | 20 | 0.37 | 164 | | 150 | 164 |
| 2 | CARE LABEL ATTACH | SNLS | 23 | 0.43 | 155 | 18 | 0.33 | 182 | | 155 | 182 |
| 3 | DOUBLE FLY TACK | SNLS | 23 | 0.41 | 160 | 18 | 0.33 | 182 | | 160 | 182 |
| 4 | SINGLE & DOUBLE FLY O/L | O/L | 22 | 0.40 | 165 | 15 | 0.28 | 218 | | 165 | 218 |
| 5 | FRONT RISE OVERLOCK | 3TOL | 22 | 0.40 | 166 | 18 | 0.33 | 182 | | 166 | 182 |
| 6 | SINGLE FLY ATTACH | SNLS | 22 | 0.40 | 164 | 17 | 0.31 | 193 | | 164 | 193 |
| 7 | SINGLE FLY TOP STITCH | SNLS | 22 | 0.40 | 166 | 15 | 0.28 | 218 | | 166 | 218 |
| 8 | SINGLE FLY 'J' TOP STITCH | SNLS | 22 | 0.41 | 162 | 16 | 0.29 | 205 | | 162 | 205 |
| 9 | FLY BUTTON HOLE | B/H | 22 | 0.40 | 163 | 12 | 0.22 | 273 | | 163 | 273 |
| 10 | DOUBLE FLY ATTACH | SNLS | 23 | 0.41 | 160 | 18 | 0.33 | 182 | | 160 | 182 |
| 11 | DOUBLE FLY TOP STITCH | SNLS | 23 | 0.41 | 160 | 16 | 0.29 | 205 | | 160 | 205 |
| 12 | FRONT L+R ATTACH | SNLS | 22 | 0.41 | 162 | 14 | 0.26 | 234 | | 162 | 234 |
| 13 | FLY J BOX DECORATION STITCH | SNLS | 22 | 0.40 | 165 | 16 | 0.29 | 205 | | 165 | 205 |
| 14 | FRONT RISE TACK | SNLS | 22 | 0.41 | 161 | 14 | 0.26 | 234 | | 161 | 234 |
| 15 | HIGH TOP STITCH | DNLS | 23 | 0.41 | 160 | 14 | 0.26 | 234 | | 160 | 234 |

In this table, I can see the difference of SMV & capacity before & after IE

**Table 3.1 Table, we can see the difference of SMV& capacity before & after IE**

To calculate capacity study I have to calculate some tools of IE. Mainly I have used cycle time and SMV. At first I have calculated cycle time using the formula = observed time / no. of readings. For example, in max 3 pack I have found the cycle time of **back rise top stitch** is 24 sec using the formula? Then I have calculated SMV of back rise top stitch 0which is 0.44 using the formula, SMV= (cycle time/60) + 10% allowance .This formula is used in our industry.  After Line balancing I have again calculated cycle time, SMV and found capacity study of **back rise top stitch** process which is 164 using the formula , capacity study= 60/SMV. We can see that actual production of back rise top stitch is 150 and after capacity study it increases to 164. Other processes are modified in the same manner. Increase use IE after 14.

### 3.1.2 Capacity study Table: Line B

CAPACITY STUDY (SEWING)

