Faculty of Engineering

Department of Textile Engineering

Thesis Report
On
Study on Industrial Engineering in Knit Garments production

Course code: T.E.- 4214 Course Title: Project (Thesis)

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A thesis submitted in partial fulfilment of the requirements for the degree of **Bachelor of Science in Textile Engineering**

Advance in Apparel Manufacturing Technology

Summer 2020

DECLARATION

We attest that this report is our work, except where we have given fully documented references to the work of others and that the materials contained in this report have not previously been submitted for assessment in any formal course of study. If we do anything, which will breach the first declaration, the examiner/supervisor has the right to cancel our report at any point of time.

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Approval Sheet

This research entitled 'Study on Industrial Engineering in knit garments production' at Daffodil International University, Fall, 2020'' was prepared and submitted by **Md. Sahriar Bin Mostafa (ID: 173-23-5165)** & **Sojeeb Ahmed (ID: 173-23-5191)** in partial fulfilment of the requirement for the degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.

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ACKNOWLEDGEMENT

Firstly, we would like to express our heartfelt gratitude to Almighty Allah for his divine blessings for making it possible to complete this thesis report successfully.

We are highly delighted to express our regards & gratitude to **Mr Md. Mominur Rahman**, Assistant Professor & Head (In-Charge) Department of Textile Engineering, Daffodil International University, and our supervising teacher **Mohammad Abdullah Al Mamun** (Assistant Professor), for his tremendous support and all the necessary information for preparing this study report.

We would also like to thank the management of the Executive Greentex Limited for providing the opportunity to work on different sections and for helping in every possible way.

Our most profound appreciation goes to **Mohammad Abdul Barek** (Deputy General Manager), **Mamun Bhuiya** (Manager- Operation), **Lakhman Chandra Baidya** (Manager-Compliance), and **Md. Keramat Ali** (Manager- QC), **Md. Mamun** (Deputy Manager-Production), **Md. Sumon Mia** (Assistant Manager- I.E.), **Muhammad Mahabubur Rahman** (Assistant Manager-Maintenance), **Md. Abdul Razzak** (Jewel) (Assistant Manager- Finishing), **Alamgir Mridha** (Assistant Manager- Store), **Md. Armen Khan** (Senior Executive-HR), **Md. Kamal Ahmmed** (Senior Executive- Cutting), of Executive Greentex Limited, and the whole merchandising team of Sublime Greentex limited. Without their permission and help, this thesis report could be measurable. Again, thanks to them for providing the required data and guidelines in a profound way to complete this thesis report.

Finally, we want to thank our parents and classmates for their enormous support, inspiration, and assistance during this project report.

DEDICATION

We dedicate this report to our Parents, who give us a chance to study Textile Engineering and support us all time and who are the strength of our life, motivation, lifeline, inspiration, and most importantly, our way Jannah.

We have also dedicated this report to our supervisor Md. Abdullah Al Mamun, Assistant Professor of Daffodil International University, provided us with tremendous guidelines to complete this report.

ABSTRACT

In the current scenario, the textile and apparel industry needs to satisfy the various needs of customers in the aspect of quantity and quality of the products. In traditional methods, the apparel industry used basic sewing machines for all operations with the help of manpower, so at that time, introducing different styles in the apparel was very difficult. In recent days, automation and improved techniques are known as industrial engineering concepts applicable to improve productivity and quality to overcome the competitive market. The manufacturing of garments involves many operations in different departments. To improve productivity and quality in the apparel sector, one must concentrate on machine, method, material, and man. So, the industrial engineering concepts will cover and manage all the above-said factors and help improve the productivity and quality of the products that will satisfy the consumer needs.

This project is on "Study on Industrial Engineering in knit garments production." Traditionally-operated garment industries confront issues like low Productivity, low efficiency, longer production lead time, high remake, modification, rejection, poor line balancing, low flexibility of style change over, etc. These problems were identified.

This paper introduces the various concepts utilizing the method of wastage. Work-study took to record the actual individual capacity of each operator. We have recorded each operation's actual cycle time for each operator and helper to discover the ideal number of workers, type of machines, and individual capacity. This paper discussed the layout plan and the operation breakdown, S.M.V. calculation for each operation, target calculation for each operation, cycle time, and efficiency. Process-wise capacity has been calculated, and other tools and techniques consist of different experimental details.

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CHAPTER: 1 INTRODUCTION

INTRODUCTION

1.1 Introduction

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

According to the Institute of Industrial Engineers, they "work to eliminate waste of time, money, materials, energy and other commodities," 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.

We can see I.E. at a glance.

I.E. = Production ↑ ↓ Proper use of all elements ↑ Efficiency↑ Profit ↑

Objectives of this thesis:

- To know about industrial engineering.
- To understand how to increase productivity by using the best methods and most efficient use of resources.
- To find out how to reduce value-adding activities.
- To know how to establish methods for improving the operations and controlling the production costs.
- To know how to develop the process for reducing cost.

Scope of this thesis:

- Study, measure & improve the way of individual performance.
- Design and install a better system for co-coordinating each other.
- Specify, predict, and evaluate the works.

Limitation of this thesis:

- It is a time-consuming process.
- It is a costly procedure.

CHAPTER: 2 LITERATURE REVIEW

2.1 Industrial Engineering

Industrial engineering is a branch of engineering that optimizes complex processes or systems. It is concerned with the development, improvement, implementation, and evaluation of integrated systems of people, money, knowledge, information, equipment, energy, materials, analysis, and synthesis, as well as the mathematical, physical, and social sciences together with the principles and methods of engineering design to specify, predict, and evaluate the results to be obtained from such systems or processes. Its underlying concepts overlap considerably with specific business-oriented disciplines such as Operations Management, but the engineering side tends to emphasize extensive mathematical proficiency and usage of quantitative methods.

Industrial Engineering is concerned with designing, improving, and installing integrated men, materials, and equipment systems. It draws upon specialized knowledge and skills in the mathematical and physical sciences and the principles and methods of engineering analysis and design to specify, predict, and evaluate the results obtained from such systems. American Institute of Industrial Engineers (AIIE) defines Industrial Engineering as follows: "Industrial Engineering is concerned with the design, improvement, and installation of an integrated system of men, materials, and equipment. It draws upon specialized knowledge and skills in the mathematical and physical sciences and the principles and methods of engineering analysis and design to specify, predict, and evaluate the results obtained from such a system".

The Institute of Industrial Engineers defined time study as "A work measurement technique consisting of careful time measurement of the task with a time-measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal needs." Time study is the most popular and used method for line balancing and solving bottlenecks. One problem of time study is the Hawthorne Effect, where it is found that employees change their behaviour when they know that their being measured (Jannat et al., 2009). Balance is an essential factor. In the traditional performance measurement approach, the most critical goal of evaluation is performance measurement, while the modern approach focuses on evaluating growth and development capacity (Norton, 1999). Drucker (1954) argued that one potential solution

was introducing ‘’balanced’’ sets of measures. Market standings, innovation, productivity, physical and financial resources, profitability, manager performance and development, worker performance and attitude, and public responsibility are appropriate performance criteria (Neely, 2005). Modern evaluation system results in satisfaction improvement, efficiency improvement, and finally, improvement in the effectiveness of organizational activities (Nabi et al., 2015; Jung et al., 2020).

When there was no industrial engineering department, exporting our products had many difficulties. That timeline efficiency was less, time wastage, and bottleneck process was more. So, the production quality was not good. However, after coming to the concept of industrial engineering in 1979, we can solve this problem.

Industrial engineers are responsible for designing integrated people, machines, materials, energy, and information systems. Industrial engineers work to eliminate the waste of time, money, materials, energy, and other resources. Therefore, more and more companies hire industrial engineers and promote them into management positions. On the other hand, industrial engineering is a section in which knowledge of mathematical and natural sciences that are gained by studies, experiences, and practices are applied with judgment to develop the ways to economically utilize the materials, which we do not find in other garments sectors.

2.2 Objectives of Industrial Engineering:

- Improving processes and methods of working to increase factories’ overall performance and standardized garment manufacturing processes.
- Monitoring the production floor and having better control over the production floor.
- Contribute to the successes of companies through effective problem-solving.

2.3 I.E. Department Working Procedure:

2.3.1 For Pre-Production of Development Step:

Merchandisers receive teck-pack from buyers.

↓

Buyer coordinate (merchandiser)

↓

I.E. section

↓

Pre-sampling meeting comments (style analysis)

↓

Pattern section

↓

Pattern check according to style analysis

↓

Sample section

↓

Attachments and folder direction from the I.E. section

2.3.2. For Pre-Production of Confirm Step:

Pre-sampling meeting comments check with the sample

↓

Simplifying the operation

↓

Costing productivity

↓

Confirmed style machine requirement/ Style evaluation report

↓

Operation bulletin making & S.M.V. calculating

↓

S.M.V. & learning curve entry to first react for planning

2.3.3 For Production Step:

Collect the next style details

↓

Sample collect & folder attachment

↓

Process break down collect

↓

Primary layout & line fitting

↓

Method study

↓

After five days, make the Time study for line balance

↓

After eight days target set according to a five-day analysis

↓

Final report

2.4 Working Field of I.E.:

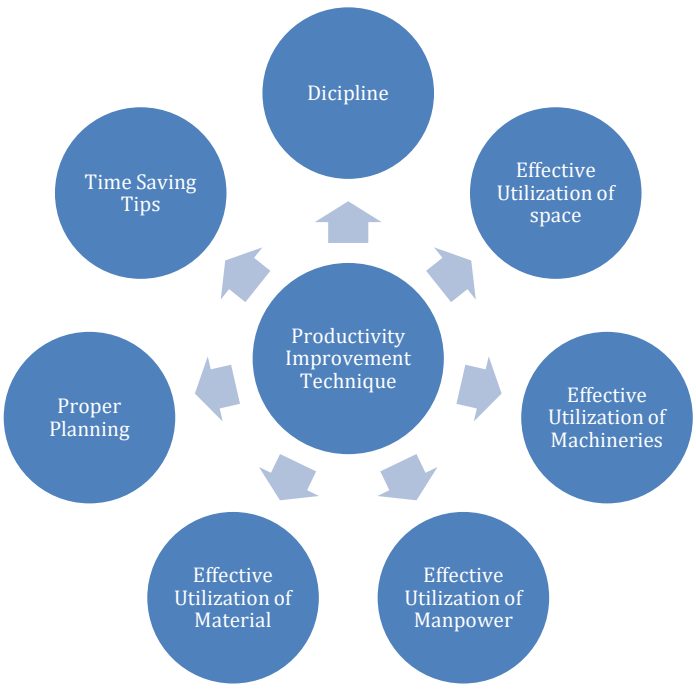


Figure 2.1: Working Field of I.E.

2.5 Production Planning:

Production planning is an essential prerequisite to production control. It involves management decisions on the resources that the firm will require for its manufacturing operations and selecting them to produce the desired goods at the appropriate time and at the least cost. Production planning is defined as "the technique of foreseeing or picturing ahead, every step in a long series of separate operations, each step to be taken in the right place, of the right degree and at the right time, and each operation to be done at maximum efficiency."Production planning provides a line for effective, balanced product flow, incorporating line and individual (operation) productivity standards. The end product of production planning efforts is the formulation of production plans. The plans are formulated in light of a specified future period. The plans are to be implemented in light of the estimated cost and agreed to policies.

