Department of Textile Engineering

Faculty of Engineering

Study on Industrial Engineering

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Bachelor of Science (B.Sc.) in Textile Engineering

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LETTER OF APPROVAL

To

The Head

Department of Textile Engineering

Daffodil International University

102, Shukrabad, Mirpur Road, Dhaka-1207

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

Dear Sir,

I am just writing to let you know that this thesis report title as ‘Study on Industrial Engineering’ has been prepared by the students Sabit Chakma, bearing ID: 151-23-4258 and Koushik Chandra Roy, bearing ID: 161-23-4584 are finished for final evaluation. The whole report is ready based on the proper investigation and intermission through critical analysis observed data with required things. The students were directly involved in their project activities and developed vital to inspiration of valuable information for the person who reads.

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

Yours Sincerely

…………………….

Engr. Mohammad Abdul baset

Assistant Professor

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Daffodil International University

DECLARATION

We hereby declare that, this thesis report has been done by us under the honourable supervisor of Engr. Mahammad Abdul Baset, Assistant Professor, Department of Textile Engineering, Faculty of Engineering at Daffodil International University. We also announce that neither project report nor any part of this project has been submitted away for award of any degree where due to references has been made in the next.

Submitted By:

Name	ID	Signature
Sabit Chakma	151-23-4258	
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ACKNOWLEDGEMENT

At first, thanks to the God for this kind of blessing for completion of this progression successfully.

We feel grateful to thanks our respectable academic supervisor to **Mohammad Abdul Baset (Assistant Professor)**, Department of Textile Engineering, Daffodil International University. Deep knowledge and keen interest of our supervisor in the field of garments manufacturing influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest to the authority of the **Robintex Group**. For their kind of help we have finished our project research successfully. Special thanks to **Md. Mahbubul Alam (GM in Dyeing)** who guided us in the factory and entire employees and workers who gave their valuable time for us. And also express gratefulness to the honorable head of department, faculty members and the staff of Textile engineering department of Daffodil International University. We also would like to thanks our entire course mate in Daffodil International University, who took part of this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

This thesis paper contains the overall procedure of Industrial Engineering (IE) in the garments industry. We have visited on **Robintex Group** at Vulta, Rupganj, Narayanganj to research the operation breakdown, standard minute value (SMV), production target, efficiency%, capacity, labor productivity, method study, time study, performance rating calculation and its related data as the Industrial Engineer working procedure.

We have completed our research to gained depth knowledge study on industrial engineering in the sewing section at normal sewing line and just in time (JIT) line. After applying all those, we have compared before and after situation of labor productivity and line efficiency. Finally proposed production layout has been modeled and ensures a better productivity. In this paper, we discussed some procedure about time, Capacity, Target, SMV, and production study and analysis of different method and also discussed about operation breakdown and other tools and techniques which consisted of different experimental discussion, experiment results and discussion this analysis can know about the different items of SMV, efficiency wise production variation. We are analysis four items operation bulletins as work dividing plan. We are achieved result of product SMV for Naomi Is Top 4.37, Tilly Solid 5.74, Erik Basic Fit Tank Top 3.80, Gabbi Tank 4.10. And also we have achieved result of product Efficiency% for Naomi Is Top 55%, Tilly Solid 52%R, Erik Basic Fit Tank Top 52%, Gabbi Tank 55%.

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CHAPTER-1: INTRODUCTION

1.1 Introduction

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

1.2 Nature of Work in Industrial Engineering

Industrial Engineers determine the most effective ways for an organization to use the basic factors of production – people, machines, materials, information, and energy – to make or process a product or produce a service. They are the bridge between management goals and operational performance. They are more concerned with increasing productivity through the management of people, methods of business organization, and expertise than are engineers in other specialties, who generally work more with product or process.

1.3 Objective of the Study

- For cumulative productivity of a garments industry
- For improved work in place in garments industry
- Reduce work in process (WIP) and eliminate the bottleneck
- In development of layout in different line of a garments industry
- For advance of inventory control system
- Reduce Sameness in sewing floor

1.4 Importance of the Project

A combination between our general education line practical life with various articles, documents and calculation. A big number of distant moneys are earned by garments and textile sector around (80-85) %. There is a large number of industrial engineers working in textile and its sub sector. We hope that the project will give a way to tech industrials engineers which will help in the future to lead our textile and garments sector. Bangladesh is a development country and a developing country largely depends on foreign currency.

1.5 Scope of the Project

Huge chances to do somewhat in the Industrial Engineering department of a garments industry. Now a day IE demanded for cumulative production. Almost all of RMG factories and comprehend the role of IE for increasing production and labor productivity. RMG industry is given so many opportunities for developing IE techniques and methods for increasing production. It is a stimulating topic so that almost all businesses are giving change for researching about IE to increasing productivity. RMG industries author can realize the actual demand for IE section for increasing their quality of production.

CHAPTER-2: LITERATURE REVIEW

2.1 Definition of Industrial Engineering

Industrial Engineering is respected to the design, improvement and installation of integrated system of men, materials and machines for the benefit of mankind and draws upon specialized knowledge and skills in the practical mathematical and physical sciences together with the principles and methods of engineering analytical design to specify predict and evaluate the results to be obtained from such system.

2.2 Objective of Industrial Engineering

The main purpose of the industrial engineering is to increasing production productivity considering by reducing cost, proper use of materials that means of increasing efficiency and make suitable profit.

- To get higher production
- Reduce maximum cost
- Properly use of men, machines and materials
- Increase efficiency

2.3 Activities of Industrial Engineering Department

To produce sustainable product according to controlling quality of buyers demand such the industrial engineers are directly responsible to do this kind of activities.

- Preparing daily, weekly and monthly production plan
- Operation breakdown and machine layout
- Buyer and style wise operation breakdown and machine layout
- Prepare man and machine report
- Buyer and style wise capacity study and line balancing
- Train up production staff on efficiency
- Production planning
- Monitoring the production and achieve the line wise daily target
- Line wise daily production target setup
- Controlling wastage in the production floor
- Arranging trims and accessories in proper time
- Preparing daily crisis report
- SMV calculation
- Time study
- Method and motion study
- Data collection and efficiency report
- Non productive time (Loss time) record
- Ensure optimum use of materials

- Reporting to daily production, efficiency and man power
- Daily quality statistical report presentation
- Monthly production and shipment closing report

2.4 Process flow chart of IE

Negotiation with Garments Merchandiser

⇩

Garments Analysis

⇩

Make Pre-production Meeting if Required Fabrics, Trimmings and Accessories in Housed

⇩

Production Target

⇩

Set Machine Layout

⇩

Line Setting

⇩

Line Balancing

⇩

Continuous Production Meeting

⇩

Production Data Collection

⇩

Prepare Production Report

⇩

Analysis of Production Report

⇩

Submit Report to the Factory Manager

Fig-2.4: Process flow chart of IE

2.5 Line Balancing

Line Balancing is leveling the workload across all processes in a cell or value stream to remove bottlenecks and excess capacity. A constraint slows the process down and results if waiting for downstream operations and excess capacity results in waiting and absorption of fixed costs.

It is the allocation of sewing machine, according to style and design of the garments. It depends on what types of garments we have to produce. It is done to increasing productivity.

When you consider mass production, garments are produced in lines or set of machines instead of single machine. A line may be assembly line, modular line or section, a line set with online finishing and packing. A line includes multiple work stations with varied work contents. Production per hour is varied depending on work content (standard minutes of particular task/operation), allocation of total manpower to a particular operation, operator skill level and machine capacity. Operation with lowest production per hour is called as bottleneck operation for that line.

2.5.1 Line Efficiency

$$\text{Line Efficieny } = \frac{\text{Total Minutes Produce in the Line} \times 100}{\text{Total Minutes Allocated by all Operations}}$$

$$\text{Line Efficiency} = \frac{\text{Total output in the line} \times \text{SMV} \times 100}{\text{Working Hours} \times 60 \times \text{Number of Operators}}$$

2.6 Standard Minutes Value (SMV)

SMV is defined as the time which is allowable to perform a job acceptably. Generally it is expressed in minute value. The full amplification of SMV is Standard Minute Value MV term is broadly used in the garment industrial industry. SMV is also known as Standard Allocated Minute (SAM). For smooth and timely shipment an export order a merchandiser need to proper SMV set up in garment production floor. Standard minute value is the standard time to complete any given task by using best possible methods at standard level of performance.

2.6.1 Factors consider of SVM Calculation

- Types of garments
- Types of fabric

- Garments size
- Critical style of garments
- Types of machine use

2.6.2 SMV Calculation

Standard allowed minutes (SAM) = (Basic minute + Bundle allowances + machine and personal allowances). Add bundle allowances (10%) and machine and personal allowances (20%) to basic time

2.6.3 Operation Breakdown

Operation breakdown is the particular components each different style of the garments to be completed. To manufacturing a garment it's need to joining or attaching different parts by using different types of sewing machines and required helpers to move body so, it's particular each operation we called operation breakdown.

2.6.4 Bottleneck

A bottleneck is a marvel where the performance or capacity of an entire system is limited by a single or limited number of components or resources. The upper narrow portion of a front is called neck (opening side) and it is an obstruction to go to the way from large portion of a bottle through narrow portion of a neck. It is a metaphorical scene of obstruction of production sector.

2.7 Pitch Time

In industrial engineering, pitch time in a ratio of total SMV of garments and number of operation to be set of style.

2.8 Method Study

Method study can be defined as the procedure for systematic recording, analysis and critical examination of existing or proposed method f doing work for the purpose of development and application of easier and more effective method.

2.8.1 Flow Chart of Method Study in Garment Industry

Select

⇓

Record

⇓

Examine

⇓

Develop

⇓

Evaluate

⇓

Define

⇓

Install

⇓

Maintain

Fig-2.8.1: Flow Chart of Method Study

2.9 Time Study

A work measurement technique for recording times and rates of working for the elements within specific condition and for analyzing the data so as to determine the time necessary for carrying out a job at a defined level of performance.

Time Study Equipments:

- ✓ Stop watch
- ✓ Study board
- ✓ Time study form according to garments operation breakdown

2.10 Target Setting

Many companies do not use standard time systems; target setting is based on guesswork and experience. Establishment of Standard times and the development of the best method to manufacture are vitally important to improve productivity. Every company that wishes to compete in the future must realize this. This chart clearly illustrates the benefits to factory efficiency if standard times and well developed methods are used.

Production quantity produced by a qualified worker in a day at standard performance is known as daily production target.

