Faculty of Engineering
Department of Textile Engineering

**"Study on Activities of an IE in Sewing Section of a Garments Industry"**
**Course Title: Project (Thesis)**
**Course Code: TE-410**

**Prepared for:**
Kazi Rezwan Hossain
Lecturer
Department of Textile Engineering
Daffodil International University.

A Thesis submitted In Partial Fulfillment of the Requirement for the Degree of Bachelor of Science in Textile Engineering.

**Prepared by:**
Sajon Debnath
Id: 162-23-238
Md. Sahadot Hossion
ID: 162-23-240
Md. Sultanul Islam
Id: 162-23-244
Department of Textile Engineering Daffodil International University

Advance in Apparel Manufacturing Technology
Date: April, 2019.

## Declaration

We hereby declare that, this project has been done by us under the supervision of **Kazi Rezwan Hossain, Lecturer, Department of TE,** and Daffodil International University. I also declare that neither this project nor any part of this project have been submitted elsewhere for award of any degree.

……..
Sajon Debnath
ID: 162-23-238

…….
Md. Sahadot Hossion
ID: 162-23-240

……..
Md. Sultanul Islam
ID: 162-23-244

# Acknowledgement

First we express our heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this project successfully.

We fell grateful to and wish our profound indebtedness to **Kazi Rezwan Hossian**, Lecturer, Department of **TE,** and Daffodil International University. Deep Knowledge & interest of our supervisor in the field of 'Industrial Engineering' influenced me to carry out this project. His endless patience, guidance ,continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stage have made it possible to complete this project.

We would also like to express our sincere gratuity to **Engr. Prodeep** Factory Industrial Engineer, **"Turag Garments & Hosiery Mills Ltd. & Pinaki Group Fin-Bangla Apparels Ltd. Located at South panishail, Kashimpur, Gazipur."& 72, Degerchala Road, Chaydana, National University, Gazipur, Bangladesh. Deger Chla Rd.** For allowing us to complete our Two months industrial training in this factory and also for his useful guidance throughout the course. I also want to thank **Md. Khairul Islam** Manager (Lab & QC) for his help and Head, Department of TE, for his kind help to finish our project and also to other faculty member and the staff of TE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took Part in this discuss while completing the course work.

At last but not the least, we like to acknowledge my parents for their approval, support & love to complete the report.

# LETTER OF APPROVAL

11th April, 2019
To
The Head Department of Textile Engineering 102, Shukrabad, Mirpur Road, Dhaka-1207

Subject: Approval of Project Report of B.Sc. in Textile Program.
Dear Sir,

I am just waiting to know you that, this project report titled as "**Study on Activities of an IE in Sewing Section of a Garments Industry**" has been prepared by the student bearing ID's **162-23-238** and **162-23-240** and **162-23-244** are 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 student was directly involved in their project activities and the report become vital to spark of many valuable information for the readers.

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

…….....
Kazi Rezwan Hossain
Lecturer
Department of Textile Engineering
Daffodil International University

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# ABSTRACT

We discussed the paper comparing the productivity and efficiency before and after applying the Industrial engineering & lean technique. This is true today Millions of dollars are wasted each and every day in organization, through lack of awareness of this need to constantly improve productivity. Most of it can be stopped.

By using method, time, capacity and production study, it is possible to improve productivity while reducing wastage. Two important attributes have been considered, one is possible standard method for each process and another is considerable time. Time study took to record the actual individual capacity of each worker. I have recorded the time to make each process for each and every worker to find out the optimum number of operator and helper, type of machines, basic and standard pitch time and individual capacity. To find out the (standard minute value) S.M.V, process wise capacity has been calculated, in addition to that we have calculated the target, capacity, manpower, line graph, labor productivity and line efficiency. Line has been balanced considering the bottleneck and balancing process where the balancing process has shared the excess time after the production in the bottleneck process.

In this paper we discussed some procedure about Time, Capacity, and Production study. Also discussed about operation breakdown and others tools and techniques which consist of different experimental discussion, experimental result & discussion. In this project efficiency has increased 5% to previous history.

# CHAPTER-1

# INTRODUCTION

## 1.1 History OF Industrial Engineering:

Mr. F W Taylor who is called the father of scientific management is the founder of work-study. During the Second World War USA needed so many arms within a short time. Then Mr. F W Taylor applied Work-Study method to make many arms in short time & go tremendous result. After that work-study is being used in everywhere. Now it's circumference is getting larger day by day.

Mr. Keith Harding form England started Work-Study in Bangladesh (Young one Corporation) in 1991.Now it is contributing very well to increase the productivity in Bangladesh.

## 1.2 Introduction:

Management frequently alls on specialist to assist it in improving productivity .One of the most powerful tools they can use is that of Work-Study.

When management calls on work -study to improve productivity then they aim at

1. Examining the way an activity is being carried out.
2. Simplifying or modifying the method.
3. Reduce unnecessary or excess work.
4. Wasteful use of resources
5. Setting up a time standard for performing that activity.

The relation between Work-Study and productivity is obvious. If the Work-Study can

Reduce/ cutting down of an activity by 20%, merely as a result of rearranging the sequence or modifying or simplifying the method of operation without additional expenditure.

Then productivity will go up/increase 20%

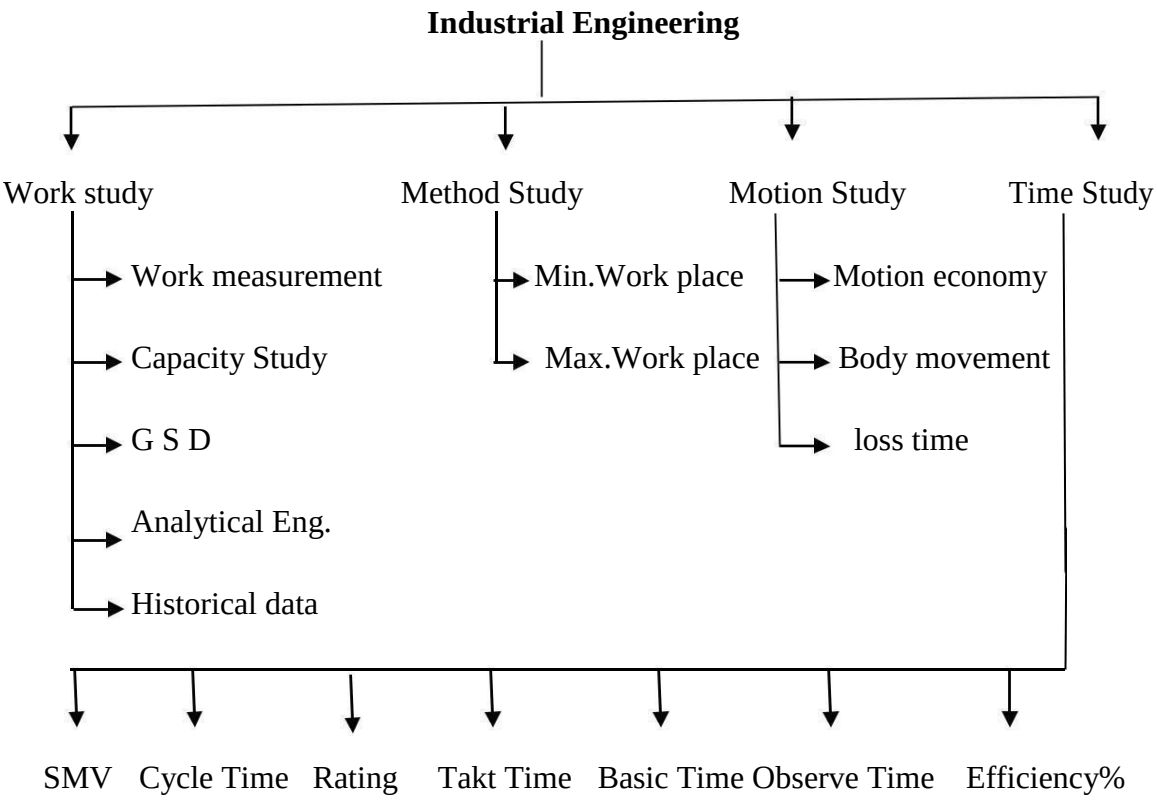
# CHAPTER-2

# Literature review

**2.1 Industrial Engineering:** is a branch of engineering which is used to eliminate waste of time, money, materials, machine time, energy, person-hours, and other resources that do not generate value. As like other manufacturing industry, industrial engineering now widely used in textile and apparel industry. Textile and garment industry have to face heavy challenges due to various factors including global competition, production costs increase, less productivity/efficiency, labor attrition, etc. For overcoming those challenges industrial engineering knowledge and formulas are frequently used in apparel manufacturing industry. In this article I have given some important and popular terms and formulas of industrial engineering. I have also given some examples for which reader can easily understand

**Industrial Engineering (IE) =production↑ cost↓**

**proper use of all elements↑ Efficiency↑ Profit↑**



## 2.2 Latest utilization of IE:

- Computer and Simulation
- Robotics and Automation
- Materials Handling
- Logistics and Distribution
- Management Information Systems
- Advanced Manufacturing Processes
- Quality Control

## 2.3 Responsibilities of an Industrial Engineer:

- Participate PP Meeting.
- Collecting information form fast react planner about running & new style input status.
- Making work plan/ Departmental plan
- Work-Study members job allocation.
- Providing Estimated SMV to sales team for costing
- Process analysis
- Established standard minutes (SMV find out form sewing line by performance rating)
- Prepare GRMT Breakdown before issue with Technician & APM
- Process Layout including time.
- Work Process flow chart during layout
- Cycle Check & Line Balancing.
- Making line graph
- Co-Ordinate (Work-together) with line Supervisor/ Technician for line balancing
- Production Study
- Speed Training & Performance Program
- Method Study & Time study.
- Production monitoring in the required line
- Physical consumption of Thread, Fabric, Seam Tap & Accessories
- Target & Efficiency Calculation
- Production planning
- C.M calculation
- C.P.M calculation
- Departmental & Factory inventory
- Analytical work of others department.

## 2.4 Tools and techniques for Industrial engineering

### Tools:

- Magnitude of operations
- Labor:
- Industrial machinery
- Expensive fabric

### Techniques:

- Method analysis
- Capacity studies and strength analysis
- Follow-up study
- Statistical quality control
- Scheduling systems

## 2.5 Key points for Observer:

- At first need to inform to the production manager.
- Observe item
- Input date(after2-5 from input date)
- Ending date
- Flow of production
- Supply of materials
- Estimated time
- Method of layout(straight or zigzag)
- Note down daily input and output
- Number of worker and number of machine

# CHAPTER-3
# Methodology

## 3.1 Process Flow Chart:

Outline process chart is also called of process flow chart. Process flow chart is a process which is giving an overall picture by recording main operation and inspection.