- Plant limit can be ascertained by the I.E department with the goal that arranging can book arranged according to the accessible limit.
- I.Ecanaidbetterarrangingbyaidinginbetterstyledesignationtovariousunitsorlines.
- I.E can figure a proficiency/execution development for a specific style. This can advise the arranging department that a specific line will take how long to deliver a particular amount to a style. This will help the arranging department design the accessibility of assets and materials ahead of time.

2.6 Why is Industrial Engineering Need in Apparel Industry?

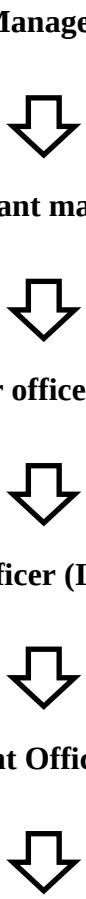
The industrial way of garment production needs a thorough preparation of production because, at the same time, it is necessary to combine a few factors: people, time, machines and place of production, organization, and material in a coordinated and rational system. The technological system of garment production must enable the expected quality of product, necessary scope of production, delivery of ready-made garments in the expected time, and maximum use of capacity with minimum expenses. An Industrial Engineer can perform several activities to fulfil their task; processes and Procedures of manufacturing or service activities can be examined through Process Analysis. Industrial engineers can use Work-Study comprehending Method Study and Time Study. The mentioned activities are also called operations management. Furthermore, Industrial Engineering involves

inventory management to make a manufacturing process more feasible and efficient. Industrial Engineers used to increase efficiencies and cost-effectiveness of operations by product strategies like High-volume production, long runs, and minimal variations.

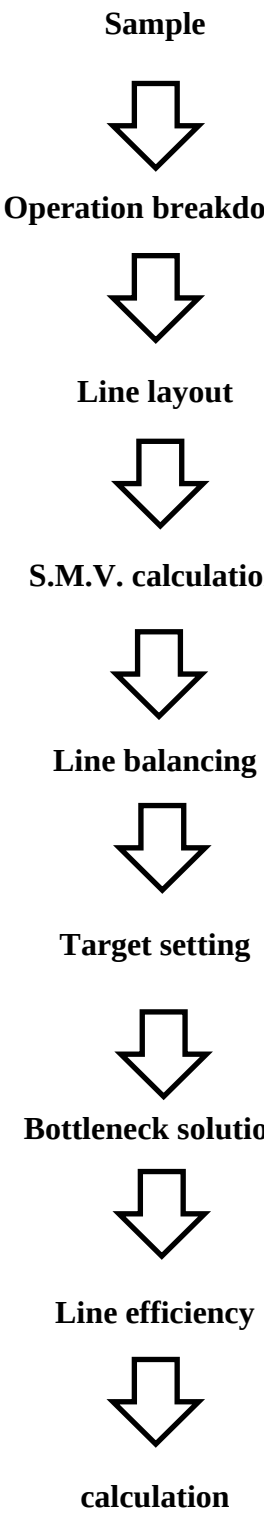
CHAPTER 3: Methodology/ Experimental Details

3.1 Overview of the I.E. Department

3.1.1 Organogram of industrial engineering department:



3.1.2 Flow process of the industrial engineering section



3.1.3 Functions/responsibilities of the industrial engineering department

- Operation breakdown.
- Line layout making.
- S.M.V. Calculation.
- Line balancing.
- Individual target setting.
- Ensure optimum use of the machine.
- Bottleneck solution.
- Reduce non-value adding activities.
- Line efficiency calculation.
- Called pre-production meeting after test cutting.

3.1.4 Industrial engineering formula with example

Basic Time = Observed time * Rating

Observed time = Total Cycle time/ No of cycle

SMV = Basic Time + Allocated Allowance

Efficiency = Output/ Input

= SMV*Product Quantity / No of Worker*Working Hours*60 X 100

Target/hour = (60/SMV) *Efficiency%

Target/Line = No of Worker*Working Hours*60/SMV*Efficiency%

Example:

If the time for joining a side seam is 10.84, 12.06, 14.35, 13.35, 13.67, 14,99, 15.98, 10.10, 10.26, 10.49 seconds & worker rating and allowance are 70% and 15%, so find out the observe time, basic time and S.M.V.?

Solution:

Observed Time = Total Cycle time/ No of cycle

= (10.84+12.06+14.35+13.35+13.67+14,99+15.98+10.10+10.26+10.49) / 10

= 12.60 Sec

Basic time = 12.60 X 70%

= 8.82 Sec

SMV = 8.82+15% = 8.97/60 = 0.15

Example:

A sewing line output is 1800 pcs in 8 hours. The operator was 35, the helper was 5, and the ironman was 2, and the garment S.M.V. was 8.00. What is the efficiency of the sewing line?

Here,

Output- 2000 pcs

SMV- 8.00

Manpower- 35+5+2= 42

Working minute- 8 x 60 = 480 minutes

So, Sewing Line Efficiency = [(1800 x 8.00)/ (42 x 480)] x 100 = 71.42%

Example:

Target/line = [(No of worker*working hour*60)/SMV] *Efficiency%

If

No of workers=46

Working hours=8

SMV=17.04

Efficiency-50%

So, **Target/line =** [(46 x 8 x 60) / 17.04] x 50%

= 648 pcs/ Shift

Example:

Target/hour = (60/SMV) *Efficiency%

If

No of workers=28

SMV=13.82

Efficiency-50%

So, **Target/hour =** (28 x60 / 13.82) x 50%

= 61 pcs/hour

Example:

Required days for the schedule = Total order quantity/ Average target

If

Average Target = 819 pcs/Shaft

Order quantity = 5000 pcs

So, the required days for the schedule = 5000/819 = **7 days.**

3.1.5 Techniques of Industrial Engineering:

Method study:

To establish a standard method to perform a job or an operation after a thorough analysis of the jobs and to develop the layout of production facilities to have a uniform flow of material without backtracking.

Time study (work measurement):

This is a technique used to establish a standard time for a job or an operation.

Motion Economy:

This is used to analyze the motions employed by the operators doing the work. The principles of motion economy and motion analysis are very useful in mass production or for short-cycle repetitive jobs.

Value Analysis:

It ensures that no unnecessary costs are built into the product, and it tries to provide the required functions at the minimum cost. Hence, it helps to enhance the worth of the product.

Financial and non-financial Incentives:

These help to evolve a rational compensation for the workers' effort.

Production, Planning, and Control:

This includes the planning for the resources (like men, materials, and machines), proper scheduling, and controlling production activities to ensure the right quantity and quality of product at a pre-determined time and pre-established cost.

3.1.6 Material Handling Analysis:

To scientifically analyze the movement of materials through various departments to eliminate unnecessary movement to enhance material handling efficiency.

3.1.7 Equipment used by industrial engineers in the garment industry:

Stopwatch: Measuring observed time at the time of time study.

Measuring Tape: Measuring the length of seams and measuring distances

Digital Camera: Capturing videos for various operations that help in motion analysis of operations.

Calculator: Data calculation and report making.

3.1.8 DATA COLLECTION

SMV:

"Standard Minute Value." It is a standard time for completing given tasks using the best possible method.

Importance of S.M.V. calculation:

- Planning for making garments depends on S.M.V.
- Line balancing depends on S.M.V.
- Costing of garments depends on S.M.V.

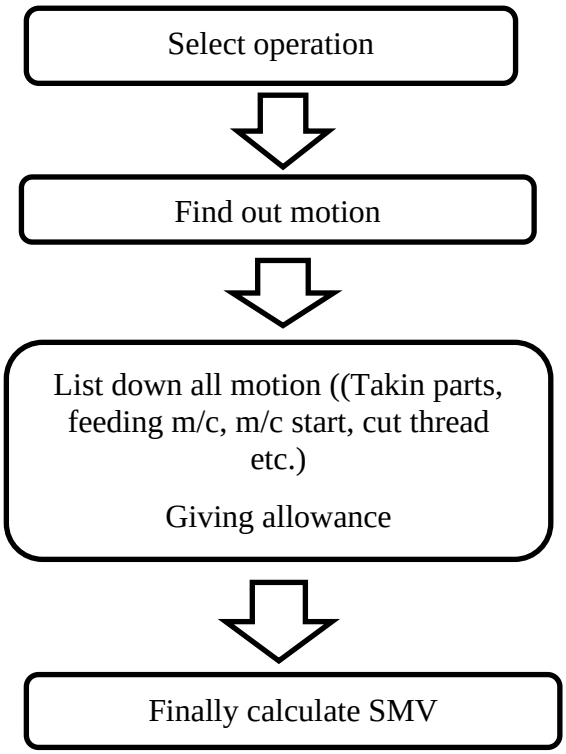
The problem of manual S.M.V. calculation:

- Rating problem.
- The exact result does not come because input varies from man to man.
- Difficult to take cycle time.

3.1.9 GSD Software:

GSD means "General Sewing Data," which is a pre-determined time and motion-based time measuring system (PMTS).

Flow process of S.M.V. calculation by GSD software:



Advantages of using GSD software:

- Easy to calculate S.M.V.
- We can get the exact results for each operation.
- Required less time.

3.1.10 Bottleneck process

Bottleneck means a delay in work. Suppose input comes faster, but the next operator cannot provide output smoothly to the next operator.

Way of bottleneck operation identification:

- Check the capacity of each process for each operator.
- W.I.P. analysis. (Work in Process)
- Visually.

Way of reducing bottleneck operation:

- Method improvement (At first attach care label, join yoke, then load all parts together).
- Sharing capacity/work to other operators (Take a few pieces from the bottleneck operation to a nearby operation with a potentially higher capacity).
- Add additional manpower or machine.
- Allocate a better operator (A' grade operator is allocated on a high-capacity operation).
- Work extra hours.

Line balancing:

Proper allocation of machines & sharing of time to each operator equally so that they can get equal time for their operation & share their work with each operator equally for equal production.

Objectives of line balancing:

- To eliminate bottlenecks, ensuring a smoother flow of production.
- To minimize work-in-progress (zero inventory or just-in-time concept)
- To improve the quality and Productivity of the assembled products.
- To reduce waste of production and delay.

Allowances:

Allowances mean 100% time so that an operator can earn a satisfactory wage. It is determined by a time study. At least 30% allowances are provided to workers.

Worker rating:

Rating is a comparison of the worker's performance, which is given by visual seen based upon their experience. During time study for industrial engineering needs to record the time of any process to find out the S.M.V. A slower performance rate, which will produce fewer pieces per hour, is recorded as a percentage below 100%. A faster performance rate that produces more pieces per hour is recorded as greater than 100%.

When we give a 100% rating to workers:

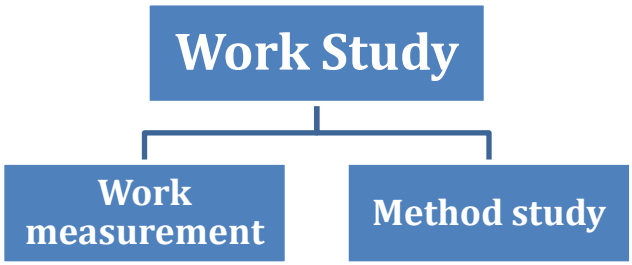
- Fluid motions without hesitation.
- No false starts or duplications
- The consistent, coordinated, effective rhythm of work.
- No wasted actions.
- Clear attention on the task.