Daily production target can be calculated by using the below formula in apparel industry:

Daily production target, = (Daily clock minute/ Standard time) × Efficiency

= [{(No. of operator × working hours × 60) / Standard time} × Efficiency]

Worker Efficiency

$$\text{Worker Efficiency} = \frac{\text{No. of Pieces Produce by an operator} \times \text{SMV of Particular job} \times 100}{\text{Total Number of Hours Worked}}$$

2.11 Rating

Performance rating is the process during which the time study engineer compares the performance of the operator under observation with his own concept of normal performance.

$$\text{Performance Rating} = \frac{\text{Observed Performance} \times 100}{\text{Normal Performance}}$$

CHAPTER-3: EXPERIMENTAL DISCUSSION

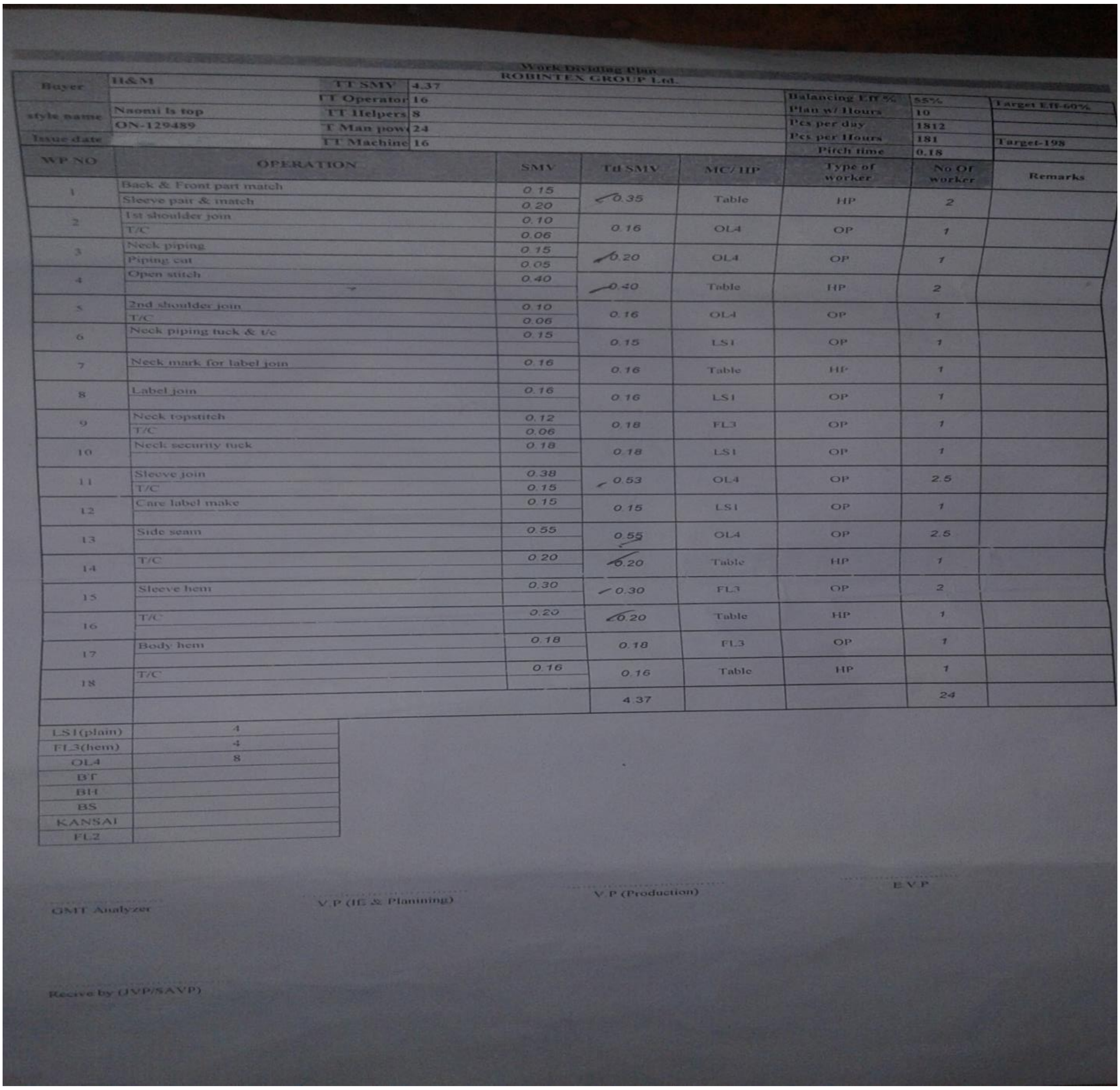
3.1 Work Dividing Plan of Naomi Is Top

Buyer Name: H&M

Style Name: Naomi Is Top (Ladies-T)

Order No: 129489

Line No: 65



Work Dividing Plan
ROBINTEX GROUP Ltd.

Buyer	H&M	TT SMV	4.37				
		TT Operator	16	Balancing Eff %	55%	Target Eff-60%	
style name	Naomi Is top	TT Helpers	8	Plan w/ Hours	10		
	ON-129489	T Man pow	24	Pcs per day	1812		
Issue date		TT Machine	16	Pcs per Hours	181	Target-198	
				Pitch time	0.18		

WP NO	OPERATION	SMV	Ttl SMV	MC/ HP	Type of worker	No Of worker	Remarks
1	Back & Front part match	0.15	0.35	Table	HP	2	
	Sleeve pair & match	0.20					
2	1st shoulder join	0.10	0.16	OL4	OP	1	
	T/C	0.06					
3	Neck piping	0.15	0.20	OL4	OP	1	
	Piping cut	0.05					
4	Open stitch	0.40	0.40	Table	HP	2	
5	2nd shoulder join	0.10	0.16	OL4	OP	1	
	T/C	0.06					
6	Neck piping tuck & t/c	0.15	0.15	LS1	OP	1	
7	Neck mark for label join	0.16	0.16	Table	HP	1	
8	Label join	0.16	0.16	LS1	OP	1	
9	Neck topstitch	0.12	0.18	FL3	OP	1	
	T/C	0.06					
10	Neck security tuck	0.18	0.18	LS1	OP	1	
11	Sleeve join	0.38	0.53	OL4	OP	2.5	
	T/C	0.15					
12	Care label make	0.15	0.15	LS1	OP	1	
13	Side seam	0.55	0.55	OL4	OP	2.5	
14	T/C	0.20	0.20	Table	HP	1	
15	Sleeve hem	0.30	0.30	FL3	OP	2	
16	T/C	0.20	0.20	Table	HP	1	
17	Body hem	0.18	0.18	FL3	OP	1	
18	T/C	0.16	0.16	Table	HP	1	
			4.37			24	

LS1(plain)	4
FL3(hem)	4
OL4	8
BT	
BH	
BS	
KANSAI	
FL2	

GMT Analyzer V.P (IE & Planning) V.P (Production) E.V.P

Recive by (JVP/SAVP)

Fig-3.1.1: Work Dividing Plan of Naomi Is Top

3.1.1 Data Table of Naomi Is Top

Work Dividing Plan

Robintex Group Ltd.

Buyer	**H&M**	**TT SMV**	**4.37**	**Balancing Effi%**	**55%**		**Target Eff-60%**
		TT Operator	**16**	**Plan w/Hours**	**10**		
Style Name	**Naomi Is Top**	**TT Helpers**	**8**	**Pcs per day**	**1812**		
	ON-129489	**TT Man power**	**24**	**Pcs per hours**	**181**		**Target-198**
Issue date		**TT Machine**	**16**	**Pitch Time**	**0.18**		

WP No.	**Operation**	**SMV**	**Ttl SMV**	**MC/HP**	**Type of Worker**	**No. of Worker**	**Capacity /Hour**
1	Back & Front part match	o.15	0.35	Table	HP	2	103
	Sleeve pair & Match	0.20					
2	1st shoulder join	0.10	0.16	OL4	OP	1	225
	T/C	0.06					
3	Neck piping	0.15	0.20	OL4	OP	1	180
	Piping cut	0.05					
4	Open Stitch	0.40	0.40	Table	HP	2	90
5	2nd shoulder join	0.10	0.16	OL4	OP	1	225
	T/C	0.06					
6	Neck piping tuck & T/C	0.15	0.15	LS1	OP	1	240
7	Neck mark for label join	0.16	0.16	Table	HP	1	225
8	Label join	0.16	0.16	LS1	OP	1	225
9	Neck top stitch	0.12	0.18	FL3	OP	1	200
	T/C	0.06					
10	Neck security tuck	0.18	0.18	LS1	OP	1	200
11	Sleeve join	0.38	0.53	OL4	OP	2.5	68
	T/C	0.15					
12	Care label make	0.15	0.15	LS1	OP	1	240
13	Side seam	0.55	0.55	OL4	OP	2.5	65

14	T/C	0.20	0.20	Table	HP	1	180
15	Sleeve hem	0.30	0.30	FL3	OP	2	120
16	T/C	0.20	0.20	Table	HP	1	180
17	Body hem	0.18	0.18	FL3	OP	1	200
18	T/C	0.16	0.16	Table	HP	1	225
			4.37			24	

LS1	4
FL3	4
OL4	8
BT	
BH	
BS	
KANSAI	
FL2	

Table-3.1.1: Work Dividing Plan of Naomi Is Top

3.1.2 Description

Above the operation breakdown data sheet for Naomi Is Top in 65 number sewing line located of the Robintex Group, the buyer name is H&M. During doing this task we found 16 machines are required would to be complete this item. We calculated assumed Efficiency accordingly 55%, 60%, 65%, 70% and 80% with same SMV value to identify the production target calculation. Here are the others required calculation data's given below from the data table.

Number of worker = 24

Efficiency = 60%

Working hours = 10

Total SMV = 4.37

Target per hour = 181 Pcs

Target per day = 1812 Pcs

3.1.3 Production Target, SMV and Pitch Time Calculation

Target Calculation

Here, Total worker = 24

SMV = 4.37

Working hrs = 10

Target Efficiency = 60%

We know that,

$$Target = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 60\%}{4.37}$$

So, the daily Target = 1977 pcs/day

When Efficiency 65%,

$$Target = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 65\%}{4.37}$$

And Target will be, = 2142 psc/day

When Efficiency 70%,

$$Target = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 70\%}{4.37}$$

And Target will be remains, Target = 2306 pcs/day

And again if efficiency 80%,

$$Target = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 80\%}{4.37}$$

The production target is also increased, Target = 2636 pcs/day.

From data table the balancing efficiency got only 55% so, let the efficiency 55% and the Target is decreased here,

$$Target = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 55\%}{4.37}$$

And, actual Target = 1812 pcs/day

= 181 pcs/hr

Efficiency wise target variation data from the above calculation

Efficiency%	Target (Pcs/Per Day)
55%	1812
60%	1977
65%	2124
70%	2306
80%	2636

SMV Calculation

SMV = Basic time + Allowance of Basic Time

Basic time = Observe time × Rating

Observe time = Total cycle time/Number of cycle time

Here, we would like to shown only 1st shoulder join operation SMV.

So, observed average cycle time of the 1st shoulder join is 13 seconds

Now observe time = 11/60 = .18

Let, Rating = 80%

And, Basic Time = Observe time × Rating

= .18×80% = 0.14

Let allowance = 13%

SMV = Basic Time + Allowance of Basic Time

= 0.14+ 0.14×13/100

=0.16

So, 1st shoulder join SMV is 0.16 and others operations are calculated same formula.