| Buyer: | Next Sourcing | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Style: | BOYS SHORTS | | BEFORE IE WORK | | | AFTER IE WORK | | | COMPARISON | | Prod. Increase |
| SL | Process name | M/C | CT | SMV | ACTUAL PROD. | AVG. CT | SMV | AFTER CAPACITY | ACTUAL PROD. | AFTER IE CAPACITY | AFTER IE WORK |
| 1 | INSEAM ATTACH | FOA | 36 | 0.66 | 100 | 28 | 0.51 | 117 | 100 | 117 | 17 |
| 2 | SIDE SEAM | SNLS | 45 | 0.83 | 80 | 36 | 0.66 | 91 | 80 | 91 | 11 |
| 3 | SIDE CORD 1/16 T/S | DNLS | 51 | 0.94 | 70 | 38 | 0.70 | 86 | 70 | 86 | 16 |
| 4 | WAIST BELT LOOP MAKE | F/L | 33 | 0.60 | 110 | 24 | 0.44 | 136 | 110 | 136 | 26 |
| 5 | WAIST BELT LOOP ATTACH | SNLS | 40 | 0.73 | 90 | 28 | 0.51 | 117 | 90 | 117 | 27 |
| 6 | WAIST BELT ATTACH | K/N | 60 | 1.10 | 60 | 40 | 0.73 | 82 | 60 | 82 | 22 |
| 7 | WAIST BELT MOUTH CLOSED INNER | SNLS | 45 | 0.83 | 80 | 34 | 0.62 | 96 | 80 | 96 | 16 |
| 8 | WAIST BELT MOUTH CLOSED TOP | SNLS | 50 | 0.92 | 72 | 40 | 0.73 | 82 | 72 | 82 | 10 |
| 9 | W/B MOUTH CLOSED (INNER+TOP) | SNLS | 90 | 1.65 | 40 | 65 | 1.19 | 50 | 40 | 50 | 10 |
| 10 | WAIST BELT LOOP BTM TACK | SNLS | 42 | 0.78 | 85 | 29 | 0.53 | 113 | 85 | 113 | 28 |
| 11 | WAIST BELT LOOP TOP TACK | SNLS | 41 | 0.75 | 88 | 32 | 0.59 | 102 | 88 | 102 | 14 |
| 12 | BOTTOM HEM FALSE STITCH | C/S | 45 | 0.83 | 80 | 27 | 0.50 | 121 | 80 | 121 | 41 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | BOTTOM HEM | SNLS | **45** | 0.83 | **80** | 28 | 0.51 | **117** | **80** | **117** | **37** |

In this table, we can notice the difference of SMV & capacity before & after IE

## 3.2 Table, we can see the difference of SMV& capacity before & after IE

To calculate capacity study we have to calculate some tools of IE. Mainly we have used cycle time and SMV. At first we have calculated cycle time using the formula = observed time / no. of readings. For example, in boys shorts we have found the cycle time of inseam attach is 36 sec using the formula. Then we have calculated SMV of inseam attach which is 0.66 using the formula, SMV= (cycle time/60)+ 10% allowance .This formula is used in our industry. After Line balancing we have again calculated cycle time, SMV and found capacity study of inseam attach process which is 117 using the formula, capacity study= 60/SMV. We can see that actual production of inseam attach is 100 and after capacity study it increases to 117. Increase use IE after 17.

## 3.2 Capacity Study of finishing section:

In sewing section we used capacity study for calculating the productivity of finishing section. We have study in sewing section for increase production and running situation of finishing. We used a study sheet where the process or steps name are included and time is included in table. We also calculate SMV & capacity per hour.

In finishing floor in different line different types or style of products are running. So we took every style wise data. Such as running production was a Boxer and Boys shorts. We took data from this types of product.

Style wise data are given below.

All data are practically taken from sewing section of Tajir Apparels Ltd.

### 3.2.1 Capacity study Table: Line A

CAPACITY STUDY (FINISHING)