3.1.11 Work-Study

A Systematic examination and development of operational methods and standards to enhance productivity and quality of work.

Classification of Work-Study:

i. Work Measurement
ii. Method Study



Work measurement:

Work measurement is the technique designed to set up the standard time required by a qualified worker to accomplish a task at a defined rate of work. This technique is used to determine standard time.

3.1.12 TIME STUDY

Time study is a method of measuring the time of a process/operation. An operator does the same operation throughout the day. Time study helps to define how much time is necessary for an operator to carry out the task at a defined rate of performance.

Time study tools:

- ❖ A stopwatch
- ❖ Time study format
- ❖ One pen or pencil

Time study procedure:

- ✓ Take preparation.
- ✓ Time capturing.
- ✓ Calculate observed time.
- ✓ Calculate basic time.
- ✓ Finally, calculate S.M.V.

3.1.13 Method study

Method study is the systematic recording & critical analysis of ways of doing a job to make improvements. It analyzes how work is being done currently to find out ways to improve so that productivity increases. Method study discovers a suitable and easier work method to complete the task quickly.

7 Steps of Method Study: -

i. Select: Select the job to be studied.
ii. Record: Record all relevant facts by direct observation.
iii. Examine: Examine the data/facts critically and in sequence.
iv. Develop: Develop the most practical, ergonomic & economical method.
v. Define: Define the new method in detail.
vi. Install: Install the method as standard and train the operator to use it.
vii. Maintain: Maintain the new method by routine checks.

3.2 Operation Breakdown

3.2.1 Operation breakdown: Bottom Long Pant

Description: C&S Waist, Front & Back rise with Top stitch, Side Pocket, Trim-Drawcord, Bottom Cuff.

Fabric: Single jersey, 100% cotton, GSM-14

Table 3.1: Operation breakdown: Bottom Long Pant

SL	**Operation Description**	**Machine Name**
1	Back and front rise join with thread trim	4T O/L
2	Back & front rise top stitch	3T F/L-CB
3	pocket beg make	4T O/L
4	Attach front pocket	SND-LS
5	pocket inner Suring with corner cut	4T O/L
6	Pocket mouth top stitch	SND-LS
7	Pocket tack at upper area	SND-LS
8	tack for side seam	SND-LS
9	side seam joins with pocket	4T O/L
10	inseam join	4T O/L
11	waistband elastic ring makes and mark	3T O/L
12	waist ring make fabric	SND-LS
13	waist 2 hole and lining remove	BH
14	Elastic 4-point tack	SND-LS
15	Waist belt make	KANSAI
16	Waist belt servicing	3T O/L
17	Attach waist belt with match	4T O/L
18	Elastic waist band top stitch	5T F/L-CB
19	Cuff make and fold	SND-LS
20	Cuff attach with match	4T O/L
21	Drawstring insert and measure HP	MANUAL
22	Drawstring end fold and tack with excess cut	BT
23	Level tack at side	SND-LS
24	Side pocket BT* 4	BT
25	BT at waist and inseam	BT
26	Loop tack with measure cut at waist	SND-LS
27	Thread cut	MANUAL

S.M.V. calculation: With Allowance 10%+ 100% Operator Rating (No of Cycle – 5)

Back and front rise join with thread trim:

Observe Time: Total Cycle Time/No of Cycle = 165 / 5 = **33** With Allowance

Basic Time: Observe Time x Rating = 33 x 100% = **33**

SMV: Basie Time + Allowance = 33 / 60 = **0.55**

Back & front rise top stitch:

Observe Time: Total Cycle Time/No of Cycle = 159 / 5 = **31.8**

Basic Time: Observe Time X Rating = 31.8 x 100% = **31.8**

SMV: Basie Time + Allowance = 31.8 / 60 = **0.53**

Pocket beg make:

Observe Time: Total Cycle Time/No of Cycle = 195 / 5 = **39**

Basic Time – Observe Time X Rating = 39 x 100% = **39**

SMV: Basie Time + Allowance = 39 / 60 = **0.65**

Attach front pocket:

Observe Time: Total Cycle Time/No of Cycle = 165 / 5 = **33**

Basic Time: Observe Time X Rating = 33 x 100% = **33**

SMV: Basie Time + Allowance = 33 / 60 = **0.55**

Pocket inner Suring with corner cut:

Observe Time: Total Cycle Time/No of Cycle = 117 / 5 = **23.4**

Basic Time: Observe Time X Rating = 23.4 x 100% = **23.4**

SMV: Basie Time + Allowance = 23.4 / 60 = **0.39**

Pocket mouth top stitch:

Observe Time: Total Cycle Time/No of Cycle = 195 / 5 = **39**

Basic Time: Observe Time X Rating = 39 x 100% = **39**

SMV: Basie Time + Allowance = 39 / 60 = **0.65**

Pocket tack at upper area:

Observe Time: Total Cycle Time/No of Cycle = 186 / 5 = **37.2**

Basic Time: Observe Time X Operator Rating = 37.2 x 100% = **37.2**

SMV: Basie Time + Allowance/60 = 37.2 / 60 = **0.62**

Tack for side seam:

Observe Time: Total Cycle Time/No of Cycle =132 / 5 = **26.4**

Basic Time: Observe Time X Operator Rating = 26.4 x 100% = **26.4**

SMV: Basie Time + Allowance/60 = 26.4 / 60 = **0.44**

Side seam joins with pocket:

Observe Time: Total Cycle Time/No of Cycle = 222 / 5 = **44.4**

Basic Time – Observe Time X Operator Rating = 44.4 x 100% = **44.4**

SMV: Basie Time + Allowance/60 = 44.4 / 60 = **0.74**

Inseam join:

Observe Time: Total Cycle Time/No of Cycle = 168 / 5 = **33.6**

Basic Time: Observe Time X Operator Rating = 33.6 x 100% = **33.6**

SMV: Basie Time + Allowance/60 = 33.6 / 60 = **0.56**

Waistband elastic ring makes and mark:

Observe Time: Total Cycle Time/No of Cycle = 93 / 5 = **18.6**

Basic Time: Observe Time X Operator Rating = 18.6 x 100% = **18.6**

SMV: Basie Time + Allowance/60 = 18.6 / 60 = **0.31**

Waist ring make fabric:

Observe Time: Total Cycle Time/No of Cycle = 66 / 5 = **13.2**

Basic Time: Observe Time X Operator Rating = 13.2 x 100% = **13.2**

SMV: Basie Time + Allowance/60 = 13.2 / 60 = **0.22**

Waist 2 hole and lining remove:

Observe Time: Total Cycle Time/No of Cycle = 102 / 5 = **20.4**

Basic Time: Observe Time X Operator Rating = 20.4 x 100% = **20.4**

SMV: Basie Time + Allowance/60 = 20.4 / 60 = **0.34**

Elastic 4-point tack:

Observe Time: Total Cycle Time/No of Cycle = 183 / 5 = **36.6**

Basic Time: Observe Time X Operator Rating = 36.6 x 100% = **36.6**

SMV: Basie Time + Allowance/60 = 36.6 / 60 = **0.61**

Waist belt make:

Observe Time: Total Cycle Time/No of Cycle = 123 / 5 = **24.6**

Basic Time: Observe Time X Operator Rating = 24.6 x 100% = **24.6**

SMV: Basie Time + Allowance/60 = 24.6 / 60 = **0.41**

Waist belt servicing:

Observe Time: Total Cycle Time/No of Cycle = 126 / 5 = **25.2**

Basic Time: Observe Time X Operator Rating = 25.2 x 100% = **25.2**

SMV: Basie Time + Allowance/60 = 25.2 / 60 = **0.42**

Attach waist belt with match:

Observe Time: Total Cycle Time/No of Cycle = 186 / 5 = **37.2**

Basic Time: Observe Time X Operator Rating = 37.2 x 100% = **37.2**

SMV: Basie Time + Allowance/60 = 37.2 / 60 = **0.62**

Elastic waist band top stitch:

Observe Time: Total Cycle Time/No of Cycle = 117 / 5 = **23.4**

Basic Time: Observe Time X Operator Rating = 23.4 x 100% = **23.4**

SMV: Basie Time + Allowance/60 = 23.4 / 60 = **0.39**

Cuff make and fold:

Observe Time: Total Cycle Time/No of Cycle = 168 / 5 = **33.6**

Basic Time: Observe Time X Operator Rating = 33.6 x 100% = **33.6**

SMV: Basie Time + Allowance/60 = 33.6 / 60 = **0.56**

Cuff attach with match:

Observe Time: Total Cycle Time/No of Cycle = 174 / 5 = **34.8**

Basic Time: Observe Time X Operator Rating = 34.8 x 100% = **34.8**

SMV: Basie Time + Allowance/60 = 34.8 / 60 = **0.58**

Drawstring insert and measure HP:

Observe Time: Total Cycle Time/No of Cycle = 189 / 5 = **37.8**

Basic Time: Observe Time X Operator Rating = 37.8 x 100% = **37.8**

SMV: Basie Time + Allowance/60 = 37.8 / 60 = **0.63**

Drawstring end fold and tack with excess cut:

Observe Time: Total Cycle Time/No of Cycle = 123 / 5 = **24.6**

Basic Time: Observe Time X Operator Rating = 24.6 x 100% = **24.6**

SMV: Basie Time + Allowance/60 = 24.6 / 60 = **0.41**

Level tack at side:

Observe Time: Total Cycle Time/No of Cycle = 63 / 5 = **12.6**

Basic Time: Observe Time X Operator Rating = 12.6 x 100% = **12.6**

SMV: Basie Time + Allowance/60 = 12.6 / 60 = **0.21**

Side pocket BT*4:

Observe Time: Total Cycle Time/No of Cycle = 132 / 5 = **26.4**

Basic Time: Observe Time X Operator Rating = 26.4 x 100% = **26.4**

SMV: Basie Time + Allowance/60 = 26.4 / 60 = **0.44**

BT at waist and inseam:

Observe Time: Total Cycle Time/No of Cycle = 84 / 5 = **16.8**

Basic Time: Observe Time X Operator Rating = 16.8 x 100% = **16.8**

SMV: Basie Time + Allowance/60 =16.8 / 60 = **0.28**

Loop tack with measure cut at waist:

Observe Time: Total Cycle Time/No of Cycle = 72 / 5 = **14.4**

Basic Time: Observe Time X Operator Rating = 14.4 x 100% = **14.4**

SMV: Basie Time + Allowance / 60 = 14.4 / 60 = **0.24**

Thread cut:

Observe Time: Total Cycle Time/No of Cycle = 63 / 5 = **12.6**

Basic Time: Observe Time x Operator Rating = 12.6 x 100% = **12.6**

SMV: Basie Time + Allowance/60 = 12.6 / 60 = **0.21**

Total S.M.V.:

0.55 + 0.53 + 0.65 + 0.55 + 0.39 + 0.65 + 0.62 + 0.44+ 0.740 + 0.56 + 0.31 + 0.22 + 0.34 + 0.61 + 0 .41 + 0.42 + 0.62 + 0.39 + 0.56 + 0.58 + 0.63 + 0.41 + 0.21 + 0.44 + 0.28 + 0.24 + 0.21 = **12.56 + 10%**

= 13.82

3.2.2 Operation Bulleting: Bottom Long Pant

Description: C&S Waist, Front & Back rise with Top stitch, Side Pocket, Trim-Drawcord, Bottom Cuff.