Pitch Time

Here,

Number of operation = 18

Total SMV = 4.37

So, Pitch Time = SMV/ Number of Manpower

= 4.37/18

= 0.24

3.1.4 Labor Productivity and Efficiency Calculation

Efficiency Calculation

Here, Total Production = 1812

SMV = 4.37

Total Manpower =24

Working Hour = 10

We know, Efficiency

$$Efficiency = \frac{\text{Total production } \times \text{SMV } \times 100}{\text{Total Manpower} \times \text{working hour} \times 60}$$

$$\text{Efficiency} = \frac{1812 \times 4.37 \times 100}{24 \times 10 \times 60}$$

So, Efficiency = 55%

Line Efficiency Calculation

We know,

$$Line\ Efficiency = \frac{\text{Toal Minutes Produced } \times 100}{\text{Total Minute Attended}}$$

And Total minute produced = Line output × SMV

= 1812 × 4.37

= 7918

Also known that, Total minute attended = No. of Operators × working hrs × 60

= 24×10×60

= 14400

So finally the line efficiency is,

$$Line\ Efficiency = \frac{7918 \times 100}{14400}$$

And Line efficiency is 54.98%.

Labor Productivity Calculation

$$\textbf{Labor Productivity} = \frac{\text{Total Pieces Produced}}{\text{Total Labor Input}}$$

$$= \frac{1812}{24}$$

$$= 76 \text{ Pcs/day}$$

Labor Efficiency Calculation

$$\textbf{Labor Efficiency} = \frac{\text{Produced Minutes} \times 100}{\text{Available Minutes}}$$

$$\textbf{Labor Efficiency} = \frac{76 \times 4.37 \times 100}{10 \times 60}$$

So, Labor Efficiency = 55.35%

3.1.5 Sewing Line Capacity Calculation

$$\text{Line Capacity} = \frac{\{(\text{No. of Machine} \times \text{working hr} \times 60) - \text{Absentism\%}\} \times \text{Line Efficiency\%}}{\text{Garment SMV}}$$

$$\text{Line Capacity} = \frac{\{(24 \times 10 \times 60) - 0\%\} \times 54.98\%}{4.37}$$

= 1812 pcs/day

So, the line capacity for this style of the garments is 1812 pieces per day.

Capacity of Each Operation per Hour

Here is given below calculation only for Back, front & Sleeve fair match and other capacities calculated in same way.

$$\textbf{Capacity} = \frac{\text{Working hrs in sec}}{\text{Average Cycle time}}$$

$$\textbf{Capacity} = \frac{60 \times 60}{35}$$

$$\textbf{Capacity} = 102 \text{ Pcs/hr}$$

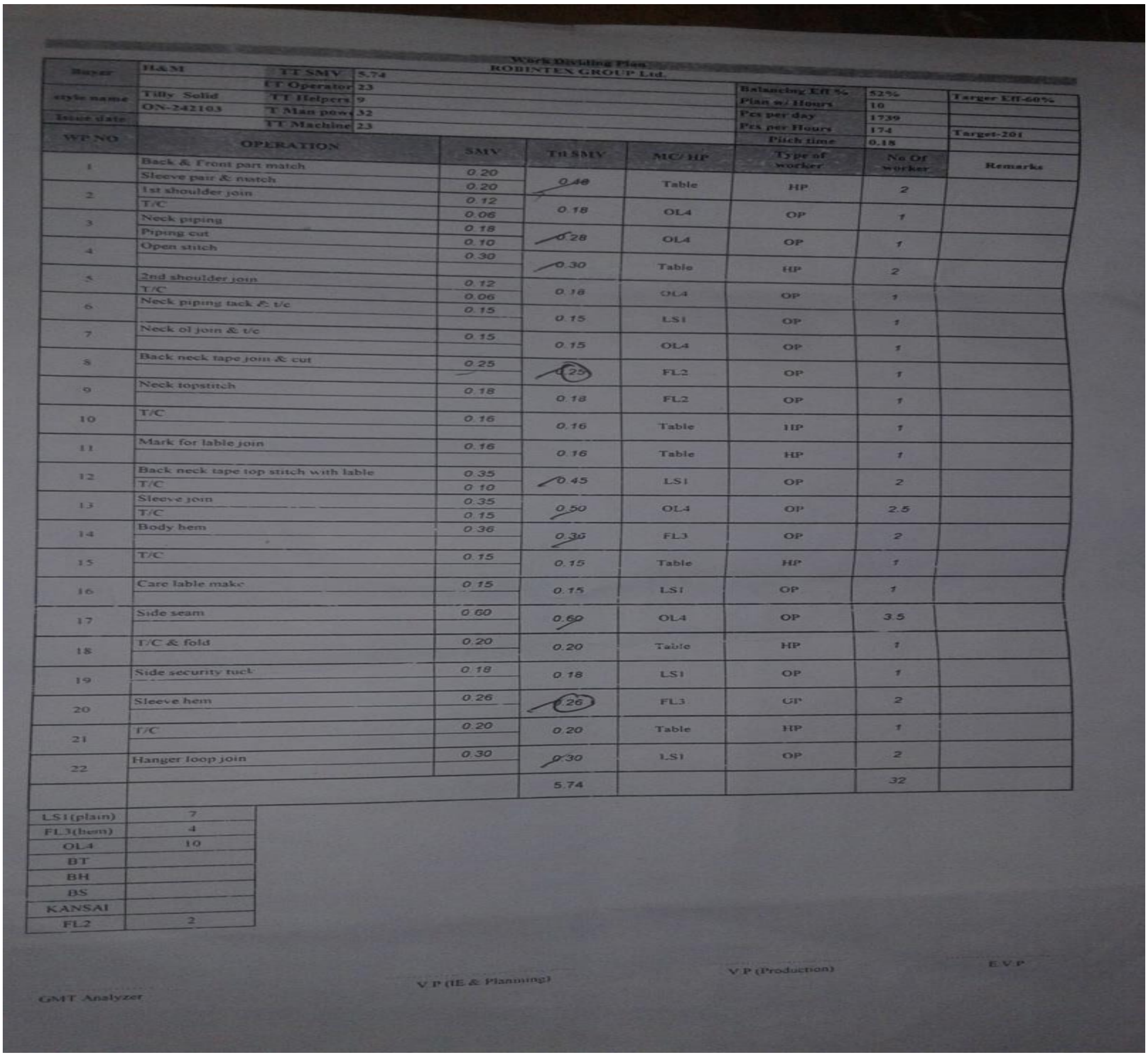
3.2 Work Dividing Plan of Tilly Solid

Buyer Name: H&M

Style Name: Tilly Solid (Basic T-Shirt)

Order No: 242103

Line No: 32



Work Dividing Plan

ROBINTEX GROUP Ltd.

Buyer	H&M	TT SMV	5.74			
		TT Operator	23	Balancing Eff %	52%	Targer Eff-60%
style name	Tilly Solid	TT Helpers	9	Plan w/ Hours	10	
	ON-242103	T Man powe	32	Pcs per day	1739	
Issue date		TT Machine	23	Pcs per Hours	174	Target-201
				Pitch time	0.18	

WP NO	OPERATION	SMV	Th SMV	MC/ HP	Type of worker	No Of worker	Remarks
1	Back & Front part match Sleeve pair & match	0.20 0.20	0.40	Table	HP	2	
2	1st shoulder join T/C	0.12 0.06	0.18	OL4	OP	1	
3	Neck piping Piping cut	0.18 0.10	0.28	OL4	OP	1	
4	Open stitch	0.30	0.30	Table	HP	2	
5	2nd shoulder join T/C	0.12 0.06	0.18	OL4	OP	1	
6	Neck piping tack & t/c	0.15	0.15	LS1	OP	1	
7	Neck ol join & t/c	0.15	0.15	OL4	OP	1	
8	Back neck tape join & cut	0.25	0.25	FL2	OP	1	
9	Neck topstitch	0.18	0.18	FL2	OP	1	
10	T/C	0.16	0.16	Table	HP	1	
11	Mark for lable join	0.16	0.16	Table	HP	1	
12	Back neck tape top stitch with lable T/C	0.35 0.10	0.45	LS1	OP	2	
13	Sleeve join T/C	0.35 0.15	0.50	OL4	OP	2.5	
14	Body hem	0.36	0.36	FL3	OP	2	
15	T/C	0.15	0.15	Table	HP	1	
16	Care lable make	0.15	0.15	LS1	OP	1	
17	Side seam	0.60	0.60	OL4	OP	3.5	
18	T/C & fold	0.20	0.20	Table	HP	1	
19	Side security tuck	0.18	0.18	LS1	OP	1	
20	Sleeve hem	0.26	0.26	FL3	OP	2	
21	T/C	0.20	0.20	Table	HP	1	
22	Hanger loop join	0.30	0.30	LS1	OP	2	
			5.74			32	

LS1(plain)	7
FL3(hem)	4
OL4	10
BT	
BH	
BS	
KANSAI	
FL2	2

GMT Analyzer

V P (IE & Planning)

V P (Production)

E V P

Fig-3.2.1: Work Dividing Plan of Tilly Solid

3.2.2Work Dividing Plan of Tilly Solid

Robintex Group Ltd.

Buyer	H&M	TT SMV	5.74	Balancing Effi%	52%		Target Eff-60%
		TT Operator	23	Plan w/Hours	10		
Style Name	Tilly Solid	TT Helpers	9	Pcs per day	1739		
	ON-242103	TT Man power	32	Pcs per hours	174		Target-201
Issue date		TT Machine	23	Pitch Time	0.18		
WP No.	**Operation**	**SMV**	**Ttl SMV**	**MC/HP**	**Type of Worker**	**No. of Worker**	**Remarks**
1	Back & Front part match	0.20	0.40	Table	HP	2	90
	Sleeve pair & Match	0.20					
2	1st shoulder join	0.12	0.18	OL4	OP	1	200
	T/C	0.06					
3	Neck piping	0.18	0.28	OL4	OP	1	128
	Piping cut	0.10					
4	Open Stitch	0.30	0.30	Table	HP	2	120
5	2nd shoulder join	0.12	0.18	OL4	OP	1	200
	T/C	0.06					
6	Neck piping tuck & T/C	0.15	0.15	LS1	OP	1	240
7	Neck ol join & T/C	0.15	0.15	OL4	OP	1	240
8	Back neck tape join & cut	0.25	0.25	FL2	OP	1	144
9	Neck top stitch	0.18	0.18	FL2	OP	1	200
10	T/C	0.16	0.16	Table	HP	1	225
11	Mark for label join	0.16	0.16	Table	HP	1	225
12	Back neck tape top stitch with label	0.35	0.45	LS1	OP	2	80
	T/C	0.10					
13	Sleeve join	0.35	0.50	OL4	OP	2.5	72
	T/C	0.15					
14	Body hem	0.36	0.36	FL3	OP	2	100

15	T/C	0.15	0.15	Table	HP	1	240
16	Care label make	0.15	0.15	LS1	OP	1	240
17	Side seam	0.60	0.60	OL4	OP	3.5	60
18	T/C & Fold	0.20	0.20	Table	HP	1	180
19	Side security tuck	0.18	0.18	LS1	OP	1	200
20	Sleeve hem	0.26	0.26	FL3	OP	2	138
21	T/C	0.20	0.20	Table	HP	1	180
22	Hanger loop join	0.30	0.30	LS1	OP	2	120
			5.74			32	

LS1	7
FL3	4
OL4	10
BT	
BH	
BS	
KANSAI	
FL2	2

Table-3.2.2: Work Dividing Plan Data of Tilly Solid

3.2.2 Description

Above the operation breakdown data sheet for Tilly Solid in 32th number sewing line located of the Robintex Group, the buyer name is H&M. During doing this task we found 23 machines are required would to be complete this item. We calculated assumed efficiency accordingly 52%, 60%, 65%, 70% & 80% with same value of SMV to calculate the production target. Here are the others required calculation data's given below from the data table.