**FLOWCHART OF PROCESS**

MARKING

↓

CUTTING

↓

INSPECTION

↓

NUMBERING

↓

BUNDLING

↓

SEWING

↓

FINSHING

↓

WAREHOUSE

## 3.2 Application of process flow chart:

(i) Elimination or simplification of operations.

(ii) Elimination or simplification of inspections needed or relocation of Inspection points.

(iii) Reduced in movement distance of man or materials in shops.

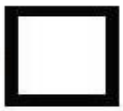
(iv) Reduction in delay or waiting times.

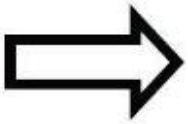
(v) Reduction in number or elimination of periods of temporary storage of Materials between operations. This saves floor space as well as reduces

**3.3**

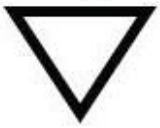
**Process chart symbols**

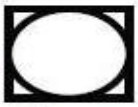
(a) **Operation** – Any operation for making altering or changing the job is said to be an operation. 

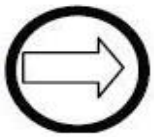
(b) **Inspection** – Checking the quality and quantity. 

(c) **Transport** – Movement or travel of the job. 

(d) **Delay or temporary storage** – Breakdown, interface or time required for some adjustments. A temporary halt in the process. 

(e) **Storage** – Keeping, holding and storing the job and other things. 

(f) **Operation and inspection** – Set of tool, e.g., powder milk tin is being weighed (inspection) as it is filled. 

(g) **Operation cum transport** – Articles are being painted as they are transported by the chain conveyor. 

## 3.4 Method analysis:

| Flow process chart | Man/material/equipment type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Location of materials warehouse | Product name<br>Men's shirts | | | Survey date | | Analyst | | Dept<br>cutting | |
| Activity: transport, spreading, cutting, bundling, storing. | Start point | | | Taken from material warehouse | | | | | |
| | End point | | | Stored on shelves in cutting dept | | | | | |
| | Symbols | | | Time | | Distance | | | |
| | ○ - Operation | | | 3.5 h | | | | | |
| | ⇨ - Transport | | | 0.2 h | | | | | |
| | D- Delay | | | 0 | | 27 m | | | |
| | □ - Inspection | | | 0 | | | | | |
| | ▽ - Storage | | | 27 h | | | | | |

| Tasks | Qty | Distance Travelled | Time | ○ | ⇨ | D | □ | ▽ | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Transport fabric from warehouse to cutting dept | 17 rolls | 20m | 10 min/10 rolls | ○ | ⇨ | D | □ | ▽ | |
| Wait for Spreading | 17 rolls | | 3 h | ○ | ⇨ | D | □ | ▽ | Can waiting time reduced |
| Spreading | 4 rolls | 5m | 1.2 h | ○ | ⇨ | D | □ | ▽ | |
| Marker drawing | 4 rolls | | 0.5 h | ○ | ⇨ | D | □ | ▽ | |
| Rough cutting Straight knife cutting | 4 rolls | | 0.5 h | ○ | ⇨ | D | □ | ▽ | |
| Band knife cutting | 200 garments | | 1 h | ○ | ⇨ | D | □ | ▽ | |
| Numbering/bundling | 200 garments | | 0.3 h | ○ | ⇨ | D | □ | ▽ | Can numbering m/c used |
| Transport to shelves at cutting dept | 200 garments | 2m | 0.2 h | ○ | ⇨ | D | □ | ▽ | |
| Waiting for sewing | 200 garments | | 1day | ○ | ⇨ | D | □ | ▽ | |
| **Total** | | **27m** | | **5** | **2** | **0** | **0** | **2** | |

## 3.5 Flow diagram:

Flow diagram is a drawing or a diagram which is drawn to scale.

It shows

Relative position of product machinery, fixtures, etc., and marks the paths Followed by men and materials.

In garments factory we normally see that a garment is produced by the following diagram:

Fabrics storages

⇩

Fabric lay down

⇩

Cutting

⇩

Numbering & bundling

⇩

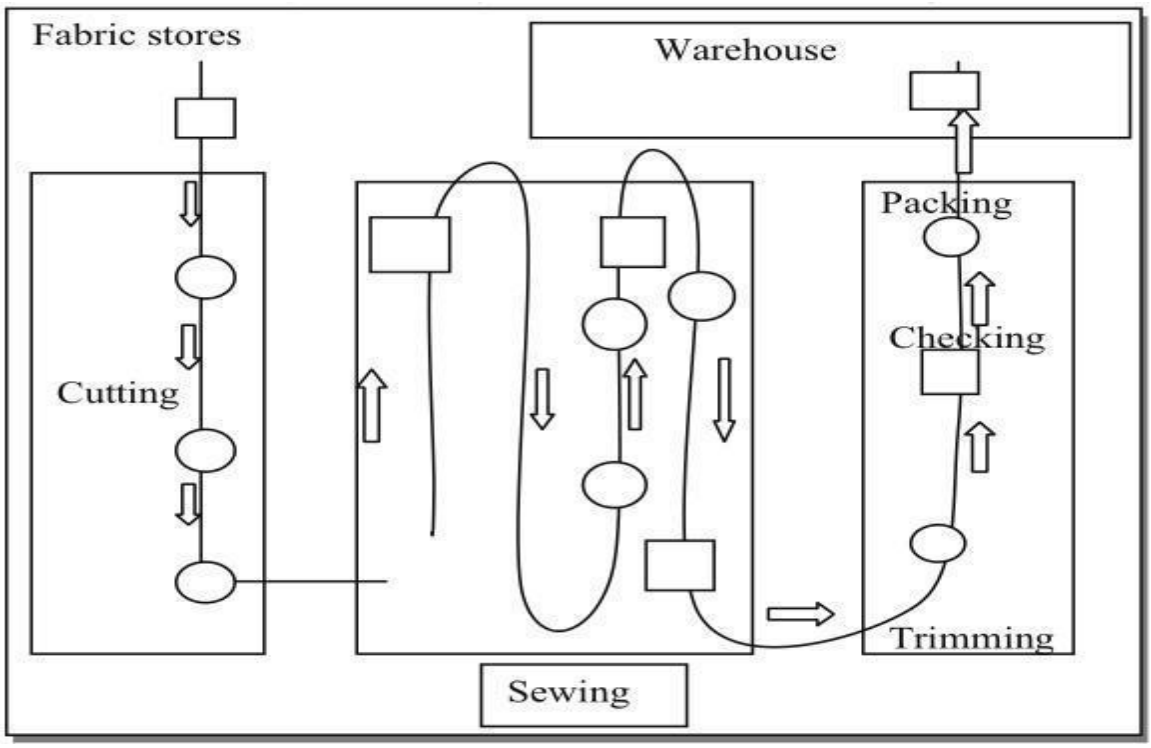
Sewing

⇩

Finishing

⇩

Warehouse




**Flow diagram – garment unit**

## 3.6Line balancing:

Production line balancing is the allocation of the work to be done to the people available to do it production line balancing is used.

- To ensure a steady flow of work
- To make the best use of the available time &
- To keep work in progress of a minimum.

Distribution of the works in a line on the basis of P.T, UCL & LCL is called line balancing. Line balance means the better allocation of the necessary tasks between the operators, which reduces waiting time.

At the time of making paper layout a work-study officer follow the balancing system & at running line to reduce bottleneck a work study officer also balance the line.

For line balance we have to know some data and some calculating information those are as follows: -

1) How many operator.
2) Operation.
3) SMV.
4) Performance.
5) Potential production / hour.
6) Hours to achieve target.
7) Capacity.
8) Target.

$$\text{Target / hour:} \quad \frac{60}{\text{SMV}} \times \text{Wanted efficiency\%}$$

If SMV = 1.22

Performance = 80%

Target / Week = 2655

$$\text{Then Target / Hour} = \frac{60}{1.22} \times 80\% = 39 \text{ pcs/hour}$$

**Potential Capacity of a operator/hour =** $\frac{60}{\text{Observe time}}$ pcs

$$= \frac{60}{1.22}$$

= 49.18

= 49 pcs

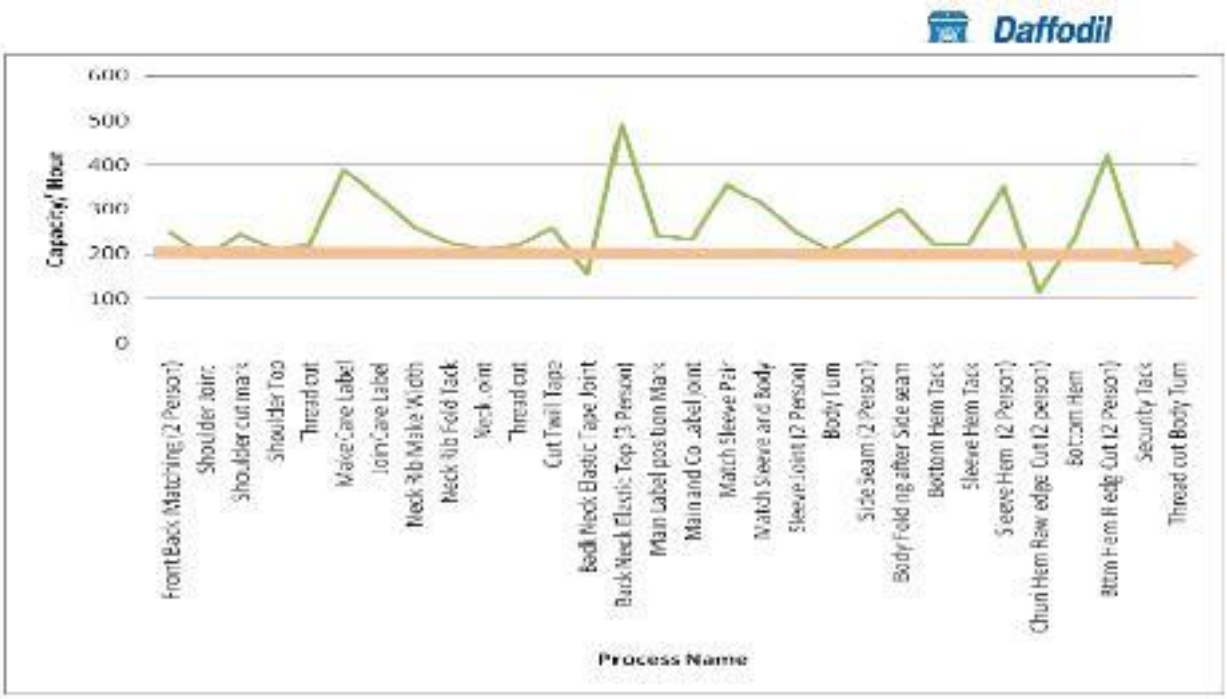
## 3.7 Required of line balancing:

- To get easily output, it is required.
- To get best performance of the workers, it is required
- To ensure of proper use of time & manpower, it is required
- To follow up the line easily, it is required
- To give the pressure to workers for optimum output, it is required
- To know the line's potential capacity of the line, it is required
- To determine the productivity gap%, it is required
- To take the next step for higher productivity at need the line balancing report it is required,
- To get higher productivity so much required

## 3.8 Before balancing the line:

In the following table we show the m/c productivity and line efficiency, worker, target before the line balancing.