Fabric: Single jersey, 100% cotton, GSM-14

Table 3.2: Operation Bulleting: Bottom Long Pant

Operation Description		Machine Name	Operation Grade	SMV (100% Rating)	No of Thread	Thread Color	100% Target (100% Rating)	75% Target (100% Rating)	Actual M/C	Hel per
1	Back and front rise join with thread trim	4T O/L	B	0.55	2X2	DTM	109	81.82	1	0
2	Back & front rise top stitch	3T F/L-CB	B	0.53	2X1	DTM	113.21	84.91	1	0
3	pocket beg make	4T O/L	A	0.65	2X2	DTM	92.31	69.23	1	0
4	Attach front pocket	SND-LS	A	0.55	1X1	DTM	109.09	81.82	1	0
5	pocket inner Suring with corner cut	4T O/L	C	0.39	2X2	DTM	153.85	115.38	1	0
6	Pocket mouth top stitch	SND-LS	A	0.65	1X1	DTM	92.31	69.23	1	0
7	Pocket tack at upper area	SND-LS	A	0.62	1X1	DTM	96.77	72.58	1	0
8	tack for side seam	SND-LS	C	0.44	1X1	DTM	136.36	102.27	1	0
9	side seam join with pocket	4T O/L	A	0.74	2X2	DTM	81.08	60.81	2	0
10	inseam join	4T O/L	A	0.56	2X2	DTM	107.14	80.36	1	0
11	waistband elastic ring make and mark	3T O/L	C	0.31	2X1	DTM	193.55	145.16	1	0
12	waist ring make fabric	SND-LS	C	0.22	1X1	DTM	272.73	204.55	1	0
13	waist 2 hole and lining remove	B.H.	C	0.34	1X1	DTM	176.47	132.35	1	0
14	Elastic 4-point tack	SND-LS	B	0.61	1X1	DTM	98.36	73.77	1	0
15	Waist belt make	KANSAI	C	0.41	3X3	DTM	146.34	109.76	1	0
16	Waist belt servicing	3T O/L	A	0.42	2X1	DTM	142.86	107.14	1	0
17	Attach waist belt with match	4T O/L	A	0.62	2X2	DTM	96.77	72.58	1	0
18	Elastic waist band top stitch	5T F/L-CB	B	0.39	3X2	DTM	153.85	115.38	1	0
19	Cuff make and fold	SND-LS	A	0.56	1X1	DTM	107.14	80.36	1	0
20	Cuff attach with match	4T O/L	A	0.58	2X2	DTM	103.45	77.59	1	0
21	Drawstring insert and measure HP	MANUAL	A	0.63		DTM	95.24	71.43	0	1

22	Drawstring end fold and tack with excess cut	B.T.	C	0.41	1X1	DTM	146.34	109.76	1	0
23	Level tack at side	SND-LS	C	0.21	1X1	DTM	285.71	214.29	1	0
24	Side pocket BT*4	BT	C	0.44	1X1	DTM	136.36	102.27	1	0
25	BT at waist and inseam	BT	C	0.28	1X1	DTM	214.29	160.71	1	0
26	Loop tack with measure cut at waist	SND-LS	C	0.24	1X1	DTM	250.00	187.50	1	0
27	Thread cut	MANUAL	C	0.21		DTM	285.71	214.29	0	1
		Total SMV=		12.56+10% =13.82			Total Machine & Man =		26	28

Line Target/Hour:

Line Target/Hour: 60 x 28/SMV = 60 x 28/13.82 = **122pcs**

Line Target/Day:

Line Target/Day: 28 X 08 X60 / 13.82= **973 pcs** [1 shift = 8 hours]

Line Production/Hour:

Total MP X W.H X 60 / SMV = 28 X 60 / 13.82= **61 pcs/hour**

So, Production per Line = **488 pcs / day**

Efficiency/Line/hour:

Efficiency/Line: Output/Input= 13.82 x 61 / 28 x 60 x 100 = **50%**

Line Efficiency/Line/Day: Efficiency/Line: 13.82 x 488 / 28 x 60 x 8 x 100 = **50%**

Loss Production in Line: (973-488) = **485 pcs/day**

Causes of Less Production in Line:

- Bottleneck process.
- Un- skill operator.
- More defects in garments.
- Lack of training for operators, supervisors, etc.
- Improper line layout.
- Fresh Company.
- New Line Setup.
- New Set-up Management.

Reduction of line Less Production:

- Reduce bottleneck process.
- Provide training to the operators.

- Proper line layout & balancing.

3.2.3 Operation breakdown: Bottom Short Pant

Description: Cuff, Elastic Attach, Drawcord

Fabric: 100% cotton,

Table 3.3: Operation breakdown: Bottom Short Pant

SL	Operation Description	Machine Name
1	Back rise join and thread trim	4T O/L
2	Level tack at the back rise	SND-LS
3	Front rise join and thread trim	4T O/L
4	Front and Back match	MANUAL
5	Side seam join	4T O/L
6	Inseam join	4T O/L
7	Elastic ring make and mark*3	3T O/L
8	waist belt make (Fabric)	SND-LS
9	Waist belt hole make	BH
10	Elastic 4-point tack	SND-LS
11	Waist belt top stitch	KANSAI
12	Waist belt match	MANUAL
13	Waist belt attach	4T O/L
14	Drawcord, measure, Cut	MANUAL
15	Insert drawcord	MANUAL
16	Drawcord edge tack and cut with measure	BT
17	Leg hem	3T F/L-HM
18	Waist and inseam security tack*3	BT
19	Hanger loop attach	SND-LS
20	Thread cut	MANUAL

S.M.V. calculation: With Allowance 10%+ 100% Operator Rating

(No of Cycle – 5)

1) **Back rise join and thread trim:**

   Observe Time: Total Cycle Time/No of Cycle = 96 / 5 = **19.2**

   Basic Time: Observe Time X Operator Rating = 19.2 x 100% = **19.2**

   SMV: Basie Time + Allowance/60 = 19.2 / 60 = **0.32**

2) **Level tack at back rise:**

   Observe Time: Total Cycle Time/No of Cycle = 69 / 5 = **13.8**

   Basic Time: Observe Time X Operator Rating = 13.8 x 100% = **13.8**

   SMV: Basie Time + Allowance/60 = 13.8 / 60 = **0.23**

3) **Front rise join and thread trim:**

   Observe Time: Total Cycle Time/No of Cycle = 81/ 5 = **16.2**

   Basic Time: Observe Time x Operator Rating = 16.2 X 100% = **16.2**

   SMV – Basie Time + Allowance/60 = 16.2 / 60 = **0.27**

4) **Front and Back match:**

   Observe Time: Total Cycle Time/No of Cycle –72 / 5 = **14.4**

   Basic Time – Observe Time X Operator Rating = 14.4 X 100% = **14.4**

   SMV – Basie Time + Allowance/60 = 14.4 / 60 = **0.24**

5) **Side seam join:**

   Observe Time: Total Cycle Time/No of Cycle – 243 / 5 = **48.6**

   Basic Time – Observe Time X Operator Rating = 48.6 X 100% = **48.6**

   SMV – Basie Time + Allowance/60 =48.6 / 60 = **0.81**

6) **Inseam join:**

   Observe Time: Total Cycle Time/No of Cycle = 183 / 5 = **36.6**

   Basic Time – Observe Time X Operator Rating = 36.6 X 100% = **36.6**

   SMV – Basie Time + Allowance/60 = 36.6 / 60 = **0.61**

7) Elastic ring make and mark*3:

Observe Time: Total Cycle Time/No of Cycle = 99/ 5 = **19.8**

Basic Time – Observe Time X Operator Rating = 19.8 X 100% = **19.8**

SMV – Basie Time + Allowance/60 = 19.8 / 60 = **0.33**

8) Waist belt make (Fabric):

Observe Time: Total Cycle Time/No of Cycle = 75/ 5 = **15**

Basic Time – Observe Time X Operator Rating = 15 X 100% = **15**

SMV – Basie Time + Allowance/60 = 15 / 60 = **0.25**

9) Waist belt hole make:

Observe Time: Total Cycle Time/No of Cycle = 114 / 5 = **22.8**

Basic Time – Observe Time X Operator Rating = 22.8 X 100% = **22.8**

SMV – Basie Time + Allowance/60 = 22.8 / 60 = **0.38**

10) Elastic 4-point tack:

Observe Time: Total Cycle Time/No of Cycle = 195 / 5 = **39**

Basic Time – Observe Time X Operator Rating = 39 X 100% = **39**

SMV – Basie Time + Allowance/60 = 39 / 60 = **0.65**

11) Waist belt top stitch:

Observe Time: Total Cycle Time/No of Cycle = 132 / 5 = **26.4**

Basic Time – Observe Time X Operator Rating = 26.4 X 100% = **26.4**

SMV – Basie Time + Allowance/60 = 26.4 / 60 = **0.44**

12) Waist belt match:

Observe Time: Total Cycle Time/No of Cycle – 45/ 5 = **9**

Basic Time – Observe Time X Operator Rating = 9 X 100% = **9**

SMV – Basie Time + Allowance/60 = 9 / 60 = **0.15**

13) Waist belt attach:

Observe Time: Total Cycle Time/No of Cycle = 183 / 5 = **36.6**

Basic Time – Observe Time X Operator Rating = 36.6 X 100% = **36.6**

SMV – Basie Time + Allowance/60 = 36.6 / 60 = **0.61**

14) Drawcord, measure, Cut:

Observe Time: Total Cycle Time/No of Cycle – 93 / 5 = **18.6**

Basic Time – Observe Time X Operator Rating = 18.6 X 100% = **18.6**

SMV – Basie Time + Allowance/60 = 18.6 / 60 = **0.31**

15) Insert drawcord:

Observe Time: Total Cycle Time/No of Cycle = 147 / 5 = **29.4**

Basic Time: Observe Time X Operator Rating = 29.4 x 100% = 29.4

SMV: Basie Time + Allowance/60 = 29.4 / 60 = **0.49**

16) Drawcord edge tack and cut with measure:

Observe Time: Total Cycle Time/No of Cycle = 135 / 5**= 27**

Basic Time: Observe Time X Operator Rating = 27 x 100% = **27**

SMV: Basie Time + Allowance / 60 = 27 / 60 = **0.45**

17) Leg hem:

Observe Time: Total Cycle Time/No of Cycle = 165 / 5 = **33**

Basic Time – Observe Time X Operator Rating = 33 X 100% = **33**

SMV – Basie Time + Allowance/60 = 33 / 60 = **0.55**

18) Waist and inseam security tack*3:

Observe Time: Total Cycle Time/No of Cycle = 105 / 5 = **21**

Basic Time – Observe Time X Operator Rating = 21 X 100% = **21**

SMV – Basie Time + Allowance/60 = 21 / 60 = **0.35**

19) Hanger loop attach:

Observe Time: Total Cycle Time/No of Cycle = 285 / 5 = **57**

Basic Time – Observe Time X Operator Rating = 57 X 100% = **57**

SMV – Basie Time + Allowance/60 = 57 / 60 = **0.95**

20) Thread cut:

Observe Time: Total Cycle Time/No of Cycle = 75/ 5 = **15**

Basic Time – Observe Time X Operator Rating = 15 X 100% = **15**

SMV: Basie Time + Allowance/60 = 15 / 60 = **0.25**

Total SMV:

0.32+0.23+0.27+0.24+0.81+0.61+0.33+0.25+0.38+0.65+0.44+0.15+0.61+0.31+0.49+0.45+0.55+0.35+0.95+0.25+10%

= 9.50

3.2.4 Operation Bulleting: Bottom Short Pant

Description: Cuff, Elastic Attach, Drawcord

Fabric: 100% cotton

Table 3.4: Operation Bulleting: Bottom Short Pant

Sl	Operation Description	Machine Name	Operation Grade	SMV	No of Thread	Thread Color	100% Target	75% Target	Actual M/C	Helper
1	Back rise join and thread trim	4T O/L	B	0.32	2X2	DTM	187.50	140.63	1	0
2	Level tack at back rise	SND-LS	C	0.23	1X1	DTM	260.87	195.65	1	0
3	Front rise join and thread trim	4T O/L	B	0.27	2X2	DTM	222.22	166.67	1	0
4	Front and Back match	MANUAL	C	0.24		DTM	250.00	187.50	0	1
5	Side seam join	4T O/L	A	0.81	2X2	DTM	74.07	55.56	3	0
6	Inseam join	4T O/L	A	0.61	2X2	DTM	98.36	73.77	2	0
7	Elastic ring make and mark*3	3T O/L	C	0.33	2X1	DTM	181.82	136.36	1	0
8	waist belt make (Fabric)	SND-LS	C	0.25	1X1	DTM	240.00	180.00	1	0
9	Waist belt hole make	B.H.	B	0.38	1X1	DTM	157.89	118.42	1	0
10	Elastic 4-point tack	SND-LS	A	0.65	1X1	DTM	92.31	69.23	2	0
11	Waist belt top stitch	KANSAI	A	0.44	3X3	DTM	136.36	102.27	1	0
12	Waist belt match	MANUAL	C	0.15		DTM	400.00	300.00	0	1
13	Waist belt attach	4T O/L	A	0.61	2X2	DTM	98.36	73.77	2	0
14	Drawcord, measure, Cut	MANUAL	C	0.31		DTM	193.55	145.16	0	1
15	Insert drawcord	MANUAL	C	0.49		DTM	122.45	91.84	0	1
16	Drawcord edge tack and cut with measure	BT	A	0.45	1X1	DTM	133.33	100.00	1	0
17	Leg hem	3T F/L-HM	A	0.55	2X1	DTM	109.09	81.82	2	0
18	Waist and inseam security tack*3	B.T.	C	0.35	1X1	DTM	171.43	128.57	1	0
19	Hanger loop attach	SND-LS	A	0.95	1X1	DTM	63.16	47.37	2	0
20	Thread cut	MANUAL	C	0.25		DTM	240.00	180.00	0	1
		Total SMV=	8.64+10% = 9.50				Total Machine & Man=		22	27

Line Target/Hour:

Line Target/Hour: 60 X 27/SMV = 60 X 27/9.50= 171pcs/Hour

Line Target/Day:

Line Target/Day: 27 X 08 X60 / 9.50= 1364pcs 1 Shaft= 8hour

Line Production/Day:

Total MP X W.H X 60 / SMV = 27 X 60 / 9.50 = 102pcs/Hour

So, Production per Line = 819pcs/Day

Efficiency/Line/hour:

Efficiency/Line: Output/Input= 9.50 X 171 / 27 X 60 X 100 = 60%

Line Efficiency/Line/Day:

Efficiency/Line: 9.50 X 1364 / 27 X 60 X 100= 60%

Loss Production in Line: (1364-819) = 545pcs/day

3.2.5 Operation breakdown: Ladies Night Dress (Top)

Description: SS-Crew Neck, Moon, Binding back neck tape, Front neck T/st, Curved Hem, Side vent-AOP (14cm)

Color- Solid, **Fabric:** 100% BCI Cotton Single Jersey

Table 3.5: Operation breakdown: Ladies Night Dress (Top)

	Operation Description	Machine Name
1	Moon serging	4T O/L
2	Moon attach	SND-LS
3	Front and Back part match	MANUAL
4	Join both shoulders and cut and arrange with match	4T O/L
5	Neck rib piping & cut	4T O/L
6	Neck stitch remove & measure, cut	MANUAL
7	Neck rib tack	SND-LS
8	Neck servicing	4T O/L
9	Back tape attach	2T F/L-BD
10	Back neck tape top stitch with label	SND-LS
11	sleeve match	MANUAL
12	Sleeve Join	4T O/L
13	Both side seam with run stitch	4T O/L
14	Sleeve hem	3T F/L-CB
15	Body hem	3T F/L-HM
16	security stitch at sleeve*2 and bottom	SND-LS
17	Side vent tack	SND-LS
18	Side vent top stitch-10cm	SND-LS
19	Hanger loop attach	SND-LS
20	Attach label to side	SND-LS
21	Final Thread cut	MANUAL

3.2.6 Operation Bulleting: Night Dress (Top)

Description: SS-Crew Neck, Moon, Binding back neck tape, Front neck T/st, Curved Hem, Side vent-AOP (14cm), Color- Solid

Fabric: 100% BCI Cotton Single Jersey,

Table 3.6: Operation Bulleting: Night Dress (Top)

	Operation Description	Machine Name	Operation Grade	SMV	No of Thread	Thread Color	100% Target	75% Target	Actual M/C	Helper
1	Moon serging	4T O/L	C	0.18	2X2	DTM	333.33	250.00	1	0
2	Moon attach	SND-LS	A	0.54	1X1	DTM	111.11	83.33	2	0
3	Front and Back part match	MANUAL	C	0.18		DTM	333.33	250.00	0	1
4	Join both shoulders and cut and arrange with match	4T O/L	A	0.32	2X2	DTM	187.50	140.63	1	0
5	Neck rib piping & cut	4T O/L	A	0.25	2X2	DTM	240.00	180.00	1	0
6	Neck stitch remove & measure, cut	MANUAL	C	0.37		DTM	162.16	121.62	0	1
7	Neck rib tack	SND-LS	A	0.16	1X1	DTM	375.00	281.25	1	0
8	Neck servicing	4T O/L	C	0.17	2X2	DTM	352.94	264.71	1	0
9	Back tape attach	2T F/L-BD	C	0.25	1X1	DTM	240.00	180.00	1	0
10	Back neck tape top stitch with label	SND-LS	A	0.41	1X1	DTM	146.34	109.76	2	0
11	sleeve match	MANUAL	C	0.22		DTM	272.73	204.55	0	1
12	Sleeve Join	4T O/L	A	0.54	2X2	DTM	111.11	83.33	2	0
13	Both side seam with run stitch	4T O/L	A	0.84	2X2	DTM	71.43	53.57	3	0
14	Sleeve hem	3T F/L-CB	B	0.43	2X1	DTM	139.53	104.65	1	0
15	Body hem	3T F/L-HM	A	0.36	2X1	DTM	166.67	125.00	1	0
16	security stitch at sleeve*2 and bottom	SND-LS	B	0.29	1X1	DTM	206.90	155.17	1	0
17	Side vent tack	SND-LS	B	0.34	2X1	DTM	176.47	132.35	2	0

18	Side vent top stitch-10cm	SND-LS	A	0.76	1X1	DTM	78.95	59.21	1	0
19	Hanger loop attach	SND-LS	C	0.39	1X1	DTM	153.85	115.38	1	0
20	Attach label to side	SND-LS	C	0.21	1X1	DTM	285.71	214.29	1	0
21	Final Thread cut	MANUAL	C	0.21		DTM	285.71	214.29	0	1
		Total SMV=	7.42+10% =8.16				Total Machine & Man=		23	27

Line Target/Hour:

Line Target/Hour: 60 X 27/SMV = 60 X 27/8.16 = **198pcs/hour**

Line Target/Day:

Line Target/Day: 27 X 08 X60 / 8.16 = 1588pcs [1 Shift= 8hour]

Line Production/Day:

Total MP X W.H X 60 / SMV = 27 X 60 / 8.16= **109pcs/Hour**

So, Production per Line = **874pcs/Day**

Line Efficiency/Line/Day:

Efficiency/Line: 8.16 X 948 / 27 X 60 X 100= **55%**

Loss Production in Line: (1588-874) = **713pcs/day**

3.2.7 Operation breakdown: Long sleeve Round-neck polo shirt

Description: LS-Crew Neck

Color- Solid

Fabric: flees fabric, 100% BCI cotton Single Jersey, GSM- 320

Table 3.7: Operation breakdown: Long sleeve Round-neck polo shirt

SL no	Operation Description	Machine Name
1	Front and back match	MANUAL
2	Join both shoulders	4T O/L
3	Shoulder top stitch	5T F/L-CB
4	Neck rib tack	SND-LS
5	Attach neck rib	4T O/L
6	Front neck top stitch	5T F/L-CB
7	Back neck tape attach	SND-LS
8	Attach woven label at neck	SND-LS
9	Back neck end tack	SND-LS
10	Sleeve match	MANUAL
11	Sleeve join	4T O/L
12	Armhole top stitch	5T F/L-CB
13	Attach fold and attach	4T O/L
14	Bottom top stitch	5T F/L-CB
15	Cuff make & fold	SND-LS
16	Cuff join	4T O/L
17	Cuff top stitch	5T F/L-CB
18	Side vent tape measure, cut and mark*4	MANUAL
19	Side slit tape join*4	SND-LS
20	Side slit tack	SND-LS
21	Side slit tape 1/16 top stitch	SND-LS
22	Side slit top stitch	SND-LS
23	Both side seam with care label	4T O/L
24	Side vent inside tack	SND-LS
25	Final thread cut	MANUAL

3.2.8 Operation Bulleting: Long sleeve Round-neck polo shirt

Description: LS-Crew Neck, Color- Solid

Fabric: flees fabric, 100% BCI cotton Single Jersey, GSM- 320

Table 3.8: Operation Bulleting: Long sleeve Round-neck polo shirt

	Operation Description	Machine Name	Operation Grade	SMV	No of Thread	Thread Color	100 % Target	75% Target	Actual M/C	Helper
1	Front and back match	MANUAL	C	0.18			333.33	250.00	0	1
2	Join both shoulders	4T O/L	B	0.33	2X2	DTM	181.82	136.36	1	0
3	Shoulder top stitch	5T F/L-CB	B	0.41	3X2	DTM	146.34	109.76	1	0
4	Neck rib tack	SND-LS	C	0.24	1X1	DTM	250.00	187.50	1	0
5	Attach neck rib	4T O/L	B	0.33	2X2	DTM	181.82	136.36	1	0
6	Front neck top stitch	5T F/L-CB	B	0.36	3X2	DTM	166.67	125.00	1	0
7	Back neck tape attach	SND-LS	C	0.25	1X1	DTM	240.00	180.00	1	0
8	Attach woven label at neck	SND-LS	B	0.32	1X1	DTM	187.50	140.63	1	0
9	Back neck end tack	SND-LS	A	0.45	1X1	DTM	133.33	100.00	1	0
10	Sleeve match	MANUAL	C	0.22			272.73	204.55	0	1
11	Sleeve join	4T O/L	A	0.54	2X2	DTM	111.11	83.33	1	0
12	Armhole top stitch	5T F/L-CB	A	0.44	3X2	DTM	136.36	102.27	1	0
13	Attach fold and attach	4T O/L	A	0.72	2X2	DTM	83.33	62.50	1	0
14	Bottom top stitch	5T F/L-CB	A	0.56	3X2	DTM	107.14	80.36	1	0
15	Cuff make & fold	SND-LS	B	0.56	1X1	DTM	107.14	80.36	1	0
16	Cuff join	4T O/L	A	0.54	2X2	DTM	111.11	83.33	1	0
17	Cuff top stitch	5T F/L-CB	B	0.51	3X2	DTM	117.65	88.24	1	0
18	Side vent tape measure, cut and mark*4	MANUAL	C	0.56			107.14	80.36	0	1