Number of worker = 32

Efficiency = 60%

Working hours = 10

Total SMV = 5.74

Target per hour = 174 Pcs

Target per day = 1739 Pcs

3.2.3 Production Target, SMV and Pitch Time Calculation

Target Calculation

Here, Total worker = 32

SMV = 5.74

Working hrs = 10

Target Efficiency = 60%

We know that,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 32 \times 60\%}{5.74}$$

So, the daily Target = 2007 pcs/day

When Efficiency65%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 32 \times 65\%}{5,74}$$

And Target will be, = 2174 psc/day

When Efficiency 70%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 32 \times 70\%}{5.74}$$

And Target will be remains, Target = 2341 pcs/day

And again if efficiency 80%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 32 \times 80\%}{5.74}$$

The production target is also increased, Target = 2676 pcs/day.

From data table the balancing efficiency got only 52% so, let the efficiency 52% and the Target is decreased here,

$$\text{Target} = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 32 \times 52\%}{5.74}$$

And, actual Target = 1739 pcs/day

= 174 pcs/hr

Efficiency wise target variation data from the above calculation

Efficiency%	Target (Pcs/Per Day)
52%	1812
60%	2007
65%	2174
70%	2341
80%	2676

SMV Calculation

SMV = Basic time + Allowance of Basic Time

Basic time = Observe time × Rating

Observe time = Total cycle time/Number of cycle time

Here, we would like to shown only Hanger loop join operation SMV.

So, observed average cycle time of the Hanger loop join is 22 seconds

Now observe time = 22/60 = .36

Let, Rating = 80%

And, Basic Time = Observe time × Rating

= .36×80% = 0.29

Let allowance = 13%

SMV = Basic Time + Allowance of Basic Time

= 0.29+ 0.29×13/100

=0.32

So, 1st shoulder join SMV is 0.16 and others operations are calculated same formula.

Pitch Time

Here,

Number of operation = 22

Total SMV = 5.74

So, Pitch Time = SMV/ Number of Operation

= 5.74/22

= 0/26

3.2.4 Labor Productivity and Efficiency Calculation

Here, Total Production = 1739

SMV = 5.74

Total Manpower =32

Working Hour = 10

We know, Efficiency

$$\text{Efficiency} = \frac{\text{Total production} \times \text{SMV} \times 100}{\text{Total Manpower} \times \text{working hour} \times 60}$$

$$= \frac{1739 \times 5.74 \times 100}{32 \times 10 \times 60}$$

So, Efficiency = 52%

Line Efficiency Calculation:

We know,

$$\textbf{Line Efficiency} = \frac{\text{Toal Minutes Produced} \times 100}{\text{Total Minute Attended}}$$

And Total minute produced = Line output × SMV

= 1739 × 5.74

= 9981

Also known that, Total minute attended = No. of Operators × working hrs × 60

= 32×10×60

= 19200

So finally the line efficiency is,

$$\text{line efficiency} = \frac{9981 \times 100}{19200}$$

And Line efficiency is 51.98%.

Labor Productivity Calculation

$$\textbf{Labor Productivity} = \frac{\text{Total Pieces Produced}}{\text{Total Labor Input}}$$

$$= \frac{1739}{32}$$

$$= 54 \text{ pcs/day}$$

Labor Efficiency Calculation

$$\textbf{Labor Efficiency} = \frac{\text{Produced Minutes} \times 100}{\text{Available Minutes}}$$

$$= \frac{54 \times 5.74 \times 100}{10 \times 60}$$

So, Labor Efficiency = 51.66%

3.2.5 Sewing Line Capacity Calculation

$$\text{Line Capacity} = \frac{\{(\text{No. of Machine} \times \text{working hr} \times 60) - \text{Absentism\%}\} \times \text{Line Efficiency\%}}{\text{Garment SMV}}$$

$$= \frac{\{(32 \times 10 \times 60) - 0\%\} \times 51.98\%}{5.74}$$

= 1739 pcs/day

So, the line capacity for this style of the garments is 1739 pieces per day.

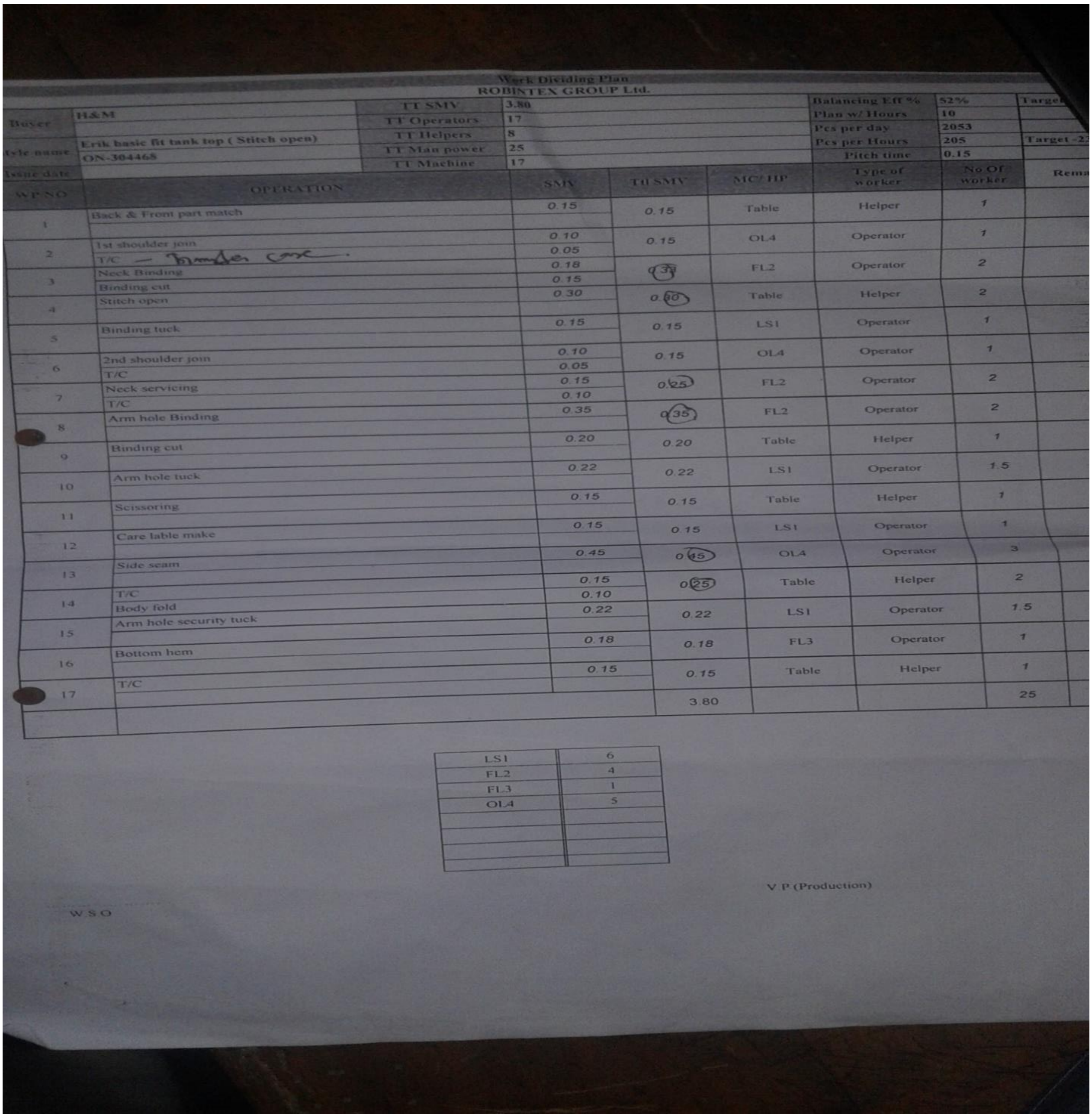
3.3 Work Dividing Plan of Erik Basic Fit Tank Top (Stitch Open)

Buyer Name: H&M

Style Name: Erik Basic Fit Tank Top

Order No: 304468

Line No: 33



Work Dividing Plan

ROBINTEX GROUP Ltd.

Buyer	H&M	TT SMV	3.80	Balancing Eff %	52%	Target
		TT Operators	17	Plan w/ Hours	10	
Style name	Erik basic fit tank top (Stitch open)	TT Helpers	8	Pcs per day	2053	
	ON-304468	TT Man power	25	Pcs per Hours	205	Target -2
Issue date		TT Machine	17	Pitch time	0.15	

WP NO	OPERATION	SMV	TH SMV	MC/ HP	Type of worker	No Of worker	Rema
1	Back & Front part match	0.15	0.15	Table	Helper	1	
2	1st shoulder join T/C — Transfer care	0.10 0.05	0.15	OL4	Operator	1	
3	Neck Binding Binding cut	0.18 0.15	0.3[illegible]	FL2	Operator	2	
4	Stitch open	0.30	0.[illegible]	Table	Helper	2	
5	Binding tuck	0.15	0.15	LS1	Operator	1	
6	2nd shoulder join T/C	0.10 0.05	0.15	OL4	Operator	1	
7	Neck servicing T/C	0.15 0.10	0.25	FL2	Operator	2	
8	Arm hole Binding	0.35	0.35	FL2	Operator	2	
9	Binding cut	0.20	0.20	Table	Helper	1	
10	Arm hole tuck	0.22	0.22	LS1	Operator	1.5	
11	Scissoring	0.15	0.15	Table	Helper	1	
12	Care lable make	0.15	0.15	LS1	Operator	1	
13	Side seam	0.45	0.45	OL4	Operator	3	
14	T/C Body fold	0.15 0.10	0.25	Table	Helper	2	
15	Arm hole security tuck	0.22	0.22	LS1	Operator	1.5	
16	Bottom hem	0.18	0.18	FL3	Operator	1	
17	T/C	0.15	0.15	Table	Helper	1	
			3.80			25	

LS1	6
FL2	4
FL3	1
OL4	5

V P (Production)

W S O

Fig-3.3.1: Work Dividing Plan of Erik Basic Tank Top

3.3.2Work Dividing Plan of Erik Basic Tank Top

Robintex Group Ltd.