## Variation chart before line balancing:



## 3.9 Line balancing process:

Table2: **Balancing Processes to equalize the bottleneck process**

| Balancing Capacity Per Hour |
|---|

| Sl No. | | Bottleneck Process | | | | Balancing Process | | |
|---|---|---|---|---|---|---|---|---|
| | Process Name | Process No. | Capacity /Hour | Balanced Capacity | Process Name | Process No. | Capacity /Hour | Balanced Capacity |
| | | | | | | | | |
| 1 | Make & Join Care Label | 6 | 178 | 208 | Neck Rib Make Width | 7 | 261 | 217 |
| | Remarks: | Process # 7 can work for 50 min. and share work with process # 6 for last 10 min. | | | | | | |
| | | | | | | | | |
| 2 | Back Neck Elastic Tape Joint | 12 | 153 | 216 | Back Neck Elastic Top | 13.B | 327 | 258 |
| | Remarks: | Process # 13.B can work for 35 min. and share work with process # 12 for last 25 min. | | | | | | |
| | | | | | | | | |
| 3 | Match Slv Pair & Sleeve & body | 16 | 167 | 195 | Main Label position Mark | 14 | 242 | 201 |
| | Remarks: | Process # 14 can work for 50 min. and share work with process # 16 for last 10 min. | | | | | | |
| | | | | | | | | |
| 4 | Sleeve Hem | 23 | 175 | 198 | Bottom Hem | 25 | 231 | 200 |
| | Remarks: | Process # 25 can work for 52 min. and share work with process # 23 for last 8 min. | | | | | | |
| | | | | | | | | |
| 5 | Churi Hem Raw edge Cut | 24 | 115 | 153 | Body Folding after Side seam | 20 | 300 | 200 |
| | Remarks: | Process # 20 can work for 40 min. and share work with process # 24for last 20 min. | | | | | | |
| | | Process # 24 can improve the method or use floater to balance the processs. | | | | | | |
| | | | | | | | | |
| 6 | Security Tack | 27 | 184 | 199 | Sleeve Hem Tack | 22 | 223 | 204 |
| | Remarks: | Process # 22 can work for 55 min. and share work with process # 27 for last 5 min. | | | | | | |

**Balancing Processes:** In the balancing process all method are processing uniformly to increase productivity and efficiency and also reduce to create bottleneck.

## After balancing the line:

In the following table we show the Target, Labor, Machine productivity & Line efficiency after Line balancing.

Table 3: Bench mark Target, Labor and machine productivity and Line Efficiency after line balancing.

| | | | |
|---|---|---|---|
| Total Output Per Day | 1250 | | |
| Total Manpower = | 32 | | |
| Working Time = | 600 | Minutes | |
| S.A.M = | 8.90 | | |
| Target /Hour = | 216 | 100% Efficiency | |
| Target /Hour = | 173 | 80% Efficiency | New Bench Mark |
| = | 129 | 60% Efficiency | |
| = | 86 | 40% Efficiency | |
| Labor Productivity = | 39 | | |
| Machine Productivity | 66 | | |
| Line Efficiency % = | 58 | | |

## Variation chart after line balancing:

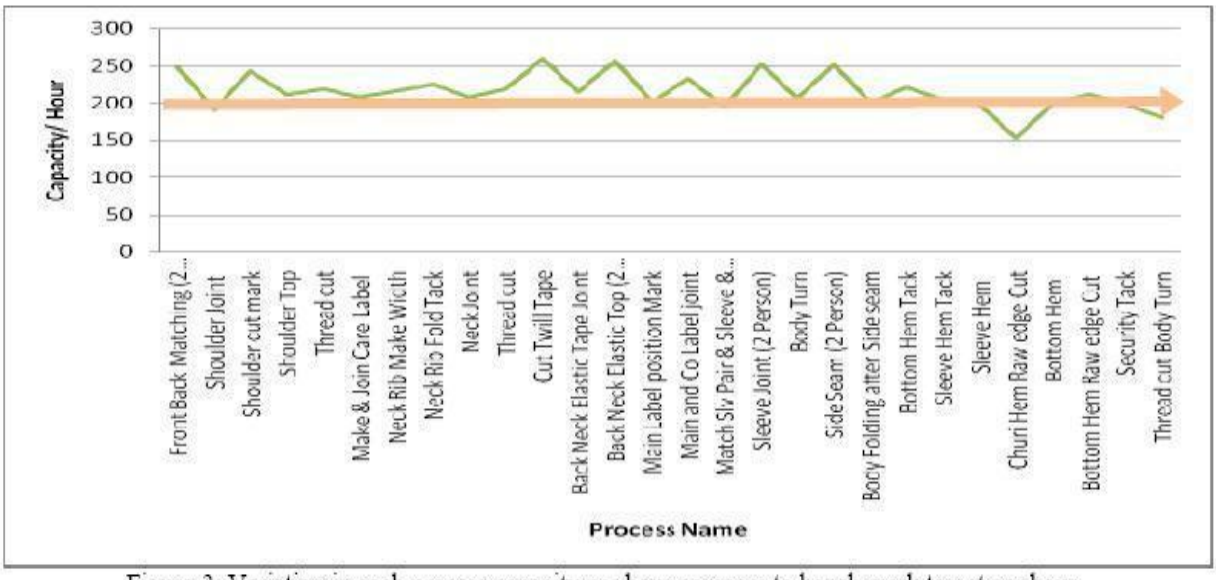



Figure-3: Variation in each process capacity per hour compare to bench mark target per hour

## 3.10 Curve Description:

Changed from traditional layout to balanced layout model, there are Considered improvements have moved toward us. the 3 operators who were replaced to another line, have been used in the flat lock stitch and Lock stitch machines and machine productivity for these less used machines has been increased from 55 to 66 where for The total worker of 32 instead of 37, labor productivity has been increased to 39 from 32. In a day we have boost up the production up to 1250 and with manpower of 32, line efficiency has been improved from 48% to 58% which is shown in Table. In an improved layout, target has been decreased at each efficiency level. At 80% efficiency, target is now 173 pieces per hour which has been considered a new bench mark target.

After balancing the process flow, figure shows the less variation of each process from the bench mark target as the upper capacity is 260(previous one was 490) pieces per hour where the lower capacity is only 153(previous one was 115) pieces per hour compare to the bench mark target of 200 pieces which shows that the variation in each process has been decreased from the previous one and reflects much better balanced production flow in the line. For Process no. 24 churi hem raw edge cut, an extra floater has been suggested to utilized.

## 3.11 Bottleneck:

Which are holding up production operations or a lengthy operation that consumes a great deal of time. If bottleneck is high then production will be less, so always try to uniform of all process.

Fig: Bottleneck

## 3.12 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

## 3.13: Bottleneck before input in line:

1) If issue is not supplied in time from M.C.D and sub-store.
2) If all issues come lately.
3) If Issues serial number is mistake.
4) If create Bundling mistake.
5) If Wrong issue is supply.
6) If Pattern is problem. Etc

## 3.14: Way of reducing bottle neck:

- To make size set sample minimum 15 to 10 days before input.
- 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 submit the layout sheet to maintenance section minimum 2-3 days before for better preparation.
- 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

## 3.15 Breakdown method:

In the clothing industry operation breakdown is the separation of the making operations so that garments can be made up quickly & cheaply using available labor & machinery.

The Breakdown procedure means helps the clothing industry in planning the number of Assembly lines required to produce the particular number of units in required time and also Helps in maintaining proper style distributions for each assembly line and machines in Order to reach the deadlines while earning profits

## Steps include in Breakdown procedure:

Assistant Production Manager, Technician Chief & Work-Study officer must sit together to make breakdown

↓

Technician breaks the garments into parts and gathered the parts one after another by operation/Process
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↓

Then Work-Study officer & APM fix up the SMV of that operation

↓

By preceding this technique when all process completed need to summarize all process SMV and the total will be called as respective garment's SMV

## 3.16 Plan layout:

Plan layout is the special arrangement & configuration of departments, work stations, & equipment used in the conversion process. Like plan layout ensure all facilities according to the type, size of activities to be carried out convenience, productivity, safety and efficiency of the facilities and users of the facilities.

## 3.17 Advantages of plan layout:

- Bottleneck should not be found in line.
- Idle operator should not be allowed.
- Can be achieve the Buyer's quality level easily.
- The process work content should be quite equivalent
- Can be reach the optimum target with in a very short period.
- Worker efficiency & daily production should be increases.
- Wastage & loss time will be reduce.