| Buyer: | LIWE ESPANOLA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Style: | Max 3 pack | | BEFORE IE WORK | | | AFTER IE WORK | | | COMPARISON | | Prod. Increase |
| SL | Process name | M/C | CT | SMV | ACTUAL PROD. | AVG. CT | SMV | AFTER CAPACITY | ACTUAL PROD. | AFTER IE CAPACITY | AFTER IE WORK |
| 1 | BODY THREAD CUT | HP | **51** | 0.94 | **70** | 42 | 0.77 | **78** | **70** | **78** | **8** |
| 2 | BODY TRANSFER FOR IRON | HP | **30** | 0.55 | **120** | 24 | 0.44 | **136** | **120** | **136** | **16** |
| 3 | BODY INSIDE IRON | IM | **33** | 0.60 | **110** | 26 | 0.48 | **126** | **110** | **126** | **16** |
| 4 | BODY INSIDE CHECK | Q.I | **30** | 0.55 | **120** | 26 | 0.48 | **126** | **120** | **126** | **6** |
| 5 | BODY OUTSIDE IRON | IM | **31** | 0.57 | **115** | 25 | 0.46 | **131** | **115** | **131** | **16** |
| 6 | FINAL GET UP CHECK | Q.I. | **31** | 0.56 | **118** | 27 | 0.50 | **121** | **118** | **121** | **3** |
| 7 | HANGTAG | HP | **28** | 0.51 | **130** | 24 | 0.44 | **136** | **130** | **136** | **6** |
| 8 | BODY PASS FOR METAL CHECK | HP | **25** | 0.46 | **145** | 21 | 0.39 | **156** | **145** | **156** | **11** |
| 9 | BODY DUST REMOVING | HP | **42** | 0.78 | **85** | 34 | 0.62 | **96** | **85** | **96** | **11** |
| 10 | BODY PACKING | HP | **33** | 0.60 | **110** | 26 | 0.48 | **126** | **110** | **126** | **16** |
| 11 | PACKING GUM TAPE ATTACH | HP | **30** | 0.55 | **120** | 24 | 0.44 | **136** | **120** | **136** | **16** |

## 3.2 Table, we can see the difference of smv& capacity before & after IE:

To calculate capacity study we have to calculate some tools of IE. Mainly we have used cycle time and SMV. First we have calculate cycle time using the formula = observed time / no. of readings. For example, in max 3 pack we have found the cycle time of body thread cut is 51 sec using the formula. Then we have calculated SMV of body thread cut Which is 0.94 using the formula, SMV= (cycle time/60)+ 10% allowance .This formula is used in our industry.  After Line balancing we have again calculated cycle time, SMV and found capacity study of body thread cut process which is 78 using the formula , capacity study= 60/SMV. We can see that actual production of body thread cut is 70 and after capacity study it increases to 78. All the process are calculated in the same manner. Increase use IE after 8.

### 3.2.2 Capacity study Table: Line B

CAPACITY STUDY (FINISHING)

| Buyer: | MARK DESIGNERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Style: | BOYS SHORTS | | BEFORE IE WORK | | | AFTER IE WORK | | | | COMPARISON | |
| SL | Process name | M/C | CT | SMV | ACTUAL PROD. | AVG. CT | SMV | AFTER CAPACITY | | ACTUAL PROD. | AFTER IE CAPACITY |
| 1 | BODY THREAD CUT | HP | **72** | 1.32 | **50** | 54 | 0.99 | **61** | | **50** | **61** |
| 2 | BODY TRANSFER FOR IRON | HP | **36** | 0.66 | **100** | 28 | 0.51 | **117** | | **100** | **117** |
| 3 | BODY INSIDE IRON | IM | **42** | 0.78 | **85** | 34 | 0.62 | **96** | | **85** | **96** |
| 4 | BODY INSIDE CHECK | Q.I | **33** | 0.60 | **110** | 26 | 0.48 | **126** | | **110** | **126** |
| 5 | BODY OUTSIDE IRON | IM | **40** | 0.74 | **89** | 31 | 0.57 | **106** | | **89** | **106** |
| 6 | FINAL GET UP CHECK | Q.I. | **48** | 0.88 | **75** | 40 | 0.73 | **82** | | **75** | **82** |
| 7 | HANGTAG | HP | **33** | 0.60 | **110** | 24 | 0.44 | **136** | | **110** | **136** |
| 8 | BODY PASS FOR METAL CHECK | HP | **32** | 0.59 | **112** | 22 | 0.40 | **149** | | **112** | **149** |
| 9 | BODY DUST REMOVING | HP | **55** | 1.02 | **65** | 38 | 0.70 | **86** | | **65** | **86** |
| 10 | BODY PACKING | HP | **45** | 0.83 | **80** | 36 | 0.66 | **91** | | **80** | **91** |
| 11 | PACKING GUM TAPE ATTACH | HP | **33** | 0.60 | **110** | 25 | 0.46 | **131** | | **110** | **131** |