Buyer	H&M	TT SMV	3.80	Balancing Effi%	52%		Target Eff-60%
		TT Operator	17	Plan w/Hours	10		
Style Name	Erik basic fit tank top (Stitch open)	TT Helpers	8	Pcs per day	2053		
	ON-304468	TT Man power	25	Pcs per hours	205		Target-237
Issue date		TT Machine	17	Pitch Time	0.15		
WP No.	**Operation**	**SMV**	**Ttl SMV**	**MC/HP**	**Type of Worker**	**No. of Worker**	**Capacity /hr**
1	Back & Front part match	0.15	0.15	Table	HP	1	240
2	1st shoulder join	0.10	0.15	OL4	OP	1	240
	T/C	0.05					
3	Neck Binding	0.18	0.33	FL2	OP	2	109
	Binding cut	0.15					
4	Open Stitch	0.30	0.30	Table	HP	2	120
5	Binding Tuck	0.15	0.15	FL1	OP	1	240
6	2nd shoulder join	0.10	0.15	OL4	OP	1	240
	T/C	0.05					
7	Neck servicing	0.15	0.25	FL2	OP	2	144
	T/C	0.10					
8	Arm hole binding	0.35	0.35	FL2	OP	2	102
9	Binding cut	0.20	0.20	Table	HP	1	180
10	Arm tuck	0.22	0.22	LS1	OP	1.5	163
11	Scissoring	0.15	0.15	Table	HP	1	240
12	Care label make	0.15	0.15	LS1	OP	1	240
13	Side seam	0.45	0.45	OL4	OP	3	80
14	T/C	0.15	0.25	Table	HP	2	144
	Body fold	0.10					
15	Arm hole security tuck	0.22	0.22	LS1	OP	1.5	163
16	Bottom hem	0.18	0.18	FL3	OP	1	200
17	T/C	0.15	0.15	Table	HP	1	240
			3.80			25	
LS1	6						

FL2	4
FL3	1
OL4	5

Table-3.3.2: Work Dividing Plan of Erik Basic Tank Top

3.3.2 Description

Above the operation breakdown data sheet for Erik Basic Fit Tank Top (Stitch Open) in 33 number sewing line located of the Robintex Group, the buyer name is H&M. During doing this task we found 17 machines are required would to be complete this item. Here are the others required calculation data's given below from the data table.

Number of worker = 25

Efficiency = 60%

Working hours = 10

Total SMV = 3.80

Target per hour = 205 Pcs

Target per day = 2053 Pcs

3.3.3 Production Target, SMV and Pitch Time Calculation

Target Calculation

Here, Total worker = 25

SMV = 3.80

Working hrs = 10

Target Efficiency = 60%

We know that,

$$\text{Target} = \frac{\text{Working Minutes } \times \text{Total Man Power } \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 25 \times 60\%}{3.80}$$

So, the daily Target = 2368 pcs/day

When Efficiency 65%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 25 \times 65\%}{3.80}$$

And Target will be, = 2565psc/day

When Efficiency 70%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 25 \times 70\%}{3.80}$$

And Target will be remains, Target = 2763 pcs/day

And again if efficiency 80%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 25 \times 80\%}{3.80}$$

The production target is also increased, Target = 3157 pcs/day.

From data table the balancing efficiency got only 52% so, let the efficiency 52% and the Target is decreased here,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 25 \times 52\%}{3.80}$$

And, actual Target = 2052 pcs/day

= 205pcs/hr

Efficiency wise target variation data from the above calculation

Efficiency%	Target (Pcs/Per Day)
52%	2052
60%	2368
65%	2565
70%	2763
80%	3151

SMV Calculation

SMV = Basic time + Allowance of Basic Time

Basic time = Observe time × Rating

Observe time = Total cycle time/Number of cycle time

Here, we would like to shown only 2nd shoulder join operation SMV.

So, observed average cycle time of the 2nd shoulder join is 9 seconds

Now observe time = 9/60 = .15

Let, Rating = 80%

And, Basic Time = Observe time × Rating

= .15×80% = 0.12

Let allowance = 13%

SMV = Basic Time + Allowance of Basic Time

= 0.12+ 0.12×13/100

=0.16

So, 2nd shoulder join SMV is 0.16 and others operations are calculated same formula.

Pitch Time

Here,

Number of operation = 17

Total SMV = 3.80

So, Pitch Time = SMV/ Number of Operation

= 3.80/17

= 0.22

3.3.4 Labor Productivity and Efficiency Calculation

Efficiency Calculation

Here, Total Production = 2053

SMV = 3.80

Total Manpower =25

Working Hour = 10

We know, Efficiency

$$\text{Efficiency} = \frac{\text{Total production} \times \text{SMV} \times 100}{\text{Total Manpower} \times \text{working hour} \times 60}$$

$$= \frac{2053 \times 3.80 \times 100}{25 \times 10 \times 60}$$

So, Efficiency = 52%

Line Efficiency Calculation

We know,

$$\text{Line Efficiency} = \frac{\text{Toal Minutes Produced} \times 100}{\text{Total Minute Attended}}$$

And Total minute produced = Line output × SMV

= 2053 × 3.80

= 7801

Also known that, Total minute attended = No. of Operators × working hrs × 60

= 25×10×60

= 15000

So finally the line efficiency is,

$$\text{Line Efficiency} = \frac{7801 \times 100}{15000}$$

And Line efficiency is 52%.

Labor Productivity Calculation

$$\textbf{Labor Productivity} = \frac{\text{Total Pieces Produced}}{\text{Total Labor Input}}$$

$$= \frac{2053}{25}$$

$$= 82\ psc/day$$

Labor Efficiency Calculation

$$\text{Labor Efficiency} = \frac{\text{Produced Minutes} \times 100}{\text{Available Minutes}}$$

$$= \frac{82 \times 3.80 \times 100}{10 \times 60}$$

So, Labor Efficiency = 51.93%

3.3.5 Sewing Line Capacity Calculation

$$\text{Line Capacity} = \frac{\{(\text{No. of Machine} \times \text{working hr} \times 60) - \text{Absentism\%}\} \times \text{Line Efficiency\%}}{\text{Garment SMV}}$$

$$= \frac{\{(25 \times 10 \times 60) - 0\%\} \times 51.93\%}{3.80}$$

= 2053 pcs/day

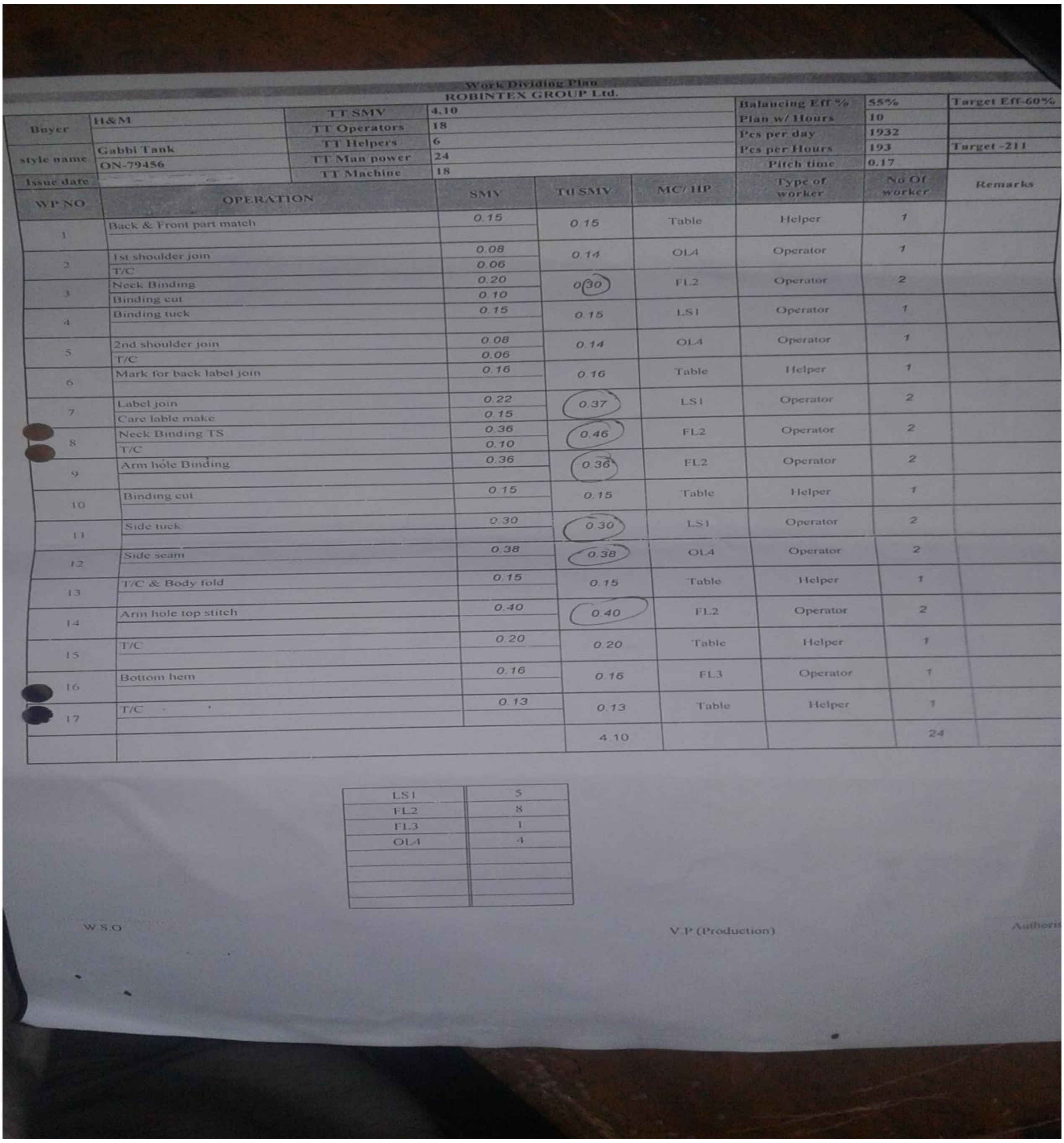
So, the line capacity for this style of the garments is 2053 pieces per day.

3.4 Work Dividing Plan of Gabbi Tank

Buyer Name: H&M

Style Name: Gabbi Tank

Line No: 48



Work Dividing Plan
ROBINTEX GROUP Ltd.

Buyer	H&M	TT SMV	4.10	Balancing Eff %	55%	Target Eff-60%
		TT Operators	18	Plan w/ Hours	10	
style name	Gabbi Tank	TT Helpers	6	Pcs per day	1932	
	ON-79456	TT Man power	24	Pcs per Hours	193	Target -211
Issue date		TT Machine	18	Pitch time	0.17	

WP NO	OPERATION	SMV	Ttl SMV	MC/ HP	Type of worker	No Of worker	Remarks
1	Back & Front part match	0.15	0.15	Table	Helper	1	
2	1st shoulder join	0.08	0.14	OL4	Operator	1	
	T/C	0.06					
3	Neck Binding	0.20	0.30	FL2	Operator	2	
	Binding cut	0.10					
4	Binding tuck	0.15	0.15	LS1	Operator	1	
5	2nd shoulder join	0.08	0.14	OL4	Operator	1	
	T/C	0.06					
6	Mark for back label join	0.16	0.16	Table	Helper	1	
7	Label join	0.22	0.37	LS1	Operator	2	
	Care lable make	0.15					
8	Neck Binding TS	0.36	0.46	FL2	Operator	2	
	T/C	0.10					
9	Arm hole Binding	0.36	0.36	FL2	Operator	2	
10	Binding cut	0.15	0.15	Table	Helper	1	
11	Side tuck	0.30	0.30	LS1	Operator	2	
12	Side seam	0.38	0.38	OL4	Operator	2	
13	T/C & Body fold	0.15	0.15	Table	Helper	1	
14	Arm hole top stitch	0.40	0.40	FL2	Operator	2	
15	T/C	0.20	0.20	Table	Helper	1	
16	Bottom hem	0.16	0.16	FL3	Operator	1	
17	T/C	0.13	0.13	Table	Helper	1	
			4.10			24	

LS1	5
FL2	8
FL3	1
OL4	4

W.S.O V.P (Production) Authori

Fig-3.4.1: Work Diving Plan of Gabbi Tank

Work Diving Plan of Gabbi Tank

Robintex Group Ltd.