## 3.18 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)

## 3.19 Plan layout:

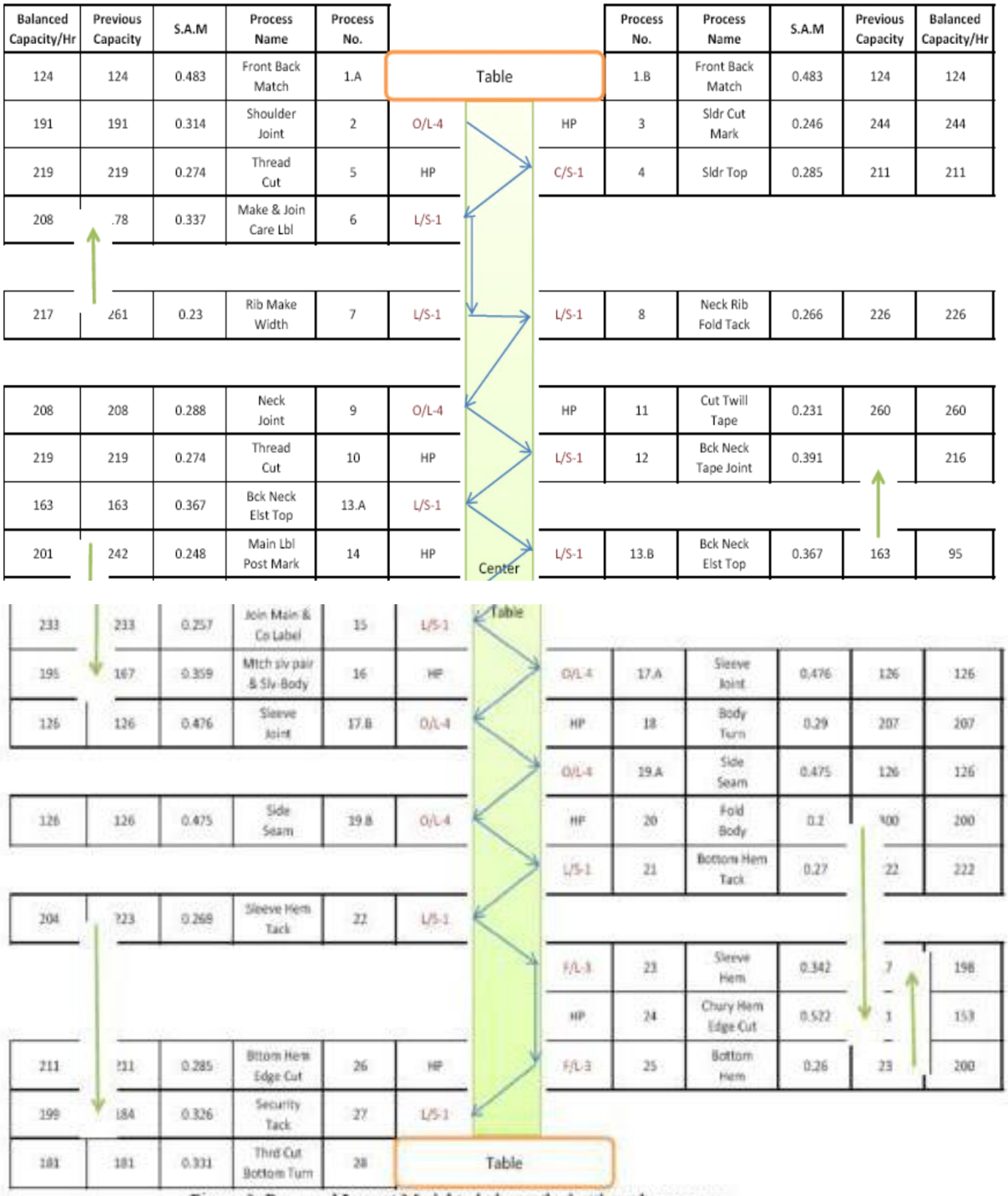
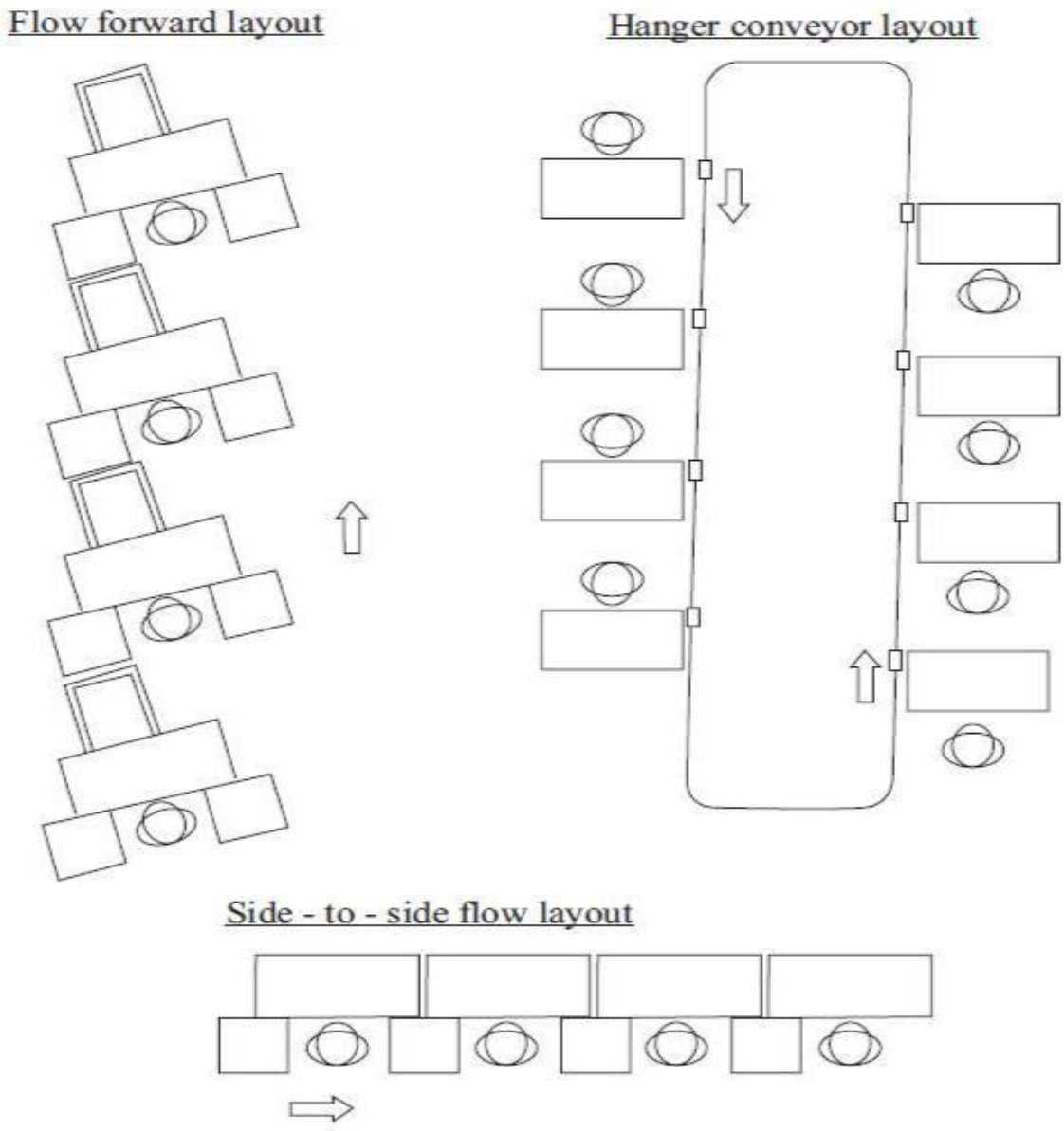



Figure 2: Proposed Layout Model to balance the bottleneck processes

## Different Types Of layout In Factory:

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




*5.5* Flow forward and side-to-side flow layouts

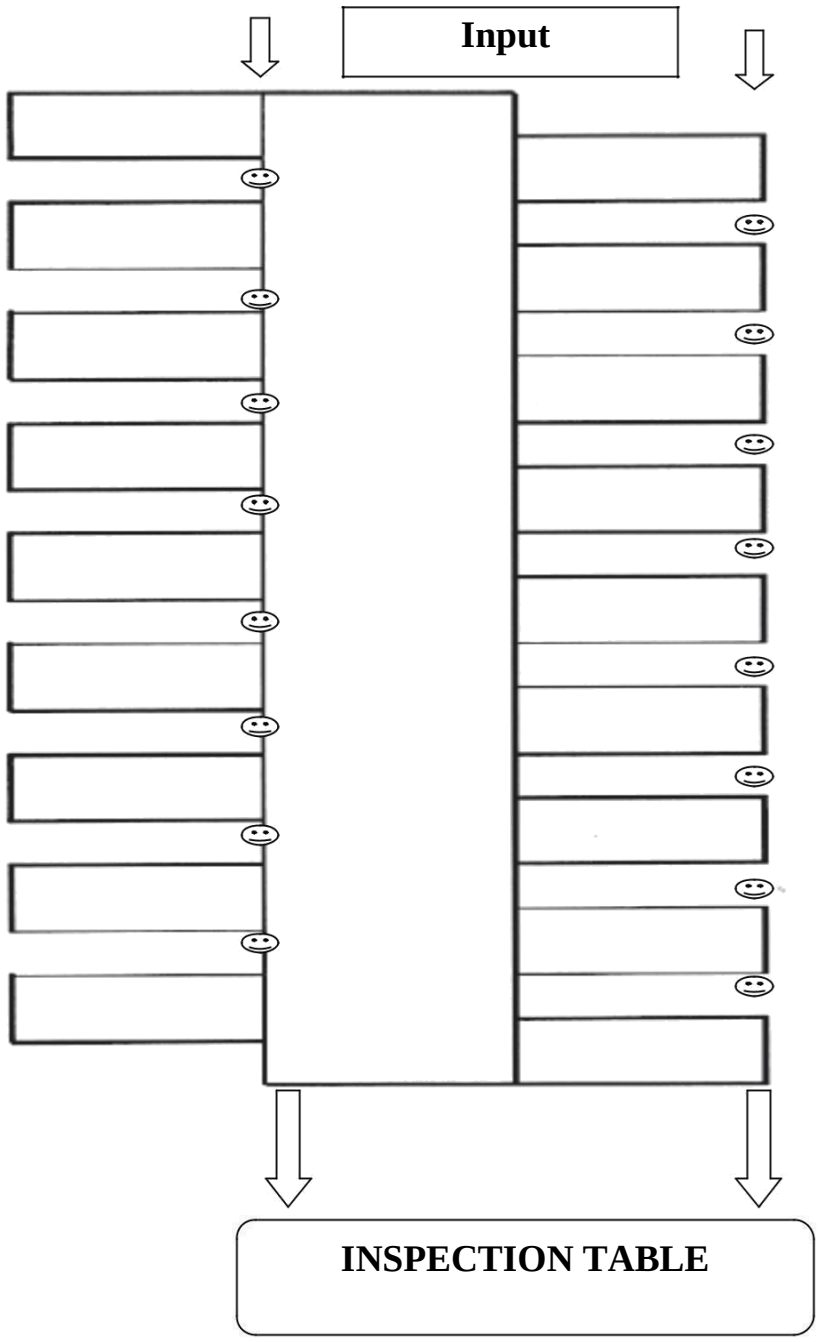



**Fig: Batch layout**

## 3.20 Cycle Time:

Cycle time is the observed time. Which can be calculated by different collected observing average time to complete any given parts. It can also express the dock-to-dock flow time of the entre 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."

**Cycle time = 60 /Team target**

## What is Takt Time?

Takt time is the allowable times to produce one product at the rate of customers' demand. This is not the same as cycle time, which is the normal time to complete an operation on a product.

**Available Minutes for Production / Required Units of Production = Takt Time**

Takt time is the calculated pieces of production based on the average speed at which the customer is buying a product or service. The formula is net available time to produce per time period divided by customer demand per time period. For example when,

Net available time = 4500 minutes / shift (10 operator's total man-minutes)

Customer demand = 500 pieces / shift

Takt time = (4500÷500) = 9 minutes / piece.

## 3.21 Pre- production planning:

The most important stage of pre-production activity is to arrange pre-production planning. In a pre-production meeting can discuss everything important related to the garments.
In pre- production planning the following decision are taken:

What is to be produced?
When to be produced?
Where to be produced?
How to be produced?