### 4.4 Table, we can see the difference of SMV & capacity before & after IE:

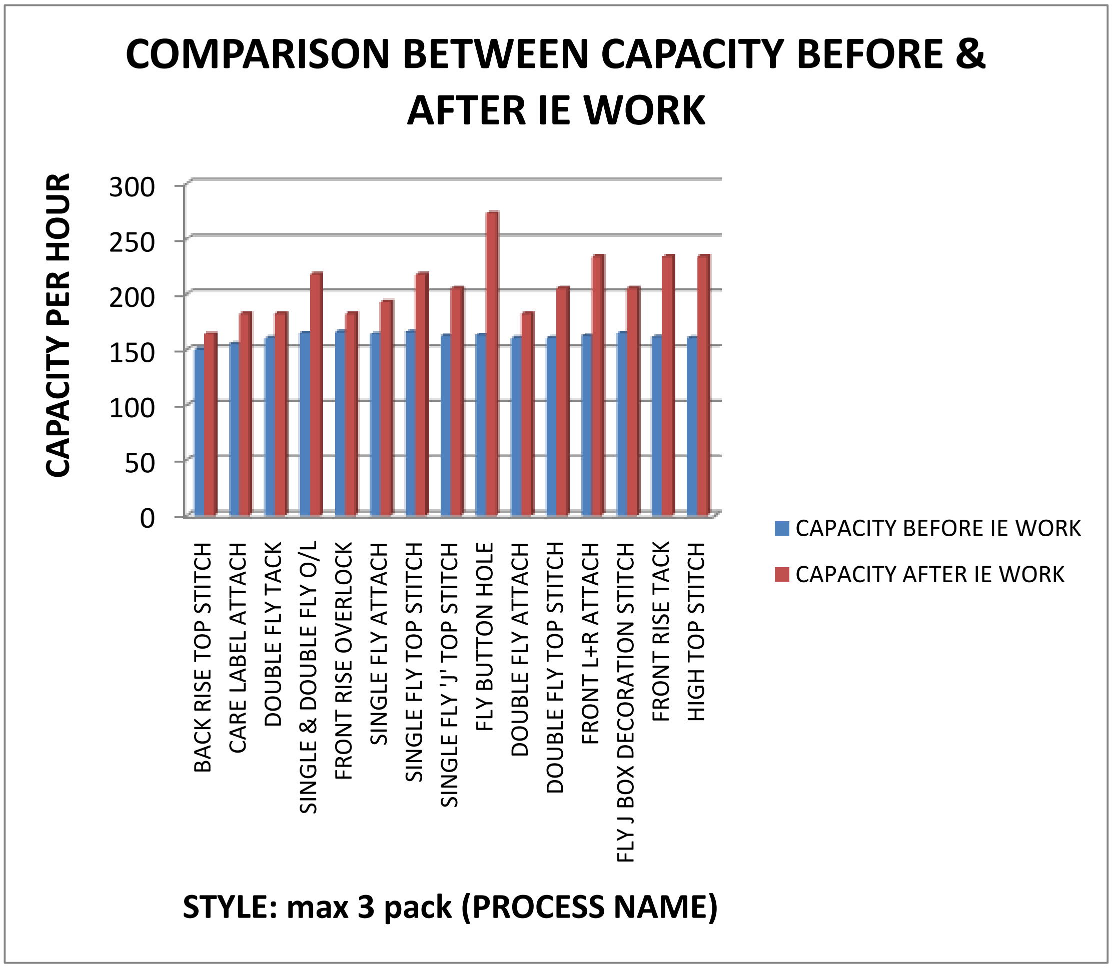
To calculate capacity study we have to calculate some tools of IE. Mainly we have used cycle time and SMV. First we have calculate cycle time using the formula = observed time / no. of readings. For example, in boys shorts we have found the cycle time of body packing is 45 sec using the formula. Then we have calculated SMV of body packing which is 0.83 using the formula, SMV= (cycle time/60) + 10% allowance .This formula is used in our industry.  After Line balancing we have again calculated cycle time, SMV and found capacity study of body packing process which is 91 using the formula , capacity study= 60/SMV. We can see that actual production of body packing is 80 and after capacity study it increases to 91. All the process are calculated in the same manner. Increase use IE after 11.