Buyer	H&M	TT SMV	4.10	Balancing Effi%	55%		Target Eff-60%
		TT Operator	18	Plan w/Hours	10		
Style Name	Gabbi Tank	TT Helpers	6	Pcs per day	1932		
	ON-79456	TT Man power	24	Pcs per hours	193		Target-211
Issue date		TT Machine	18	Pitch Time	0.17		
WP No.	**Operation**	**SMV**	**Ttl SMV**	**MC/HP**	**Type of Worker**	**No. of Worker**	**Capacity /hr**
1	Back & Front part match	0.15	0.15	Table	HP	1	240
2	1st shoulder join	0.08	0.14	OL4	OP	1	257
	T/C	0.06					
3	Neck Binding	0.20	0.30	FL2	OP	2	120
	Binding cut	0.10					
4	Binding Tuck	0.15	0.15	LS1	OP	1	240
5	2nd shoulder join	0.08	0.14	OL4	OP	1	257
	T/C	0.06					
6	Mark for label join	0.16	0.16	Table	HP	1	225
7	Label join	0.22	0.37	LS1	OP	2	97
	Care label make	0.15					
8	Neck binding Ts	0.36	0.46	FL2	OP	2	78
	T/C	0.10					
9	Arm hole binding	0.36	0.36	FL2	OP	2	100
10	Binding cut	0.15	0.15	Table	HP	1	240
11	Side tuck	0.30	0.30	LS1	OP	2	120
12	Side seam	0.38	0.38	OL4	OP	2	95
13	T/C & body fold	0.15	0.15	Table	HP	1	240
14	Arm hole top stitch	0.40	0.40	FL2	OP	2	90
15	T/C	0.20	0.20	Table	HP	1	180
16	Bottom hem	0.16	0.16	FL3	OP	1	225
17	T/C	0.13	0.13	Table	HP	1	277
			4.10			24	

LS1	5
FL2	8
FL3	1
OL4	4

Table-3.4.2: Work Diving Plan of Gabbi Tank

3.4.2 Description

Above the operation breakdown data sheet for Gabbi Tank in 48 number sewing line located of the Robintex Group, the buyer name is H&M. During doing this task we found 18 machines are required would to be complete this item. Here are the others required calculation data's given below from the data table.

Number of worker = 24

Efficiency = 60%

Working hours = 10

Total SMV = 4.10

Pcs per hour = 193 Pcs

Pcs per day = 1932 Pcs

Target Pcs/hr = 211

3.4.3 Production Target, SMV and Pitch Time Calculation

Target Calculation

Here, Total worker = 24

SMV = 4.10

Working hrs = 10

Target Efficiency = 60%

We know that,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 60\%}{4.10}$$

So, the daily Target = 2107 pcs/day

= 210 psc/hr

When Efficiency 65%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 65\%}{4.10}$$

And Target will be = 2283 psc/day

When Efficiency 70%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 70\%}{4.10}$$

And Target will be remains, Target = 2459 pcs/day

And again if efficiency 80%,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 80\%}{4.10}$$

The production target is also increased, Target = 2809 pcs/day.

From data table the balancing efficiency got only 55% so, let the efficiency 55% and the Target is decreased here,

$$\text{Target} = \frac{\text{Working Minutes} \times \text{Total Man Power} \times \text{Target Effi\%}}{\text{SMV}}$$

$$\text{Target} = \frac{(10 \times 60) \times 24 \times 55\%}{4.10}$$

And, actual production = 1932 pcs/day

= 193 pcs/hr

Efficiency wise target variation data from the above calculation

Efficiency%	Target (Pcs/Per Day)
55%	1932
60%	2107
65%	2283
70%	2459
80%	2809

SMV Calculation

SMV = Basic time + Allowance of Basic Time

Basic time = Observe time × Rating

Observe time = Total cycle time/Number of cycle time

Here, we would like to show only side seam operation SMV.

So, observed average cycle time of the side seam is 24 seconds

Now observe time = 24/60 = 0.40

Let, Rating = 80%

And, Basic Time = Observe time × Rating

= 0.40×80% = 0.32

Let allowance = 13%

SMV = Basic Time + Allowance of Basic Time

= 0.32+ 0.32×13/100

=0.361

So, side seam SMV is 0.36 and others operations are calculated same formula.

Pitch Time

Here,

Number of operation = 17

Total SMV = 4.10

So, Pitch Time = SMV/ Number of Operation

= 4.10/17

= 0.24

3.4.4 Labor Productivity and Efficiency Calculation

Efficiency Calculation

Here, Total Production = 2053

SMV = 3.80

Total Manpower =25

Working Hour = 10

We know, Efficiency

$$= \frac{\text{Total production } \times \text{SMV } \times 100}{\text{Total Manpower} \times \text{working hour} \times 60}$$

$$= \frac{1932 \times 4.10 \times 100}{24 \times 10 \times 60}$$

So, Efficiency = 55%

Line Efficiency Calculation

We know,

$$= \frac{\text{Toal Minutes Produced } \times 100}{\text{Total Minute Attended}}$$

And Total minute produced = Line output × SMV

= 1932 × 4.10

= 7921

Also known that, Total minute attended = No. of Operators × working hrs × 60

= 24×10×60

= 14400

So finally the line efficiency is,

$$= \frac{7921 \times 100}{14400}$$

And Line efficiency is 55%.

Labor Productivity

$$= \frac{\text{Total Pieces Produced}}{\text{Total Labor Input}}$$

$$= \frac{1932}{24}$$

$$= 80\, psc/day$$

Labor Efficiency

$$= \frac{\text{Produced Minutes} \times 100}{\text{Available Minutes}}$$

$$= \frac{80 \times 4.10 \times 100}{10 \times 60}$$

So, Labor Efficiency = 54.67%

3.4.5 Sewing Line Capacity Calculation

$$\text{Line Capacity} = \frac{\{(\text{No. of Machine} \times \text{working hr} \times 60) - \text{Absentism\%}\} \times \text{Line Efficiency\%}}{\text{Garment SMV}}$$

$$= \frac{\{(24 \times 10 \times 60) - 0\%\} \times 54.67\%}{4.10}$$

= 1932 pcs/day

So, the line capacity for this style of the garments is 1932 pieces per day.

CHAPTER-4: RESULT DISCUSSION AND DATA ANALYSIS

4.1 Result Discussion and Analysis of Naomi Is Top From Data-3.1.1

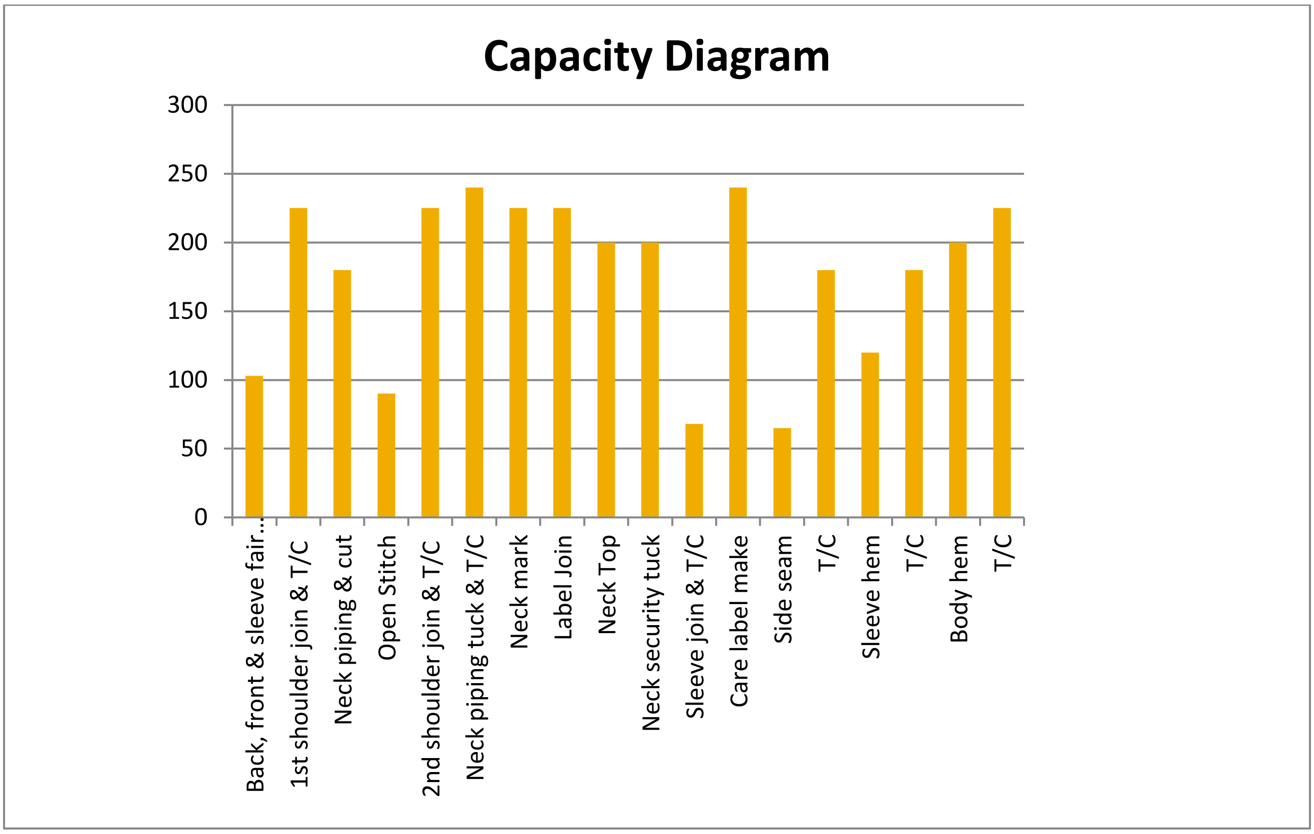


Chart-4.1.1: Analysis of Capacity Diagram of different operation from Table-3.1.1

4.1.1 Description of the Capacity Diagram Chart

Here we see that different capacities are shown in the diagram along the different operations of this Naomi Is Top style of the garment. In diagram chart each operations are shown also higher and lower production ability of care label make 240 pieces per hour and other operation side seam only 65 pieces per hourly. The capacity mainly depends on the operations SMV and efficiency.