## 3.22 Process of production planning:

- Get a list of all items that goes into a product
- Get a list of their development lead times and supply lead time
- Identify constraints and bottleneck based on those lead times
- Identify the wastage capacities due to those constrains
- Calculate the costs of delays and wastages versus cost of bottlenecks removals where possible
- Make an informed decision

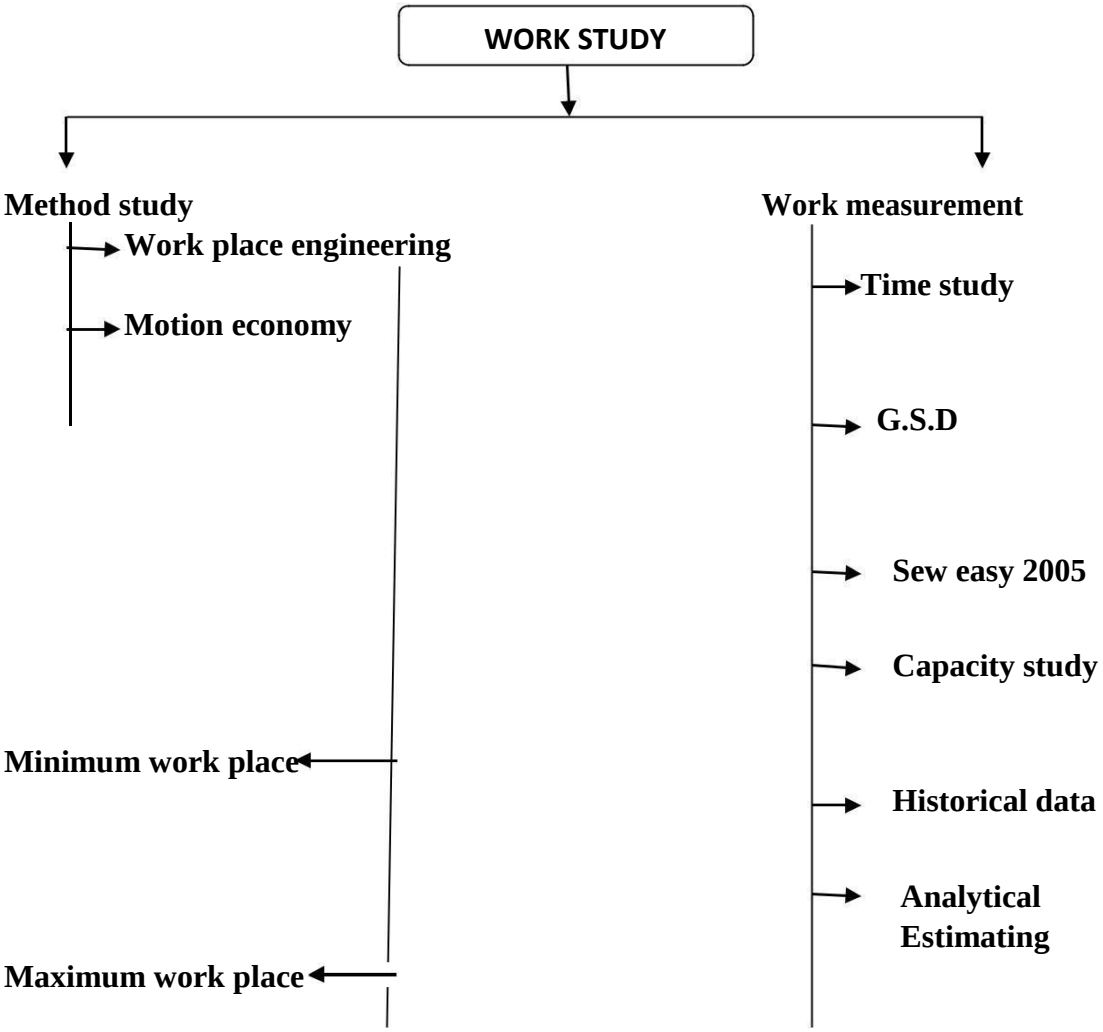
## 3.23 Attendance of pre-production meeting:

- Production manager
- Assistant production manager
- merchandiser
- Pattern maker
- Technician chief
- QA member
- Line chief
- Cutting manager
- Mechanic
- Buyer nominated QA
- GPQ Member
- IE Executive

## 3.24 Definition:

Work study is the application of techniques designed to establish the time for a qualified worker to carry out a task at a defined rate of working

Work study is a generic term for method study and work measurement which are used in the Examination of human work in all its contexts and which lead systematically to the Investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement



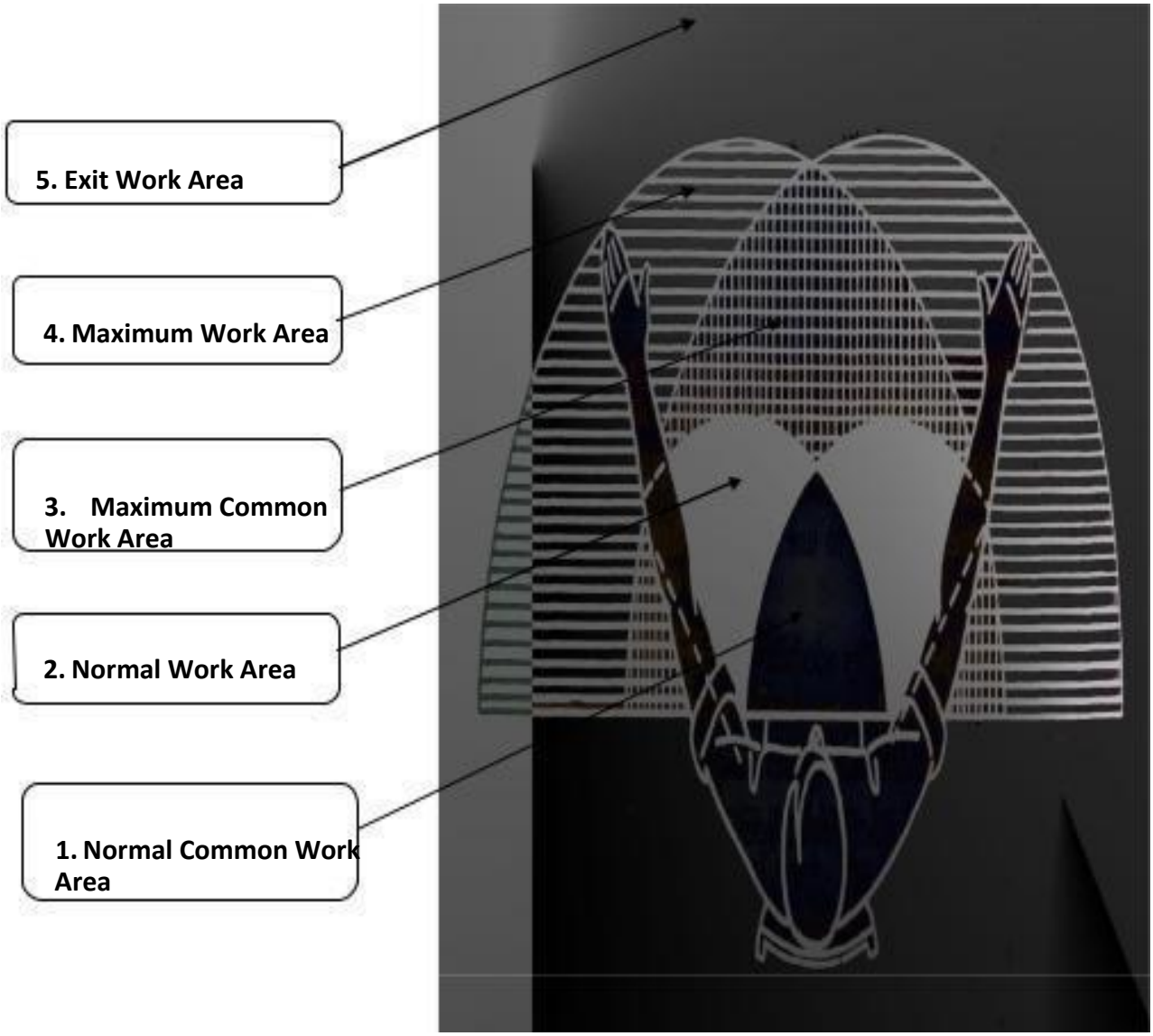
## 3.25 Method study:

Method study is the systematic recoding & critical examination of ways of doing thing in order to make improvements.

### Important consideration of the method study

- Minimum motion of the human body
- Arrangement of work place
- Working condition
- Process of manufacturing

## 3.26 Work place engineering:



**GSD**:
General sewing data is a technique for method analysis & setting of time standards for sewing products of industry

**GSD = (Man power*Work hour) / Target**

**Historical data:**

This is the technique of work measurement in this way we carry out an experimental & determine that time required for a certain operation

## Standard worker*:*

The standard worker is that worker who has the consistency a qualified worker is one who has acquired the skill, knowledge & other attributes to carry out the work in hand to satisfactory standard of quality quantity & safety.

## 3.27: Rating:

Rating is the assessment of the worker of working relative to the observer concept of the rate corresponding to standard rate.

Rating is a technique used to assess the speed and effectiveness of an operator performing an activity or group of activities

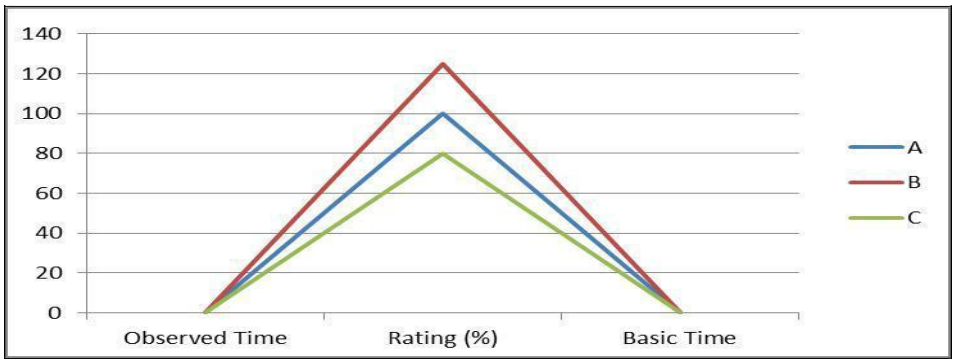
## Rating Errors:

- Loose rating
- Tight rating
- Flat rating
- Steep rating

## 3.28 Performance Rating:

| Person | Observed Time | Rating (%) | Basic Time |
|---|---|---|---|
| A | 0.20 | 100 | 0.20 |
| B | 0.16 | 125 | 0.20 |
| C | 0.25 | 80 | 0.20 |

## Performance rating graph:




From the above chart:

A is standard worker, B is a fast worker and C is a slow worker

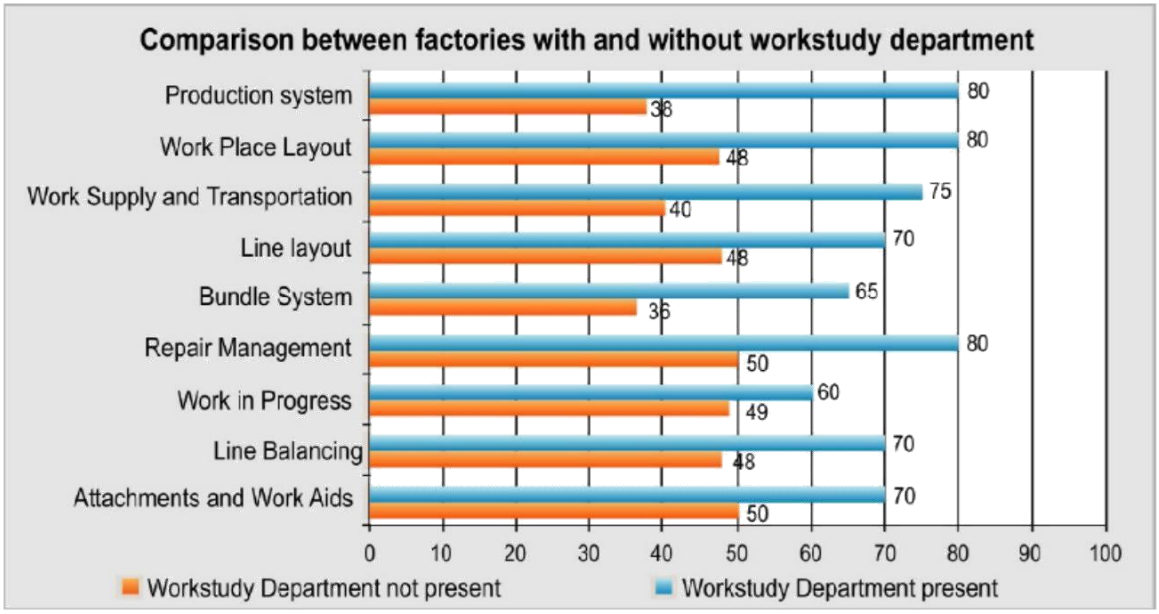
**3.29 Finally, we show some real examples of work study or its effectiveness in our report:**

*Status of Workstudy Department*

| Factory | Factory Rating (%) | Workstudy department Rating (%) | Status of Workstudy Department | Groups |
|---|---|---|---|---|
| 1 | 41 | 10 | Not present | B |
| 2 | 43 | 16 | Not present | B |
| 3 | 62 | 61 | Operational | A |
| 4 | 70 | 66 | Operational | A |
| 5 | 61 | 54 | Operational but not satisfactory | B |
| 6 | 42 | 33 | Not present | B |
| 7 | 50 | 29 | Not working properly | B |
| 8 | 52 | 47 | Being established | B |
| 9 | 55 | 17 | Not present | B |
| 10 | 56 | 33 | Not present | B |

*The workstudy departments in factories 5 and 7 are operational but ineffective.*

## Benefits of work study department:




Benefits of Workstudy Department

Looking at the comparison shown below it is obvious that group A factories are more productive than the group B factories. This fact is further strengthened when the overall factory survey results are compared. The factories in group A have a combined score of 62% for overall performance whereas factories in group B achieved a score of only 48%

## 3.30 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"

## 3.31 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

## Steps in making a time study:

- Get necessary details about the job and the machine.
- Make a number of observations before breaking the job down into basic times.
- Time 10 cycles – rating from time to time
- Convert to basic times
- Add the basic times for each element
- Give allowances

## 3.32 Time study chart:

| TIME STUDY SHEET | | | |
|---|---|---|---|
| **OPERATION NAME** | **SIDE SEAM** | | |
| **OPERATOR** | **NAHIMA** | | |
| **TYPE OF M/C** | **O/L** | | |
| **DATE** | **19/10/2012** | | |
| **ANALYST NAME** | **TOFAYEL,RABBY,AMIN** | | |
| **SL.NO** | **OT/ SC(MIN) RATING** | | **Frequency** |
| | **FACTOR** | | |
| **1** | **0.72** | | |
| **2** | **0.81** | | |
| **3** | **0.76** | | |
| **4** | **0.71** | | |
| **5** | **0.84** | | |
| **6** | **0.75** | | |
| **7** | **0.69** | | |
| **8** | **0.72** | | |
| **9** | **0.68** | | |
| **10** | **0.76** | | |
| **TOTAL** | **7.44** | | |
| **AVERAGE** | **0.74** | | |
| **OT – Observed time or SC – Single cycle time** | | | |

## 3.33 TIME STUDY SHEET: (T-SHIRT)

| | | ITEM | Men's T-Shirt | ORDER QUANTITY | 12875 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BUYER | Ernsting's Family | UNIT | | | | | | | | | | | |
| | | STYLE | 331948 | LINE | 2 | | | | | | | | | | |
| | | P.O | | | CYCLE TIME | | | | | | | | | | |
| SL | OPERATOR ID | OPERATOR NAME | PROCESS NAME | M/C | 1 | 2 | 3 | 4 | 5 | AVG | T w R | R.F | B.T | SMV | production/hr |
| 1 | 6071 | akhi | Matching Back & Front Part | HP | 5.70 | 5.8 | 4.91 | 6.7 | 7.1 | 0.10 | 595.8 | 75 | 7.55 | 0.13 | 467.3807205 |
| 2 | O2066 | Shopna | Shoulder join | O/L | 9.30 | 10.12 | 10.3 | 9.7 | 12.18 | 0.17 | 348.8 | 65 | 11.2 | 0.19 | 317.7405119 |
| 3 | 20100 | Rina | Thread Cutting | HP | 10.12 | 11.18 | 9.72 | 7.3 | 8.91 | 0.16 | 381.1 | 75 | 11.8 | 0.2 | 301.0662764 |
| 4 | O1078 | Nahar | Care level join | S/N | 12.18 | 12.09 | 11.9 | 11.92 | 12.19 | 0.20 | 298.9 | 55 | 11 | 0.19 | 321.6535374 |
| 5 | 1089 | Tarek | Process Quality | Q.I | 6.70 | 6.32 | 6.72 | 6.85 | 7.12 | 0.11 | 534 | 85 | 9.55 | 0.16 | 371.0893879 |
| 6 | 2080 | Arifa | Rib tack | S/N | 6.10 | 6.08 | 6.15 | 5.75 | 5.95 | 0.10 | 599.4 | 65 | 6.51 | 0.11 | 540.8247578 |
| 7 | 2102 | Papri | Rib service | HP | 11.21 | 10.91 | 10.9 | 10.91 | 11.2 | 0.18 | 326.8 | 75 | 13.8 | 0.23 | 258.6206897 |
| 8 | 20063 | Shohag | Neck join | O/L | 30.10 | 27.1 | 31.2 | 29.31 | 31.7 | 0.50 | 120.4 | 65 | 32.4 | 0.54 | 110.6716127 |
| 9 | 505 | Rafiq | Process Quality | Q.I | 12.71 | 12.37 | 12.8 | 11.71 | 11.91 | 0.21 | 292.7 | 85 | 17.4 | 0.29 | 204.8364154 |
| 10 | 2099 | Abul | Thread Cutting | HP | 12.35 | 12.81 | 12.2 | 15.1 | 14.71 | 0.22 | 268 | 65 | 14.6 | 0.25 | 244.839664 |
| 11 | 10077 | Amren | Back Tape join | F/L | 6.71 | 6.2 | 6.55 | 7.1 | 7.25 | 0.11 | 532.4 | 75 | 8.45 | 0.14 | 418.4829991 |
| 12 | 6083 | Nasima | Back Tape tack | S/N | 10.35 | 10.32 | 5.87 | 6.2 | 6.71 | 0.13 | 456.3 | 85 | 11.2 | 0.19 | 317.8106378 |
| 13 | 2016 | Moina | Tape cutting | HP | 10.12 | 8.7 | 7.71 | 7.91 | 8.12 | 0.14 | 422.9 | 65 | 9.22 | 0.16 | 384.1502454 |
| 14 | 6089 | Shahida | Main level point mark | HP | 12.10 | 10.12 | 10.3 | 10.35 | 9.71 | 0.18 | 342.2 | 75 | 13.2 | 0.22 | 270.6766917 |
| 15 | 30016 | Jarina | Main level join | S/N | 13.10 | 15.92 | 16.1 | 15.31 | 15.8 | 0.25 | 236.1 | 85 | 21.6 | 0.36 | 165.5070954 |
| 16 | 10104 | Saiful | Scissoring | HP | 10.12 | 10.18 | 9.12 | 9.19 | 9.18 | 0.16 | 376.6 | 65 | 10.4 | 0.18 | 342.710267 |
| 17 | 20069 | Ripon | Sleeve Hem | F/L | 6.10 | 8.7 | 7.71 | 8.12 | 8.15 | 0.13 | 464.2 | 75 | 9.7 | 0.16 | 365.6678517 |
| 18 | 12069 | Amena | Sleeve matching | HP | 6.45 | 6.15 | 6.18 | 7.45 | 6.45 | 0.11 | 550.8 | 55 | 5.99 | 0.1 | 586.1919236 |
| 19 | 1097 | Jorina | Sleeve matching with body | O/L | 8.71 | 8.12 | 7.78 | 7.98 | 8.12 | 0.14 | 442.2 | 85 | 11.5 | 0.19 | 308.100475 |
| 20 | 2016 | Lipi | Sleeve join with body | O/L | 26.90 | 26.56 | 27.1 | 27.31 | 27.22 | 0.45 | 133.2 | 75 | 33.8 | 0.57 | 106.108614 |
| 21 | 2076 | Sumi | Thread cutting | HP | 16.21 | 16.37 | 16.5 | 17.21 | 17.54 | 0.28 | 214.6 | 65 | 18.2 | 0.31 | 196.4868872 |
| 22 | 3089 | Chucana | Side Seam | O/L | 51.73 | 52.3 | 51.8 | 53.12 | 55.1 | 0.88 | 68.17 | 75 | 66 | 1.1 | 54.41148687 |
| 23 | 4098 | Sabina | Side Seam | O/L | 56.21 | 56.25 | 57.2 | 58.2 | 51.71 | 0.93 | 64.39 | 85 | 79.2 | 1.32 | 45.36366538 |
| 24 | 3081 | Maina | Kara tack | S/N | 10.31 | 9.2 | 9.21 | 9.98 | 8.14 | 0.16 | 384.3 | 85 | 13.3 | 0.22 | 268.2296841 |
| 25 | 3094 | Rajina | chaf tack | S/N | 9.12 | 0.122 | 13.2 | 15.1 | 18.01 | 0.19 | 324.1 | 65 | 12 | 0.2 | 295.5211714 |
| 26 | 2010 | Sema | Thread Cutting | HP | 16.21 | 16.37 | 16.7 | 17.21 | 17.21 | 0.28 | 215.1 | 65 | 18.1 | 0.3 | 196.8826907 |
| 27 | 3017 | Mina | Bottom Sewing | F/L | 17.22 | 17.31 | 17.5 | 14.21 | 14.71 | 0.27 | 222.5 | 55 | 14.8 | 0.25 | 240.2936923 |
| 28 | 1707 | Rema | Thread Cutting | HP | 49.31 | 51.56 | 47.1 | 53.24 | 52.71 | 0.85 | 70.89 | 85 | 71.9 | 1.2 | 49.93480733 |
| 29 | 507 | Hamida | Thread Cutting | HP | 49.22 | 50.16 | 49.8 | 54.87 | 51.64 | 0.85 | 70.4 | 75 | 63.9 | 1.07 | 56.19073633 |
| 30 | 589 | Marufa | Final Inspection | Q.I | 45.21 | 47.12 | 48.2 | 47.12 | 49.12 | 0.79 | 76.02 | 85 | 67.1 | 1.12 | 53.54141776 |
| 31 | 2548 | Dina | Final Inspection | Q.I | 43.33 | 44.12 | 43.8 | 49.12 | 48.64 | 0.76 | 78.59 | 75 | 57.3 | 0.96 | 62.70411496 |