# Chapter-4

# Discussion of Results

# 4. Discussion of Results:

## 4.1 Capacity Study of Sewing for Line A:



### 4.1.1 Results & Discussion for Line A in sewing section:

We have prepared a graphical presentation to compare the capacity of the floor before and after IE work. By the means of increasing productivity is very important to apply tools in the sewing floor. In the present world the competitive condition in the garments section makes the production manager anxious about the fulfillment of quick demand of the customer. In our project report we tried to find exposed the importance of IE tools for a sewing floor. For example we collected data from each operator during production of a Max 3 pack. We have found that in back rise top stitch process the actual production is 150 pieces per hour. But after doing capacity study we found calculated production of back rise top stitch is 164 pieces per hour.

Now here the daily increase in productivity for back rise top stitch,

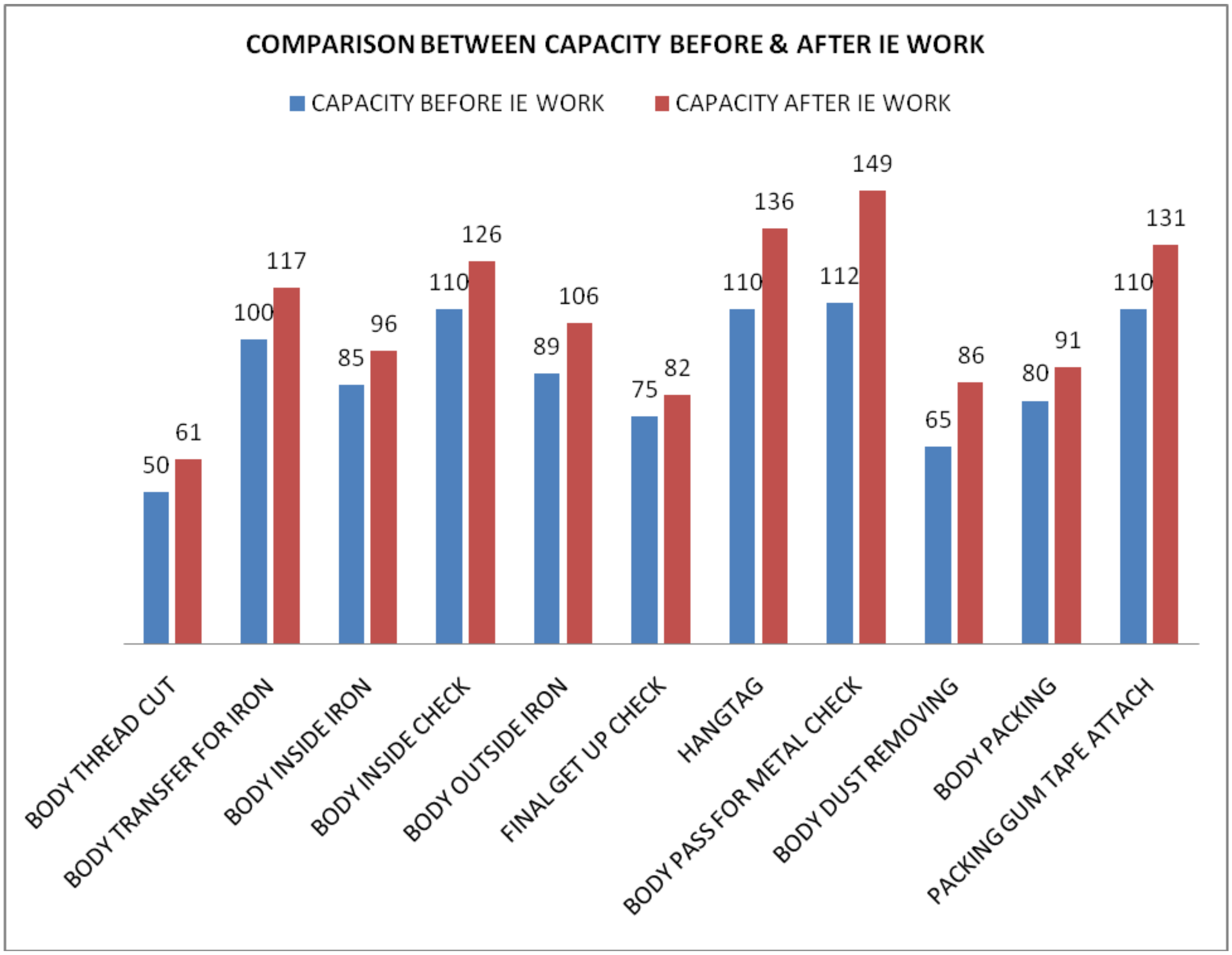
= Calculated production – Actual production