4.1.2 Analysis of Standard Minute Value (SMV)

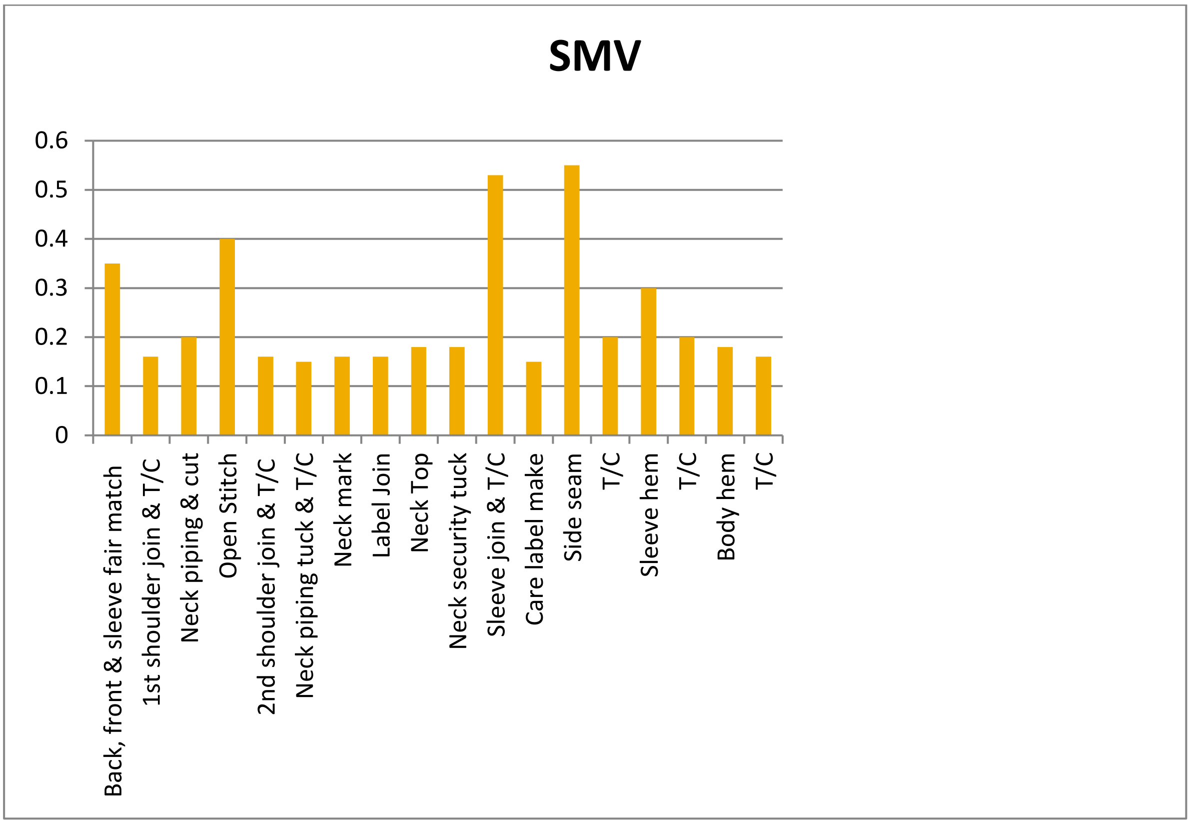


Chart-4.1.2: Analysis of SMV from different operation of Naomi Is Top Table-3.1.1

4.1.2Description

The SMV chart shown the different types of SMV values with different types of operation required to produced Naomi Is Top garment. Here in the shown values from the data-1 also present their highest and lowest values of SMV each different operation. So, here the highest SMV values is 0.55 operation of the side seam and another neck piping tuck and T/C shown lowest SMV value as 0.15. This SMV values variation directly effect on the production capacity which may increase or decrease. If total SMV value of a style of garments is less so the manufacturer get higher production, if total SMV value of a style of garment is high so the manufacturer get lower production.

4.1.3 Analysis of Efficiency Wise Production Target from Table-3.1.1

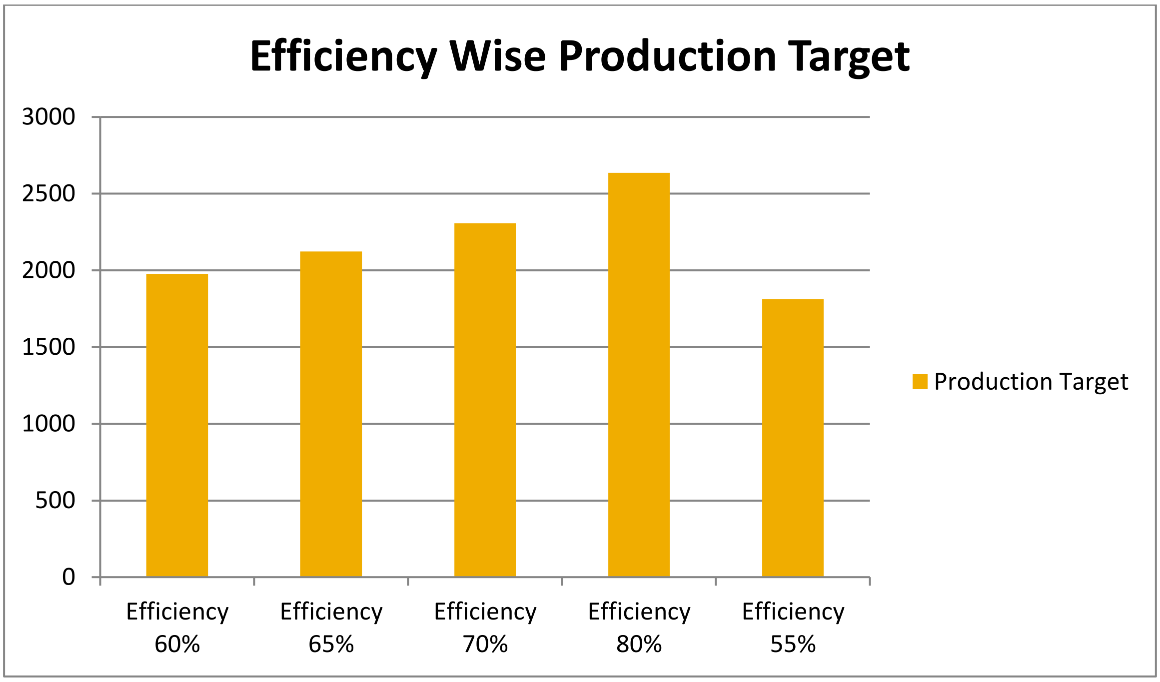


Chart-4.1.3: Efficiency Wise Target Production Analysis from Naomi Is Top Table-3.1.1

4.1.3 Description

In sewing line, the industrial engineers are given production target daily, weekly and monthly according to their capacity and efficiency wise. The target production directly depends on efficiency. If efficiency is higher, so the higher production can be possible. If efficiency is lower, the production of the sewing line is less.

Here the efficiency wise target production chart is shown the how to increase the production if had higher efficiency and also shown how to less production is appeared if the efficiency is lower. So here the chart is from the Naomi Is Top datas oriented accordingly 55%, 60%, 65%, 70% and 80% efficiency which indicates the higher and lower production target.

4.1.4 Differentiation Between Maximum and Minimum SMV from Different Operation from Data-3.1.1

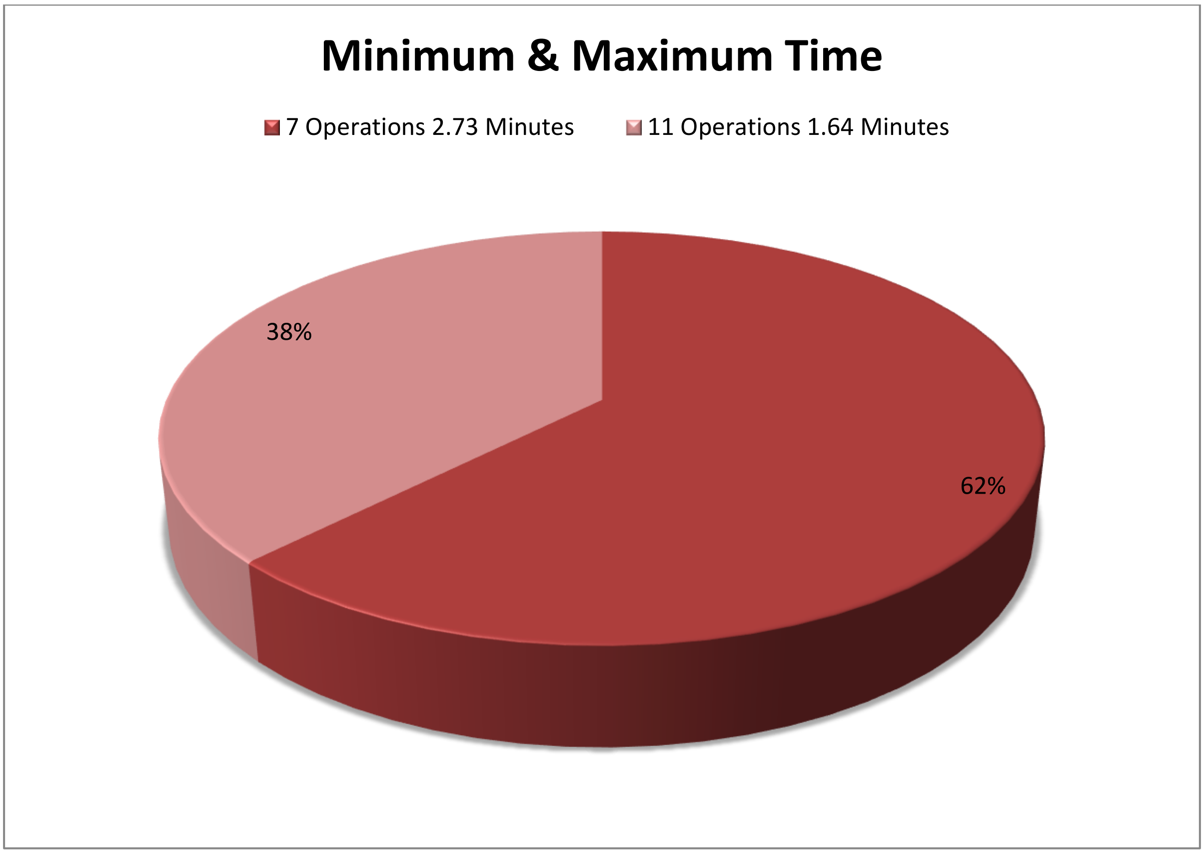


Chart-4.1.4: Differentiation between Maximum and Minimum SMV from Different Operation of Naomi Is Top Table-3.1.1

4.1.4 Description

This pie chart is obtained from the data-1 of the Naomi Is Top. Here we want to shown the time of maximum and minimum from the SMV values of the different operations appeared. So, here the style of the garment total 18th operations are to do completing and 7th operations took maximum SMV to did this job and 11th operations took minimum SMV which the total SMV is 4.37 including seven operations took 2.73 SMV and other operations took 1.64 SMV.