| | |
|---|---|
| TOTAL OPERATORS | 18 |
| TOTAL HELPERS | 10 |
| QUALITY INCHARGES | 3 |
| TOTAL MANPOWERS | 31 |

## 3.34 Application of IE to reduce loss time:

**(Without IE department)**

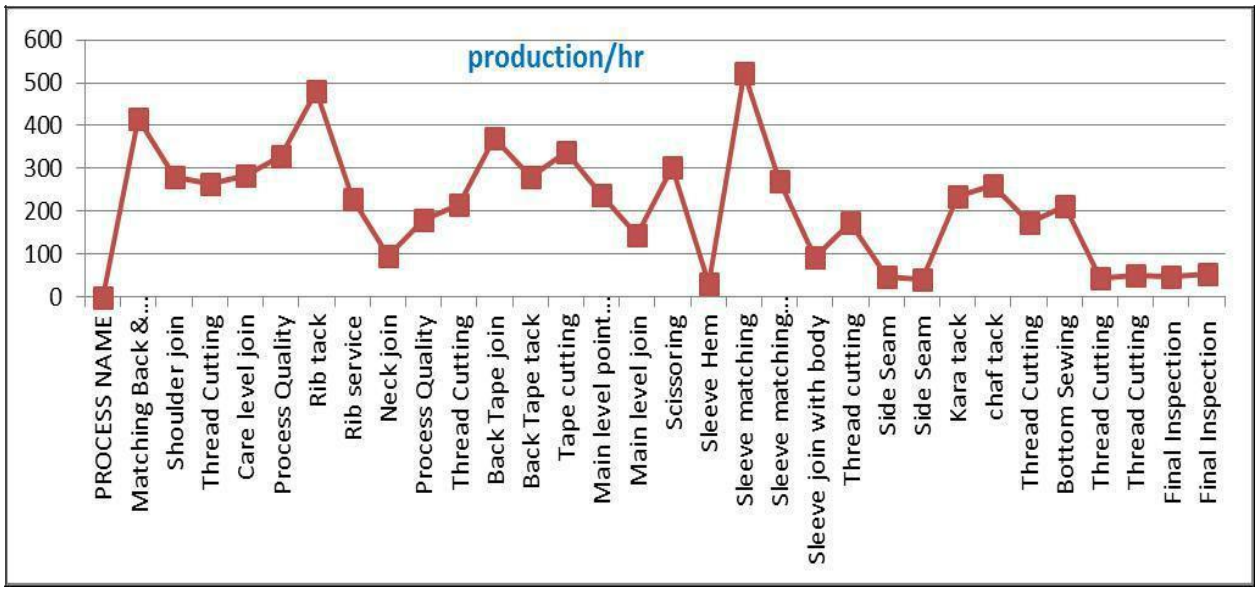
| Monthly loss time%(hours) | 4th February2019 | 4th March ,2012 | 4th April,2012 |
|---|---|---|---|
| Cutting section | 350 | 275 | 310 |
| Loss time(hours) | 8000 | 9000 | 9050 |
| Loss time% | 4.3% | 3.05% | 3.42% |
| Sewing section | 750 | 775 | 875 |
| Loss time(hours) | 15000 | 17,000 | 16050 |
| Loss time% | 5% | 4.55% | 5.45% |
| Finishing section | 525 | 645 | 570 |
| Loss time (hours) | 10000 | 12100 | 11900 |
| Loss time% | 5.25% | 5.33% | 4.78% |

## IE Department Present:

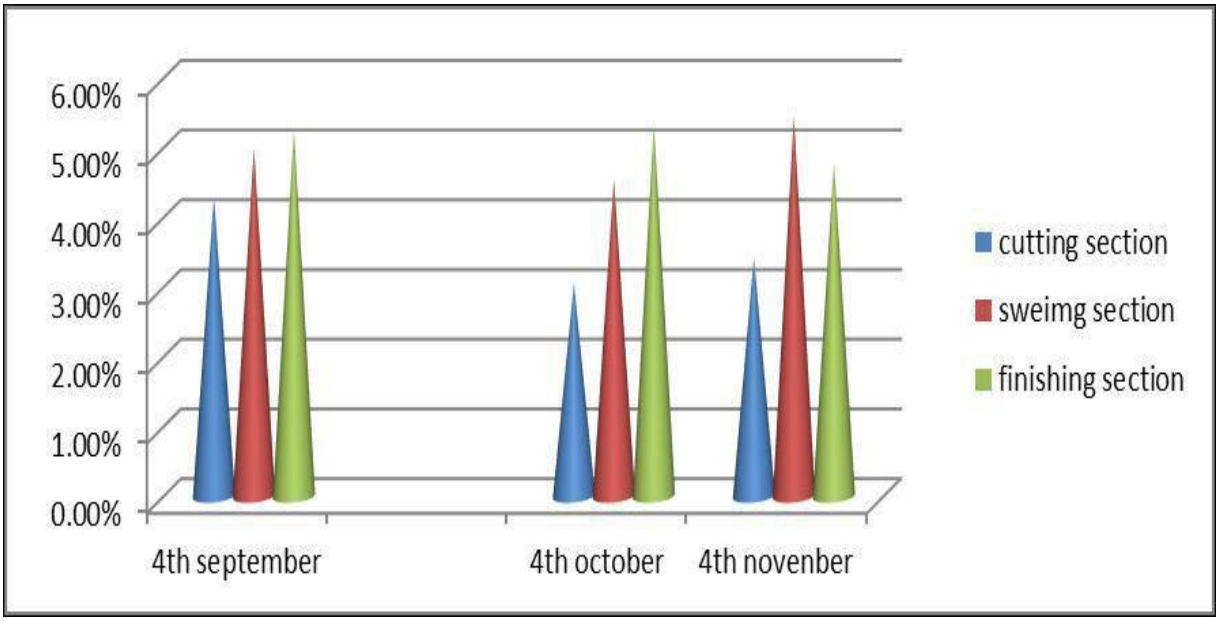
| | | | |
|---|---|---|---|
| Cutting section | 210 | 185 | 220 |
| Loss time(hours) | 8000 | 9000 | 9050 |
| Loss time% | 2.62% | 2.05% | 2.43% |
| Sewing section | 570 | 610 | 645 |
| Loss time(hours) | 15000 | 17,000 | 16050 |
| Loss time% | 3.8% | 3.58% | 4.01% |
| Finishing section | 385 | 415 | 385 |
| Loss time(hours) | 10000 | 12100 | 11900 |
| Loss time% | 3.85% | 3.42% | 3.23% |