=164 pieces per Hr. – 150 pieces per Hr.

= 14 pieces per hour.

Here 10% allowance is used.

### 4.1.2 Capacity Study of Finishing for Line A:




### 4.1.3 Result & Discussion for Line A in finishing section:

We have prepared a graphical presentation to compare the capacity of the floor before and after IE work. By the means of increasing productivity is very important to apply tools in the finishing floor. In the present world the competitive condition in the garments section makes the production manager anxious about the fulfillment of quick demand of the customer. In our project report we tried to find exposed the importance of IE tools for a finishing floor. For example we collected data from each operator during production of a Max 3 pack. We have found that in hangtag process the actual production is 110 pieces per hour. But after doing capacity study we found calculated production of hangtag is 136 pieces per hour.

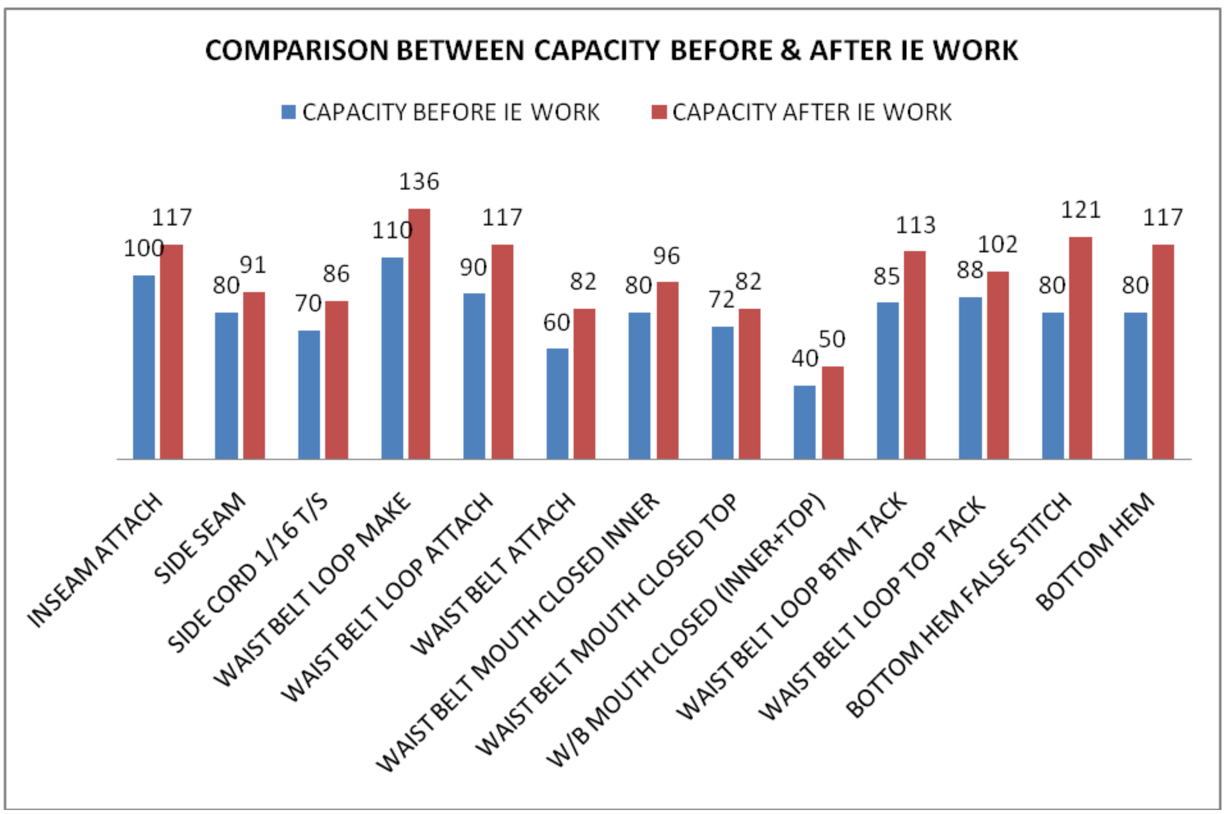
Now here the daily increase in productivity for hangtag,