19	Side slit tape join*4	SND-LS	A	0.84	1X1	DTM	71.43	53.57	2	0
20	Side slit tack	SND-LS	C	0.37	1X1	DTM	162.16	121.62	1	0
21	Side slit tape 1/16 top stitch	SND-LS	A	0.75	1X1	DTM	80.00	60.00	2	0
22	Side slit top stitch	SND-LS	A	1.16	1X1	DTM	51.72	38.79	2	0
23	Both side seam with care label	4T O/L	B	0.85	2X2	DTM	70.59	52.94	2	0
24	Side vent inside tack	SND-LS	B	0.35	1X1	DTM	171.43	128.57	1	0
25	Final thread cut	MANUAL	C	0.21			285.71	214.29	0	1
		Total SMV=	12.05+10% = 13.25				Total Machine & Man=		25	29

Line Target/Hour:

Line Target/Hour: 60 X 29/SMV = 60 X 27/13.25 = **131 pcs/hour**

Line Target/Day:

Line Target/Day: 29 X 08 X60 / 13.25 = **1051 pcs** 1 Shaft= 8hour

Line Production/Day:

Total MP X W.H X 60 / SMV = 29 X 60 / 13.25 = **65 pcs/hour**

So, Production per Line = **526 pcs/day**

Line Efficiency/Line/Day:

Efficiency/Line: 13.25 x 526 / 27 x 60 x 100 = **50%**

Loss Production in Line: (1051-525) = **525 pcs/day**

3.2.9 Operation breakdown: Top Grown

Description: Grown

Color- Solid

Fabric: 2x2 Rib fabric, 100% cotton,

Table 3.9: Operation breakdown: Top Grown

	Operation description	Machine Name
1	Front and Back serging	3T O/L
2	Front and Back armhole serging	3T O/L
3	Front neck busting	SND-LS
4	Front armhole busting	SND-LS
5	Back armhole busting	SND-LS
6	Top stitch back neck	SND-CS
7	Top stitch front neck	SND-CS
8	Top stitch back armhole	SND-CS
9	Top stitch front armhole	SND-CS
10	Front neck and armhole serging	3T O/L
11	Back neck and armhole serging	3T O/L
12	Front armhole join	4T O/L
13	Front Neck join	4T O/L
14	Top stitch front armhole	SND-LS
15	Front neck central part join and tack	SND-LS
16	Front yoke part elastic attach	4T O/L
17	Front upper part tack to front lower part	SND-LS
18	Top stitch front yoke panel	SND-LS
19	Front yoke panel join	4T O/L
20	Back neck join	4T O/L
21	Back armhole join	4T O/L
22	Pre-tack before shoulder join with match	SND-LS
23	Join both shoulders	4T O/L
24	Shoulder security tack*4	SND-LS
25	Side vent lace attach	4T O/L
26	Side vent topstitch	SND-LS
27	Bottom hem	3T F/L-HM
28	Side vent area measure and tack	SND-LS
29	Join side seam with label	4T O/L
30	Hanger loop attach*2	SND-LS
31	Side vent security tack*2	SND-LS
32	Armhole security tack*4	SND-LS
33	Bottom hem security tack*2	SND-LS
34	Mark and patch label attach	SND-LS
35	Thread cut	MANUAL

SMV calculation: With Allowance 10%+ 100% Operator Rating

(No of Cycle – 5)

1) Front and Back serging:

Observe Time: Total Cycle Time/No of Cycle = 156 / 5 = **31.2**

Basic Time: Observe Time X Operator Rating = 31.2 x 100% **= 31.2**

SMV: Basie Time + Allowance / 60 = 31.2 / 60 **= 0.52**

2) Front and Back armhole serging:

Observe Time: Total Cycle Time/No of Cycle = 174 / 5 = **34.8**

Basic Time: Observe Time x Operator Rating = 34.8 x 100% = **34.8**

SMV: Basie Time + Allowance / 60 = 34.8 / 60 **= 0.58**

3) Front neck busting:

Observe Time: Total Cycle Time/No of Cycle = 105 / 5 = **21**

Basic Time – Observe Time X Operator Rating = 21 X 100% = **21**

SMV – Basie Time + Allowance/60 = 21 /60 = **0.35**

4) Front armhole busting:

Observe Time: Total Cycle Time/No of Cycle – 105 /5 = **21**

Basic Time – Observe Time X Operator Rating = 21 X 100% = **21**

SMV – Basie Time + Allowance/60 = 21 /60 = **0.35**

5) Back armhole busting:

Observe Time: Total Cycle Time/No of Cycle – 105 /5 = **21**

Basic Time – Observe Time X Operator Rating = 21 X 100% = **21**

SMV – Basie Time + Allowance/60 = 21 /60 = **0.35**

6) Top stitch back neck:

Observe Time: Total Cycle Time/No of Cycle – 114 /5 = **22.8**

Basic Time – Observe Time X Operator Rating = 22.8 X 100% = **22.8**

SMV – Basie Time + Allowance/60 = 22.8 /60 = **0.38**

7) Top stitch front neck:

Observe Time: Total Cycle Time/No of Cycle – 198 /5 = **39.6**

Basic Time – Observe Time X Operator Rating = 39.6 X 100% = **39.6**

SMV – Basie Time + Allowance/60 = 39.6 /60 = **0.66**

8) Top stitch back armhole:

Observe Time: Total Cycle Time/No of Cycle = 198 /5 = **39.6**

Basic Time – Observe Time X Operator Rating = 39.6 X 100% = **39.6**

SMV – Basie Time + Allowance/60 = 39.6 /60 = **0.66**

9) Top stitch front armhole:

Observe Time: Total Cycle Time/No of Cycle = 168 /5 = **33.6**

Basic Time – Observe Time X Operator Rating = 33.6 X 100% = **33.6**

SMV – Basie Time + Allowance/60 = 33.6 /60 = **0.56**

10) Front neck and armhole serging:

Observe Time: Total Cycle Time/No of Cycle – 198 /5 = **39.6**

Basic Time – Observe Time X Operator Rating = 39.6 X 100% = **39.6**

SMV – Basie Time + Allowance/60 = 39.6 /60 = **0.66**

11) Back neck and armhole serging :

Observe Time: Total Cycle Time/No of Cycle – 135 /5 = **27**

Basic Time – Observe Time X Operator Rating = 27 X 100% = **27**

SMV – Basie Time + Allowance/60 = 27 /60 = **0.45**

12) Front armhole join:

Observe Time: Total Cycle Time/No of Cycle – 144 /5 = **28.8**

Basic Time – Observe Time X Operator Rating = 28.8 X 100% = **28.8**

SMV – Basie Time + Allowance/60 = 28.8 /60 = **0.48**

13) Front Neck join:

Observe Time: Total Cycle Time/No of Cycle –156 /5 = **31.2**

Basic Time – Observe Time X Operator Rating = 31.2 X 100% = **31.2**

SMV – Basie Time + Allowance/60 =31.2 /60 = **0.52**

14) Top stitch front armhole:

Observe Time: Total Cycle Time/No of Cycle – 105/5 =21

Basic Time – Observe Time X Operator Rating = 21 X 100% =21

SMV – Basie Time + Allowance/60 = 21 /60 =0.35

15) Front neck central part join and tack:

Observe Time: Total Cycle Time/No of Cycle – 123/5 =24.6

Basic Time – Observe Time X Operator Rating = 24.6 X 100% =24.6

SMV – Basie Time + Allowance/60 = 24.6 /60 =0.41

16) Front yoke part elastic attach:

Observe Time: Total Cycle Time/No of Cycle = 105 /5 =21

Basic Time – Observe Time X Operator Rating = 21 X 100% =21

SMV – Basie Time + Allowance/60 = 21 /60 =0.35

17) Front upper part tack to front lower part:

Observe Time: Total Cycle Time/No of Cycle – 108/5 =21.6

Basic Time – Observe Time X Operator Rating = 21.6 X 100% =21.6

SMV – Basie Time + Allowance/60 = 21.6 /60 =0.36

18) Top stitch front yoke panel:

Observe Time: Total Cycle Time/No of Cycle – 168/5 =33.6

Basic Time – Observe Time X Operator Rating = 33.6 X 100% =33.6

SMV – Basie Time + Allowance/60 = 33.6 /60 =0.56

19) Front yoke panel join:

Observe Time: Total Cycle Time/No of Cycle – 123 /5 =24.6

Basic Time – Observe Time X Operator Rating = 24.6 X 100% =24.6

SMV – Basie Time + Allowance/60 = 24.6 /60 =0.41

20) Back neck join:

Observe Time: Total Cycle Time/No of Cycle – 123/5 =24.6

Basic Time – Observe Time X Operator Rating = 24.6 X 100% =24.6

SMV – Basie Time + Allowance/60 = 24.6 /60 =0.41

21) Back armhole join:

Observe Time: Total Cycle Time/No of Cycle –168 /5 =33.6

Basic Time – Observe Time X Operator Rating = 33.6 X 100% =33.6

SMV – Basie Time + Allowance/60 = 33.6 /60 =0.56

22) Pre-tack before shoulder join with match:

Observe Time: Total Cycle Time/No of Cycle – 126 /5 =25.2

Basic Time – Observe Time X Operator Rating = 25.2 X 100% =25.2

SMV – Basie Time + Allowance/60 = 25.2 /60 =0.42

23) Join both shoulders:

Observe Time: Total Cycle Time/No of Cycle – 99 /5 =19.8

Basic Time – Observe Time X Operator Rating = 19.8 X 100% =19.8

SMV – Basie Time + Allowance/60 = 19.8 /60 =0.33

24) Shoulder security tack*4:

Observe Time: Total Cycle Time/No of Cycle – 123/5 =24.6

Basic Time – Observe Time X Operator Rating = 24.6 X 100% =24.6

SMV – Basie Time + Allowance/60 = 24.6 /60 =0.41

25) Side vent lace attach:

Observe Time: Total Cycle Time/No of Cycle – 225/5 =45

Basic Time – Observe Time X Operator Rating = 45 X 100% =45

SMV – Basie Time + Allowance/60 = 45 /60 =0.75

26) Side vent topstitch:

Observe Time: Total Cycle Time/No of Cycle – 225/5 =45

Basic Time – Observe Time X Operator Rating = 45 X 100% =45

SMV – Basie Time + Allowance/60 = 45 /60 =0.75

27) Bottom hem:

Observe Time: Total Cycle Time/No of Cycle – 135/5 =27

Basic Time – Observe Time X Operator Rating = 27 X 100% =27

SMV – Basie Time + Allowance/60 = 27 /60 =0.45

28) Side vent area measure and tack:

Observe Time: Total Cycle Time/No of Cycle – 156/5 =31.2

Basic Time – Observe Time X Operator Rating = 31.2 X 100% =31.2

SMV – Basie Time + Allowance/60 = 31.2 /60 =0.52

29) Join side seam with label:

Observe Time: Total Cycle Time/No of Cycle – 258/5 =51.6

Basic Time – Observe Time X Operator Rating = 51.6 X 100% =51.6

SMV – Basie Time + Allowance/60 = 51.6 /60 =0.86

30) Hanger loop attach*2:

Observe Time: Total Cycle Time/No of Cycle – 156/5 =31.2

Basic Time – Observe Time X Operator Rating = 31.2 X 100% =31.2

SMV – Basie Time + Allowance/60 = 31.2 /60 =0.52

31) Side vent security tack*2:

Observe Time: Total Cycle Time/No of Cycle –93 /5 =18.6

Basic Time – Observe Time X Operator Rating = 18.6 X 100% =18.6

SMV – Basie Time + Allowance/60 = 18.6 /60 =0.31

32) Armhole security tack*4:

Observe Time: Total Cycle Time/No of Cycle – 123/5 =24.6

Basic Time – Observe Time X Operator Rating = 24.6 X 100% =24.6

SMV – Basie Time + Allowance / 60 = 24.6 / 60 = 0.41

33) Bottom hem security tack*2:

Observe Time: Total Cycle Time/No of Cycle – 93 /5 =18.6

Basic Time – Observe Time X Operator Rating = 18.6 X 100% =18.6

SMV – Basie Time + Allowance/60 =18.6 /60 =0.31

34) Mark and patch label attach:

Observe Time: Total Cycle Time/No of Cycle = 168 / 5 = **33.6**

Basic Time: Observe Time X Operator Rating = 33.6 x 100% = **33.6**

SMV: Basie Time + Allowance/60 = 33.6 / 60 = **0.56**

35) Thread cut:

Observe Time: Total Cycle Time/No of Cycle = 123 / 5 = **24.6**

Basic Time = Observe Time X Operator Rating = 24.6 x 100% = **24.6**

SMV = Basie Time + Allowance/60 = 24.6 / 60 = **0.41**

Total S.M.V.:

0.52 + 0.58 + 0.35 + 0.35 + 0.35 + 0.38 + 0.66 + 0.66 + 0.56 + 0.66 + 0.45 + 0.48 + 0.52 + 0.35 + 0.41 + 0.35 + 0.36 + 0.56 + 0.41 + 0.41 + 0.56 + 0.42 + 0.33 + 0.41 + 0.75 + 0.75 + 0.45 + 0.52 + 0.86 + 0.52 + 0.31 + 0.41 + 0.31 + 0.56+ 0.41 + 10% (Allowance)

= 17.04

3.2.10 Operation Bulleting: Top Grown

Description: Grown

Color- Solid

Fabric: 2x2 Rib fabric, 100% cotton,

Table 3.10: Operation Bulleting: Top Grown

	Operation description	Machine Name	Operation Grade	SMV	No of Thread	Thread Color	100% Target	75% Target	Actual M/C	Helper
1	Front and Back serging	3T O/L	B	0.52	2X1	DTM	115.38	86.54	1	0
2	Front and Back armhole serging	3T O/L	B	0.58	2X1	DTM	103.45	77.59	1	0
3	Front neck busting	SND-LS	B	0.35	1X1	DTM	171.43	128.57	1	0
4	Front armhole busting	SND-LS	B	0.35	1X1	DTM	171.43	128.57	1	0
5	Back armhole busting	SND-LS	B	0.35	1X1	DTM	171.43	128.57	1	0
6	Top stitch back neck	SND-CS	B	0.38	1X1	DTM	157.89	118.42	1	0
7	Top stitch front neck	SND-CS	B	0.66	1X1	DTM	90.91	68.18	2	0
8	Top stitch back armhole	SND-CS	B	0.66	1X1	DTM	90.91	68.18	2	0
9	Top stitch front armhole	SND-CS	B	0.56	1X1	DTM	107.14	80.36	1	0
10	Front neck and armhole serging	3T O/L	B	0.66	2X1	DTM	90.91	68.18	2	0
11	Back neck and armhole serging	3T O/L	B	0.45	2X1	DTM	133.33	100.00	1	0
12	Front armhole join	4T O/L	A	0.48	2X2	DTM	125.00	93.75	1	0
13	Front Neck join	4T O/L	A	0.52	2X2	DTM	115.38	86.54	1	0
14	Top stitch front armhole	SND-LS	B	0.35	1X1	DTM	171.43	128.57	1	0
15	Front neck central part join and tack	SND-LS	B	0.41	1X1	DTM	146.34	109.76	1	0
16	Front yoke part elastic attach	4T O/L	B	0.35	2X2	DTM	171.43	128.57	1	0

17	Front upper part tack to front lower part	SND-LS	B	0.36	1X1	DTM	166.67	125.00	1	0
18	Top stitch front yoke panel	SND-LS	B	0.56	1X1	DTM	107.14	80.36	2	0
19	Front yoke panel join	4T O/L	B	0.41	2X2	DTM	146.34	109.76	1	0
20	Back neck join	4T O/L	C	0.41	2X2	DTM	146.34	109.76	1	0
21	Back armhole join	4T O/L	B	0.56	2X2	DTM	107.14	80.36	2	0
22	Pre-tack before shoulder join with match	SND-LS	A	0.42	1X1	DTM	142.86	107.14	2	0
23	Join both shoulders	4T O/L	C	0.33	1X1	DTM	181.82	136.36	2	0
24	Shoulder security tack*4	SND-LS	C	0.41	1X1	DTM	146.34	109.76	2	0
25	Side vent lace attach	4T O/L	A	0.75	1X1	DTM	80.00	60.00	2	0
26	Side vent topstitch	SND-LS	A	0.75	1X1	DTM	80.00	60.00	2	0
27	Bottom hem	3T F/L-HM	A	0.45	2X1	DTM	133.33	100.00	1	0
28	Side vent area measure and tack	SND-LS	B	0.52	1X1	DTM	115.38	86.54	1	0
29	Join side seam with label	4T O/L	A	0.86	2X2	DTM	69.77	52.33	2	0
30	Hanger loop attach*2	SND-LS	B	0.52	1X1	DTM	115.38	86.54	1	0
31	Side vent security tack*2	SND-LS	C	0.31	1X1	DTM	193.55	145.16	1	0
32	Armhole security tack*4	SND-LS	C	0.41	1X1	DTM	146.34	109.76	1	0
33	Bottom hem security tack*2	SND-LS	C	0.31	1X1	DTM	193.55	145.16	1	0
34	Mark and patch label attach	SND-LS	B	0.56	1X1	DTM	107.14	80.36	1	0
35	Thread cut	Manual	C	0.41		DTM	146.34	109.76	0	1
		Total SMV=	16.94+10% = 17.04				Total Machine & Man=		45	46

Line Target/Hour:

Line Target/Hour: 60 X 46/SMV = 60 X 44/17.04 = **162 pcs/hour**

Line Target/Day:

Line Target/Day: 46 X 08 X60 / 17.04 = **1296 pcs/day** [1 shift= 8 hours]

Line Production/Day:

Total MP X W.H X 60 / SMV = 46 X 08 X 60 / 17.04= **97 pcs/hour**

So, Production per Line= **777 pcs/day**

Line Efficiency/Line/Day:

Efficiency/Line: 7.52X 777 / 46 X 60 X 100= **60%**

Loss Production in Line: (1296-777) = **519 pcs/day**

3.2.11 Operation breakdown: Top

Description: LS-Crew Neck

Color- Solid

Fabric:100% BCI cotton, Single Jersey.

Table 3.11: Operation breakdown: Top

	Operation Description	Machine Name
1	Front part decoration mark	Manual
2	Front part decoration T/S	5T F/L-CB
3	Bar tack Front part decoration T/S	BT
4	Unstitch decoration T/S Overstitch	Manual
5	Join both Shoulder with Match	4T O/L
6	Neck rib tack	SND-LS
7	Attach neck rib	4T O/L
8	Back neck tape attach	SND-LS
9	Back Neck Tape Top stich	SND-LS
10	Sleeve match	Manual
11	Sleeve Join	4T O/L
12	Both Side Seam with Care Label	4T O/L
13	Cuff make and fold	SND-LS
14	Cuff Join	4T O/L
15	Body hem	4tT F/L-HM
16	Attach woven label at neck	SND-LS
17	Hanger loop attach	SND-LS
18	Final thread cut	Manual

3.2.12 Operation Bulleting: Top

Description: LS-Crew Neck

Color- Solid, **Fabric:**100% BCI cotton, Single Jersey

Table 3.12: Operation Bulleting: Top

	Operation Description	Machine Name	Operation Grade	SMV	No of Thread	Thread Color	100% Target	75% Target/hr.	Actual M/C	Hel per
1	Front part decoration mark	Manual	C	0.29		DTM	206.90	155.17	0	1
2	Front part decoration T/S	5T F/L-CB	A	0.41	3X2	DTM	146.34	109.76	1	0
3	Bar tack Front part decoration T/S	BT	C	0.33	1X1	DTM	181.82	136.36	1	0
4	Unstitch decoration T/S Overstitch	Manual	C	0.31		DTM	193.55	145.16	0	1
5	Join both Shoulder with Match	4T O/L	A	0.46	2X2	DTM	130.43	97.83	2	0
6	Neck rib tack	SND-LS	C	0.21	1X1	DTM	285.71	214.29	1	0
7	Attach neck rib	4T O/L	B	0.33	2X2	DTM	181.82	136.36	1	0
8	Back neck tape attach	SND-LS	A	0.33	1X1	DTM	181.82	136.36	1	0
9	Back Neck Tape Top stich	SND-LS	A	0.45	1X1	DTM	133.33	100.00	2	0
10	Sleeve match	Manual	C	0.22		DTM	272.73	204.55	0	1
11	Sleeve Join	4T O/L	A	0.54	2X2	DTM	111.11	83.33	2	0
12	Both Side Seam with Care Label	4T O/L	A	0.88	2X2	DTM	68.18	51.14	3	0
13	Cuff make and fold	SND-LS	A	0.52	1X1	DTM	115.38	86.54	2	0
14	Cuff Join	4T O/L	A	0.54	2X2	DTM	111.11	83.33	2	0
15	Body hem	4T F/L-HM	B	0.28	2X2	DTM	214.29	160.71	1	0
16	Attach woven label at neck	SND-LS	C	0.32	1X1	DTM	187.50	140.63	1	0
17	Hanger loop attach	SND-LS	C	0.41	1X1	DTM	146.34	109.76	2	0
18	Final thread cut	Manual	C	0.21		DTM	285.71	214.29	0	1
		Total SMV=	7.04+10 = 7.74				Total Machine & Man=		22	26

Line Target/Hour:

Line Target/Hour: 60 X 26/SMV = 60 X 27/7.74 = **202 pcs/hour**

Line Target/Day:

Line Target/Day: 26 X 08 X60 / 7.74 = **1612 pcs** [1 shift= 8 hours]

Line Production/Day:

Total MP X W.H X 60 / SMV = 26 X 60 / 7.74= **110 pcs/hour**

So, Production per Line = **887pcs/day**

Line Efficiency/Line/Day:

Efficiency/Line: 7.74 X 948 / 26 X 60 X 100= **55%**

Loss Production in Line: (1612 - 887) =**725 pcs/day**

3.2.13 Operation breakdown: Top Grown

Description: Grown

Color: Solid, **Fabric:** 100% cotton, SMV- 18.21, MP-36

Table 3.13: Operation breakdown: Top Grown

	Operation description	Machine Type	Operation Grade
1	Facing 2-part join	4T O/L	B
2	Front and back part match	Manual	C
3	Join both shoulders	4T O/L	C
4	Facing mark for attach*8	Manual	A
5	Facing attach with body (round)	4T O/L	A
6	loop make & measure cut	2T F/L-BD	C
7	Back neck binding with mark	2T F/L-BD	C
8	Back neck Top stitch with loop	SND-LS	C
9	Sleeve match with	Manual	B
10	Sleeve attach	4T O/L	A
11	Loop tack at side with mark	SND-LS	A
12	Bottom Hem	3T F/L-HM	A
13	Join both side seam with run stitch with label tack	4T O/L	A
14	Side slit tack	SND-LS	A
15	Side slit Top Stitch	SND-LS	A
16	Sleeve hem	3T F/L-HM	A
17	Attach hanger loop	SND-LS	B
18	Attach side hanger loop with mark	SND-LS	B
19	Security tack at bottom*2	SND-LS	B

20	brand label attaches with mark	SND-LS	C
21	back Belt Make	4T O/L	B
22	Back Belt Measurement & cut	Manual	A
23	Back Belt edge tack	SND-LS	C
24	Back Belt turn in top	Manual	C
25	Back Belt edge 1/16 tack	SND-LS	A
26	Threat cut & Sticker remove	Manual	C

3.2.14 Operation breakdown: Bottom Short Pant

Description: Grown on W/B (Single Layer)-SF-DC, Side Pocket, Front Fly with Top-Stitch, Hem-Stripe.

Color- Stripe, **Fabric:**

SMV- 12.58, MP-34

Table 3.14: Operation breakdown: Bottom Short Pant

	Operation description	Machine Type	Operation Grade
1	Back rise join & Thread trim	SND-LS	C
2	Take for fly make	SND-LS	B
3	Front rise Join	4T O/L	C
4	Front rise top stitch	3T F/L-CB	C
5	Fly J Stitch	SND-LS	B
6	Fly J Top Stitch with stitch remove	3T F/L-CB	B
7	Make pocket bag	4T O/L	B
8	Attach Front pocket	SND-LS	A
9	Pocket inner Suring with comet cut	SND-LS	C
10	Packet mouth Top Stitch	SND-LS	A
11	Pocket tack at upper area	SND-LS	A
12	Back & Front Match	Manual	C
13	Front & Back part tack-pocket area	SND-LS	A
14	Side Seam join-with pocket	4T O/L	A
15	Inseam join	4T O/L	A
16	Attach elastic at waist with cut-by device	4T O/L	C
17	Waist elastic tack	SND-LS	B
18	Waist 2 Hole & lining remove	BH	B
19	Elastic 4-point tack (Seif & turn)	SND-LS	B
20	Elastic waist band top stitch	Kansai	A

21	Leg hem	3T F/L-CB	A
22	Drawstring Make & measure cut	2T F/L-BD	C
23	Drawstring insert HP	Manual	C
24	Drawstring end fold & tack with excess cut	BT	C
25	Bar-tack at inseam, waist & fly BT	BT	C
26	Side pocket BT *4	BT	C
27	Leg hem security tack	SND-LS	C
28	Attach care label at side	SND-LS	C
29	Thread cut	Manual	C

Machine Name:

Table 3.15: Machine Name

Machine Name	
4 Thread Over Lock	4T O/L
Single Needle Lock Stitch	SND-LS
2 Thread Flat Bed Interlock Machine	2T F/L- BD
3 Thread Cylinder Bed Interlock	3T F/L-CB
3 Thread Flat Bed Interlock	3T F/L-HM
Single Needle Chain Stitch	SND-CS
Bottom Hole	BH
Bottom Attaching	BA
Bar-tack	BT
3 Thread Over Lock	3T O/L
Kansai	Kansai
5 Thread Cylinder Bed Interlock	5T F/L-CB
4 Thread Flat Bed Interlock Machine	4T F/L-HM

3.3 Machine Line Lay-out:

They are two types of Machine Line Lay-out.

1. Face to Face Type
2. Z Style Type

Z Style Type

SMV & TGT	Operation	SL	M/C
		4	

SMV & TGT	Operation	SL	M/C
		2	

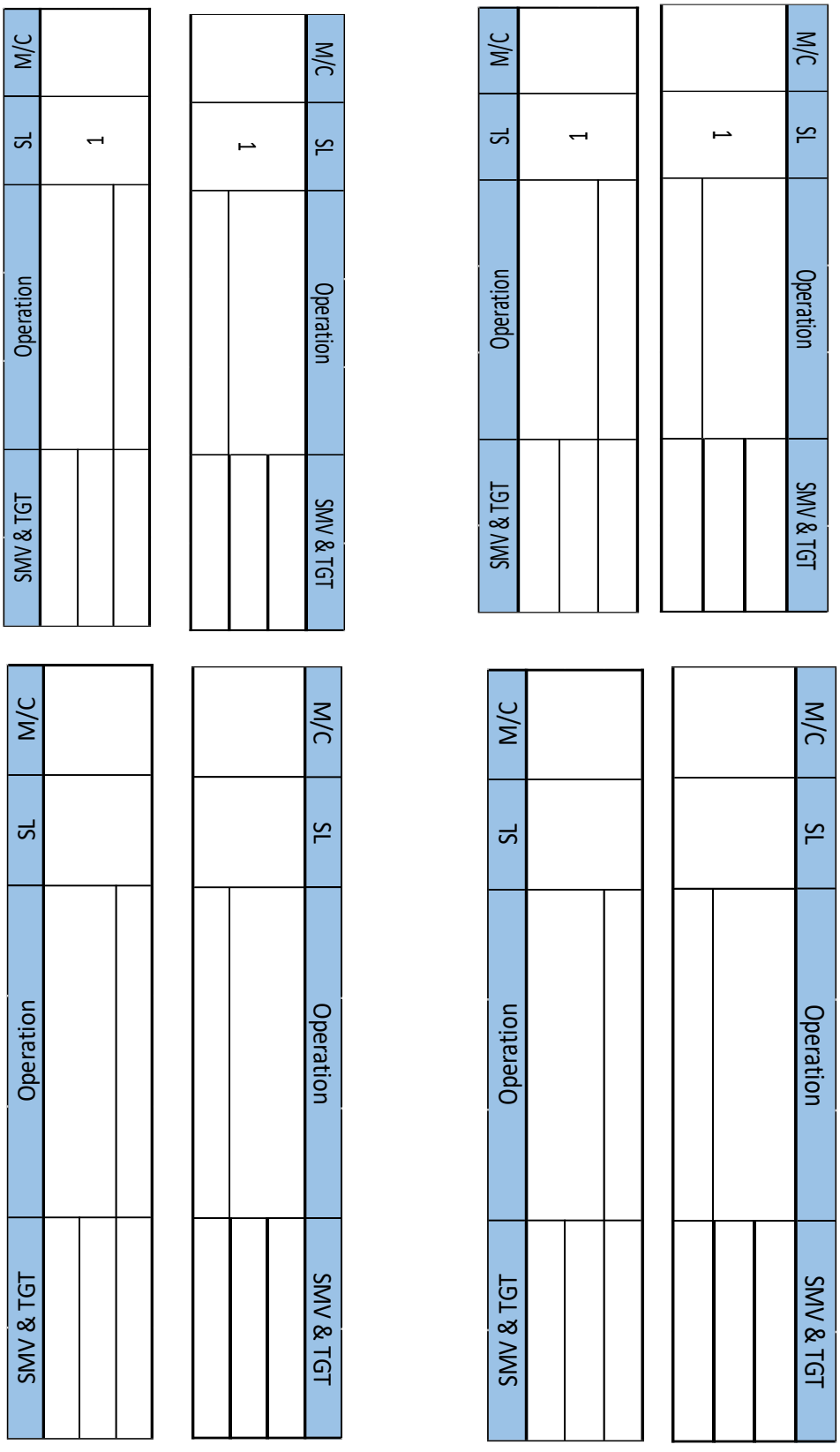
SMV & TGT	Operation	SL	M/C
		1	

M/C	SL	Operation	SMV & TGT
	3		

M/C	SL	Operation	SMV & TGT
	2		

M/C	SL	Operation	SMV & TGT
	1		

Face to Face Type



CHAPTER 4: RESULTS & DISCUSSIONS

4.1 Results and discussions

The study's findings show that implementing industrial engineering effectively in the textile sector has tremendous advantages. This sector needs to implement complete industrial engineering and lean manufacturing concepts to reap the full benefits of the I.E. setup. Most companies only focus on a few tools and techniques, neglecting others. The textile companies in Bangladesh need focused training on Industrial Engineering to understand it better. They need to implement industrial engineering in all manufacturing areas. There is a lack of understanding of industrial engineering practices.

All industries have not employed a systematic approach to industrial engineering implementation. Another vital element for successful industrial engineering implementation is the top management's commitment. They need to focus on the training of employees and make sure employees are involved in the whole process. Incentives should be given to the workers for their support. The benefits of industrial engineering must be shared among all stakeholders. It is recommended for future research to concentrate on a single unit (spinning, weaving, knit wearing, and garment) of textile rather than the overall sector. This will provide a better understanding of industrial engineering in a specific unit type. The companies should be encouraged to benchmark their system with world-class firms. This can help bring rapid improvements in their performance. A gap analysis should be performed between Bangladesh and other countries with well-established industrial engineering to identify the performance gap. Future research should be based on a detailed investigation through interviews, document review, observations, and qualitative approaches to generalize the results of this study.

CHAPTER 5: CONCLUSION

Conclusion

The importance of the textile industry in the economy of Bangladesh is very high. Furthermore, the industry is expected to be a catalyst in the industrialization of Bangladesh. It has been declared a thrust sector by the government. Bangladeshi textile industry has enormous opportunities to develop their textile industries and a massive probability of earning more profit from the textile industry by using low labour cost, skill development potential, presently huge expanding market, favourable conversion cost, etc.

Industrial engineering is the most significant and essential part of any apparel industry. We have learnt many procedures and important things about Industrial engineering. Besides, we have found many problems in Industrial engineering. By doing this experiment, we also learned how to solve problems and arrange all the work of Industrial Engineering. Before IE, there were many problems in the garment industry, such as production capacity, daily line target capacity, layout, and delivery problems.

After IE and planning, there is an implementation in line balancing, daily line target, and production capacity increase. Additionally, it gives us a chance to extend our insight into the material organization, generation arranging, acquisition framework, creation process, and apparatuses and encourages us to modify modern life.

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