# CHAPTER-4
# RESULT&DISCUSSION

## Graphical representation of production/hr:

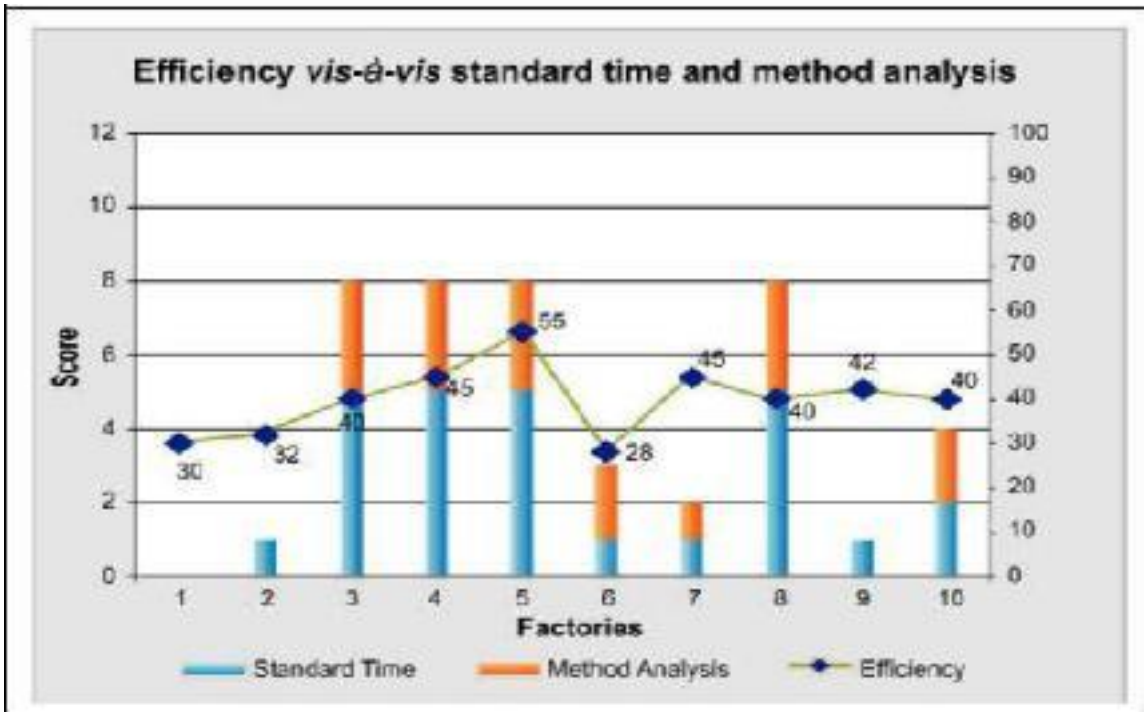



## Graphical view of loss time without IE department:

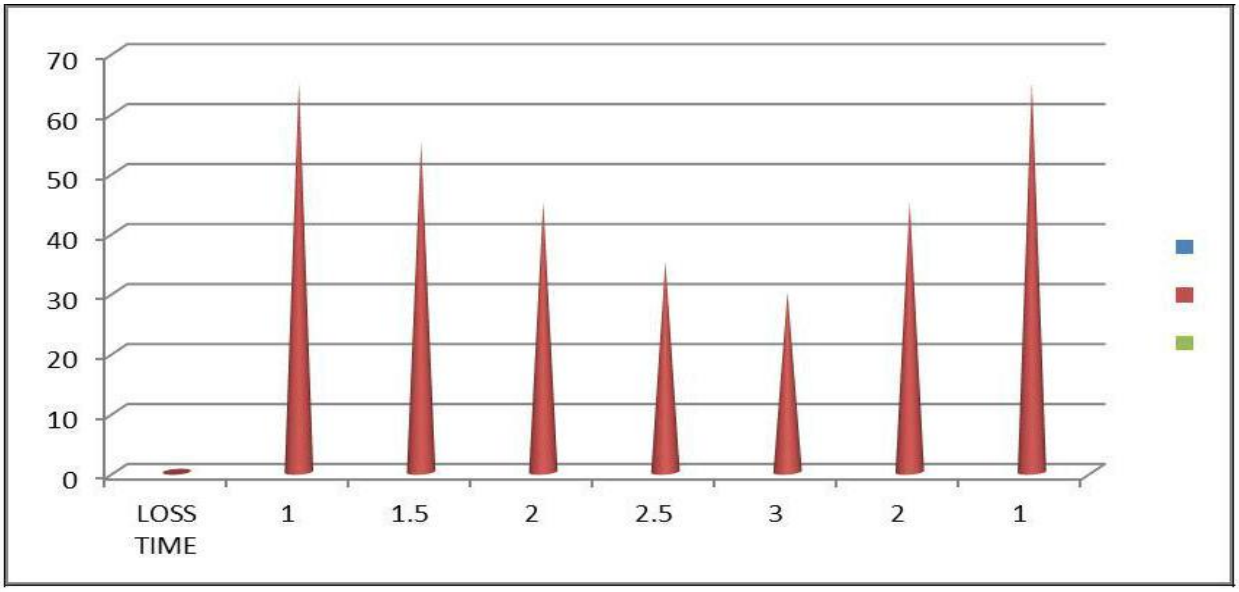


**Example-1: Efficiency increase with standard time & method analysis**

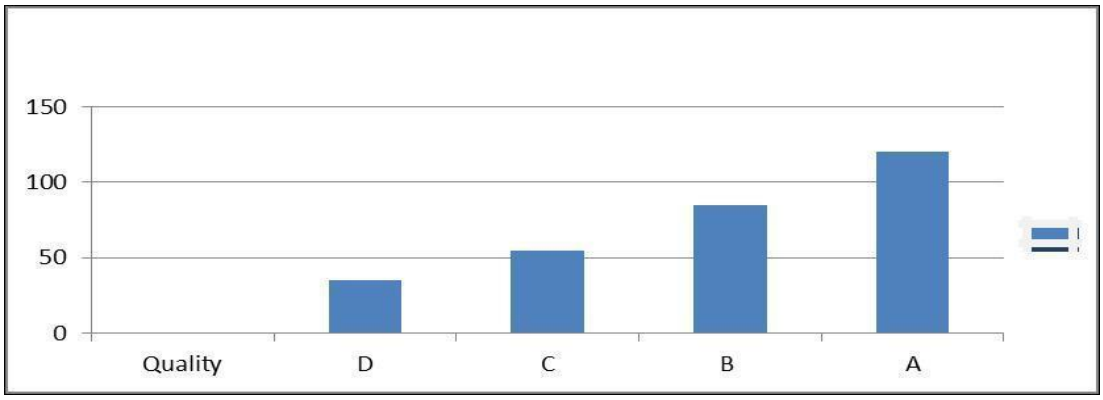
**(Method & Time study section)**



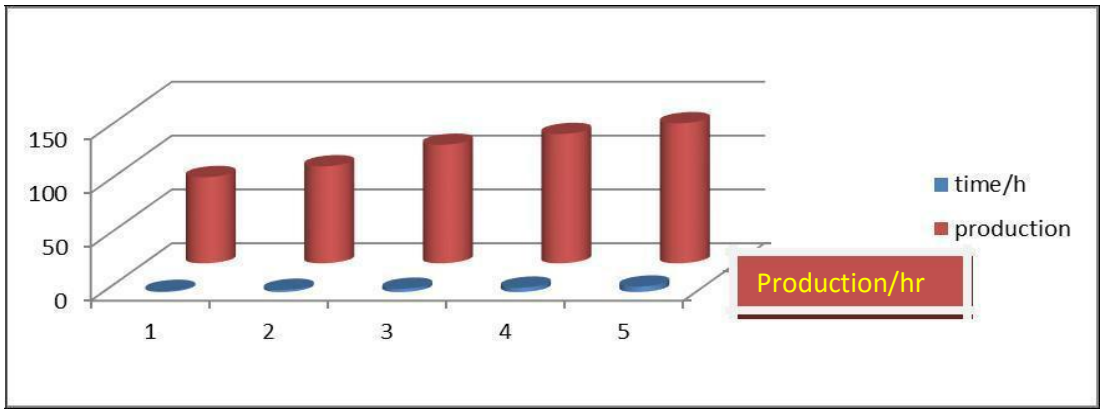

**Example-2: Reduce loss time increase production:**



## Example-3: Increase production with quality (quality section)




## Example-4: Increase Production per hour (finishing section)




## Result & findings:

Achieve the factory monthly Efficiency of 55% from its existing 50%.

- Plan to achieve 62 % efficiency in Cutting dept from existing 58%.
- Plan to achieve 64 % efficiency in finishing dept. from existing 60%.
- Maintain the end line re work below 3 % from its existing 5%.
- Maintain the end line re work below 5 % to improve the quality.
- Forecast to be reduce the wastage
- Proper utilize of elements such as (man, machine, materials, and money).

## Discussion:

First we have to set our targets. And to achieve this, work methods have to be used by different methods. Then according to the map the operation is to be started. To create a T-shirt of Normally 18 to 20 processes have to be run. Occasionally some of the processes are made of bottleneck, for which our production capacities are much lower, then increase the capacities, more capacitive processor operators, some lines have to be shared with the line on which the bottleneck was created. And to create the operation balance of that process. And it must be a seam machine. And with this sharing, it is possible to increase production capacities a lot.

## Some important formula & Example:

- Standard Pitch Time (S.P.T) = Basic Pitch Time (B.P.T) + Allowances (%)
- Target = $\frac{\text{Total manpower per line} * \text{Total working minute pewr day}}{\text{S.A.M}} * 100\%$
- Theoretical Manpower = $\frac{\text{Target per houre}}{\text{Process capacity per houre}}$
- Line Labor Productivity = $\frac{\text{Total number of output per day per line}}{\text{Number of worker worked}}$
- **Line** Machine Productivity = $\frac{\text{Total number of output per day per line}}{\text{Number of machines used}}$
- Line Efficiency = $\frac{\text{Total output per day per line} * \text{SAM}}{\text{Total manpwer per line} * \text{total working minutes per day}} * 100\%$
- **GSD:**
- GSD = (Man power * Work hour) / Target
- **SMV:**
- SMV = Basic time + (Basic time * Allowance)
- **Basic time:**
- Basic time = Observed time * Rating
- **Observed time:**
- Observed time = Total Cycle time / No of cycle
- **Rating:**
- Rating = (Observed Rating * Standard rating) / Standard rating

- **Efficiency:**

  - Efficiency = (Earn minute * Available minute) * 100
  - **Earn minute:**
  - Earn minute = No of Pc's (Production) * Garments SMV
  - **Available minute:**
  - Available minute = Work hour * Manpower
  - **Organization Efficiency:**
  - Organization Efficiency = (Basic pis time / Bottle neck time) * 100
  - **Basic pis time (BPT):**
  - Basic pis time = Total GMT SMV / Total Manpower
  - **UCL:**
  - UCL = Basic pis time / Organization Efficiency
  - **LCL:**
  - LCL = 2 * Basic pis time – UCL
  - **Capacity:**
  - Capacity = 60 / Capacity time in minute
  - **Cycle Time:**
  - Cycle Time = 60 / Team target
  - **Capacity Achievable:**
  - Capacity Achievable = Capacity * Balance
  - **Daily output:**
  - Daily output = Work hour / SMV
  - **Factory capacity:**
  - Factory capacity = (Work hour / SMV) * Total worker * Working day * Efficiency
  - **CPM:**
  - CPM = (Total over head cost of the month / No of SMV earners Work minutes) *Efficiency

**Some mathematics:**

**Here,**

Efficiency $= \frac{output}{input}$

$= \frac{smv * product\ quantity}{worker * working\ houre * 60}$

$= \frac{38.50 * 700}{60 * 10 * 60}$ *100

=74 %( line efficiency)

SMV=38.50

Working hour=10

No. of worker=60

Target/hour= $\frac{60}{SMV}$ Efficiency%

$= \frac{60}{0.85} * 70\%$

=50pcs/hour

Here,

SMV=0.85

Efficiency=70%

Target/line = $\frac{no\ of\ worker * working\ hour * 60}{SMV} * efficiency$ %

=

= 1150 pcs

here,

No of workers=75

Working hours=10

SMV=23.5

Efficiency=60%

## Limitations of the report:

- Some points (5s, Lean Manufacture etc.) in different chapters are not included as these were not available.
- It is not possible to hold the whole thing of a textile industry in such a small frame as this report. So, try my hard to summarize all the information that I am provided.
- I have not any permission to take photographs.
- I faced various types of obstacles during to my project work.

# CHAPTER-5

# CONCLUSION

## Conclusion:

Industrial engineering is an important and essential part of any Garments Industry. We learn all the implementations and techniques of the processes which we have studied theoretically. It gives us an opportunity to compare the theoretical knowledge with practical facts and thus develop our knowledge and skills. This project also gives an opportunity to enlarge our knowledge of textile administration, production planning, procurement system, production process, and machineries and teach us to adjust with the industrial life.

## References:

## Books:


- Production planning, control & Industrial management.
  (By Dr. KC. Jain)
- Industrial Engineering In Apparel Production
  (By V Ramesh Babu)
- The Apparel Industry
  (By Richard M Jones)
- Industrial Engineering And Management
- Industrial Engineering and Engineering Management
  (By professor john W H)

## Website links:


- http://www.fibre2fashion.com/industry-article/16/1591/industrial-engineering-a-new-concept-of-apparel-engineering1.asp
- http://www.lcmibd.com/industrialengineering.htm
- http://www.onlineclothingstudy.com/2012/10/how-to-calculate-sam-of-garment.html
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