= Calculated production – Actual production

= 136 pieces per Hr. – 110 pieces per Hr.

= 16 pieces per hour. Here 10% allowance is used.

## 4.2 Capacity Study of Sewing for Line B:



### 4.2.1 Result & Discussion for Line B in sewing section:

We have prepared a graphical presentation to compare the capacity of the floor before and after IE work. By the means of increasing productivity is very important to apply tools in the sewing floor. In the present world the competitive condition in the garments section makes the production manager anxious about the fulfillment of quick demand of the customer. In our project report we tried to find exposed the importance of IE tools for a sewing floor. For example we collected data from each operator during production of a Max 3 pack. We have found that in inseam attach process the actual production is 100 pieces per hour. But after doing capacity study we found calculated production of inseam attach is 117 pieces per hour.

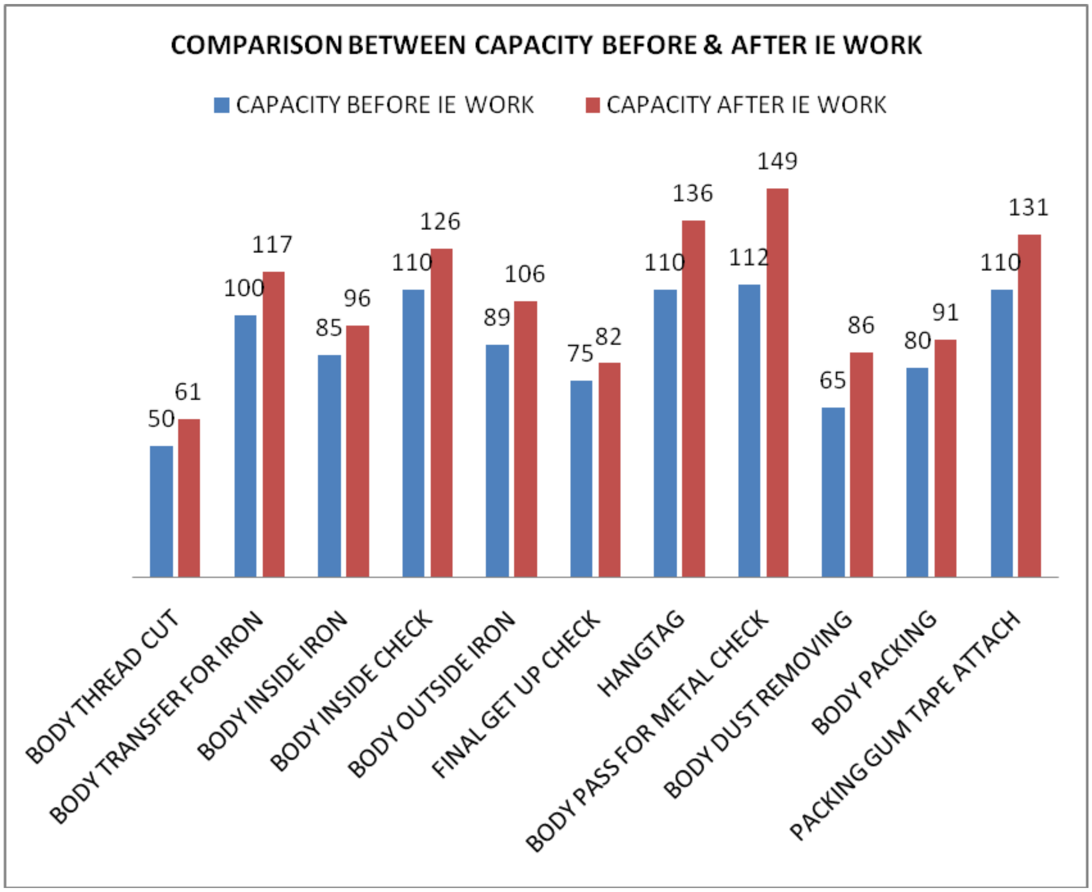
Now here the daily increase in productivity for inseam attach,
= Calculated production – Actual production

=117 pieces per Hr. – 100 pieces per Hr.

= 17 pieces per hour.

Here 10% allowance is used.

#### 4.2.2 Finishing line Capacity chart for Boys shorts:



### 4.2.3 Result & Discussion for Line B in finishing section:

We have prepared a graphical presentation to compare the capacity of the floor before and after IE work. By the means of increasing productivity is very important to apply tools in the finishing floor. In the present world the competitive condition in the garments section makes the production manager anxious about the fulfillment of quick demand of the customer. In our project report we tried to find exposed the importance of IE tools for a finishing floor. For example we collected data from each operator during production of a Boys shorts. We have found that in body thread cut process the actual production is 50 pieces per hour. But after doing capacity study we found calculated production of body thread cut is 61 pieces per hour.

Now here the daily increase in productivity for body thread cut,

= Calculated production – Actual production

= 61 pieces per Hr. – 50 pieces per Hr.

= 11 pieces per hour.

Here 10% allowance is used.

# Chapter-5

# Conclusion

5. Conclusion:

Industrial engineering is an important and essential part of any apparel industry. The productivity and efficiency of the sewing lines has been increased. The thesis is “Study on Capacity study of Sewing and Finishing Section of a Garments Industry” is properly many knowledge is achieved of This project and results is found that in **back rise top stitch process the actual production is 150 pieces per hour. But after doing capacity study we found calculated production of back rise top stitch is 164 pieces per hour. Found that in hangtag process the actual production is 110 pieces per hour. But after doing capacity study we found calculated production of hangtag is 136 pieces per hour.** We worked hard with the patient to complete the project. The proper handling of our supervisor helps us to complete our project properly. So we are grateful to our supervisor. However from this project we gathered a vital experience about line balancing, SMV, productivity, line efficiency, manpower, machine, cycle time, time study, sewing line etc. It can be said that without arranging a proper line balancing on the sewing floor of a garments factory optimum productivity & efficiency cannot be gained. So productivity can be achieved by allocating skill & semi-skilled workers to the right place and unskilled operator should be trained properly.  At last, the noticeable achievements of line balancing are-: improvement of productivity, smooth work flow, balanced cycle time, easy fault finding, reduced bottleneck, balanced line efficiency, reduction operation breakdown, equal distribution of work, skilled, semiskilled & unskilled co-ordination and easy way to supervise.

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