4.2. Analysis of Capacity Diagram Tilly Solid from Table-3.2.1

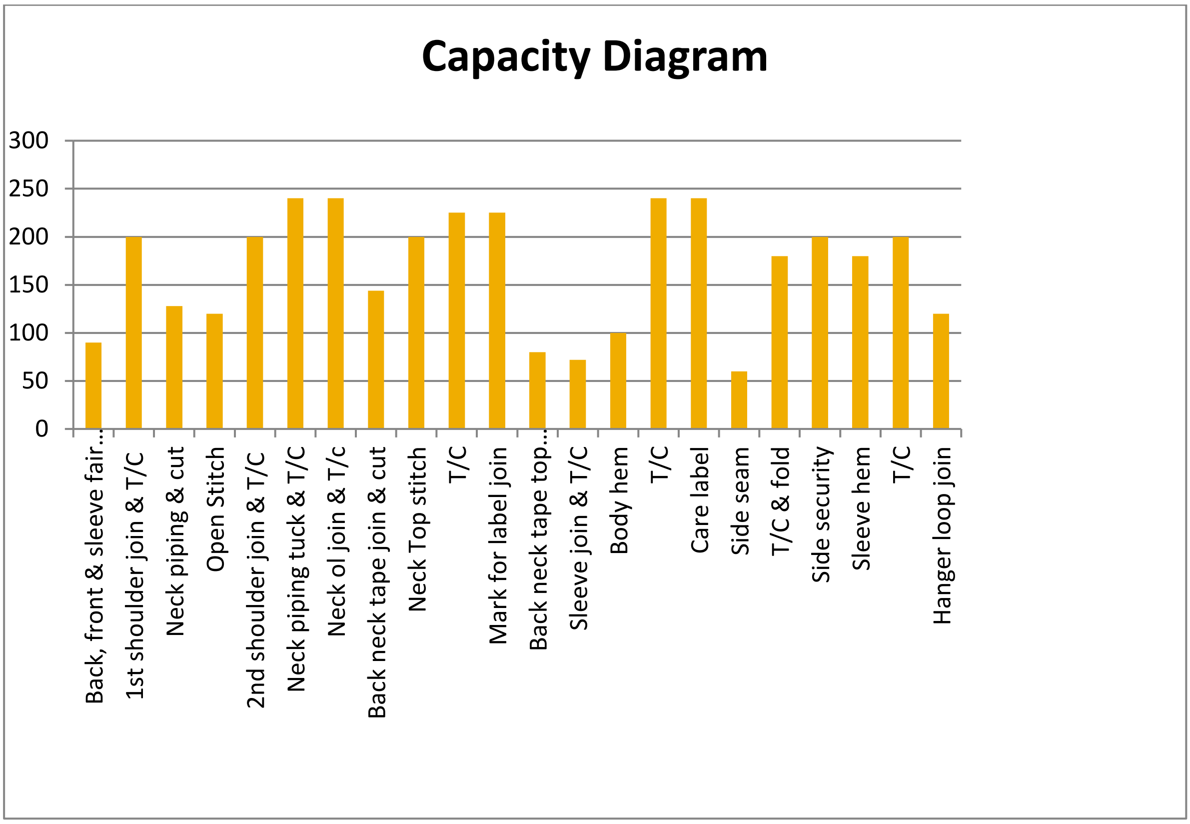


Chart-4.2.1: Analysis of Different Capacity Diagram from Tilly Solid Table-3.2.1

4.2.1 Description of the Capacity Diagram Chart

Here we see that different capacities are shown in the diagram along the different operations of this Tilly Solid style of the garment. In diagram chart each operations are shown also higher and lower production ability of neck ol join & T/C 240 pieces per hour and other operation side seam only 60 pieces per hourly. The capacity mainly depends on the operations SMV and efficiency.

4.2.2 Analysis of SMV from Different Operation of Tilly Solid Data-3.2.1

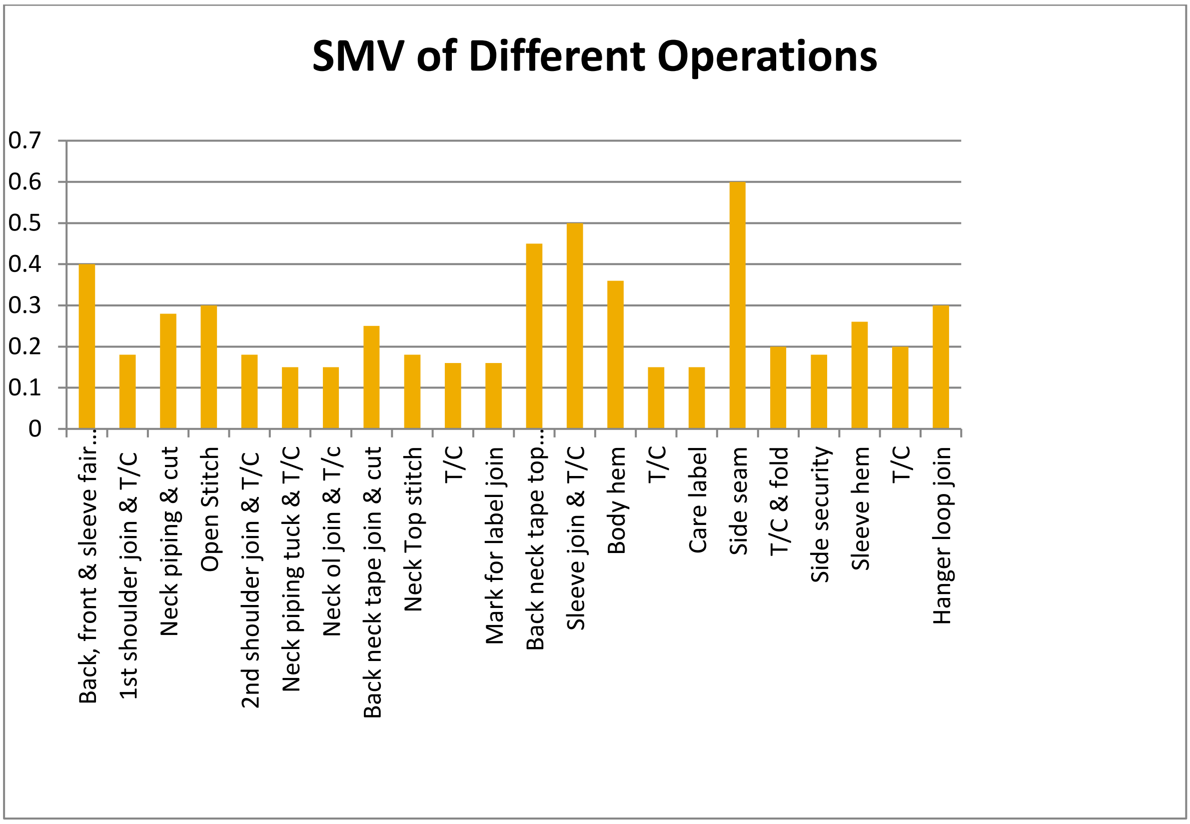


Chart-4.2.2: Analysis of SMV from Different Operation of Tilly Solid Table-3.2.1

4.2.2 Description

The SMV chart shown the different types of SMV values with different types of operation required to produced Tilly Solid garment. Here in the shown values from the data-2 also present their highest and lowest values of SMV each different operation. So, here the highest SMV value is 0.60 operation of the side seam and another care label make shown lowest SMV value as 0.15. This SMV values variation directly effect on the production capacity which may increase or decrease. If total SMV value of a style of garments is less so the manufacturer get higher production, if total SMV value of a style of garment is high so the manufacturer get lower production.

4.2.3 Analysis of Efficiency Wise Target Production Analysis from Tilly solid Data-3.2.1

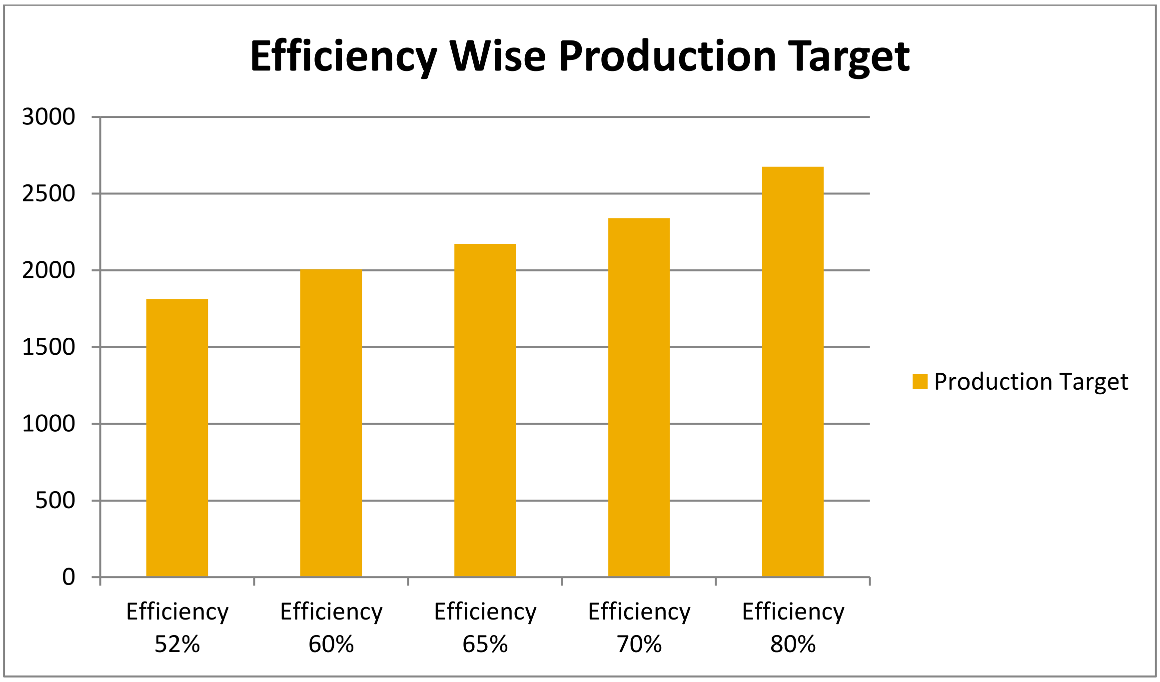


Chart-4.2.3: Efficiency Wise Target Production Analysis from Tilly solid Table-3.2.1

4.2.3 Description

In sewing line, the industrial engineers are given production target daily, weekly and monthly according to their capacity and efficiency wise. The target production directly depends on efficiency. If efficiency is higher, so the higher production can be possible. If efficiency is lower, the production of the sewing line is less.

Here the efficiency wise target production chart is shown the how to increase the production if had higher efficiency and also shown how to less production is appeared if the efficiency is lower. So here the chart is from the Tilly Solid datas oriented accordingly 52%, 60%, 65%, 70% and 80% efficiency which indicates the higher and lower production target.

4.2.4 Analysis of Maximum & Minimum SMV from Different Tilly Solid Data-3.2.1

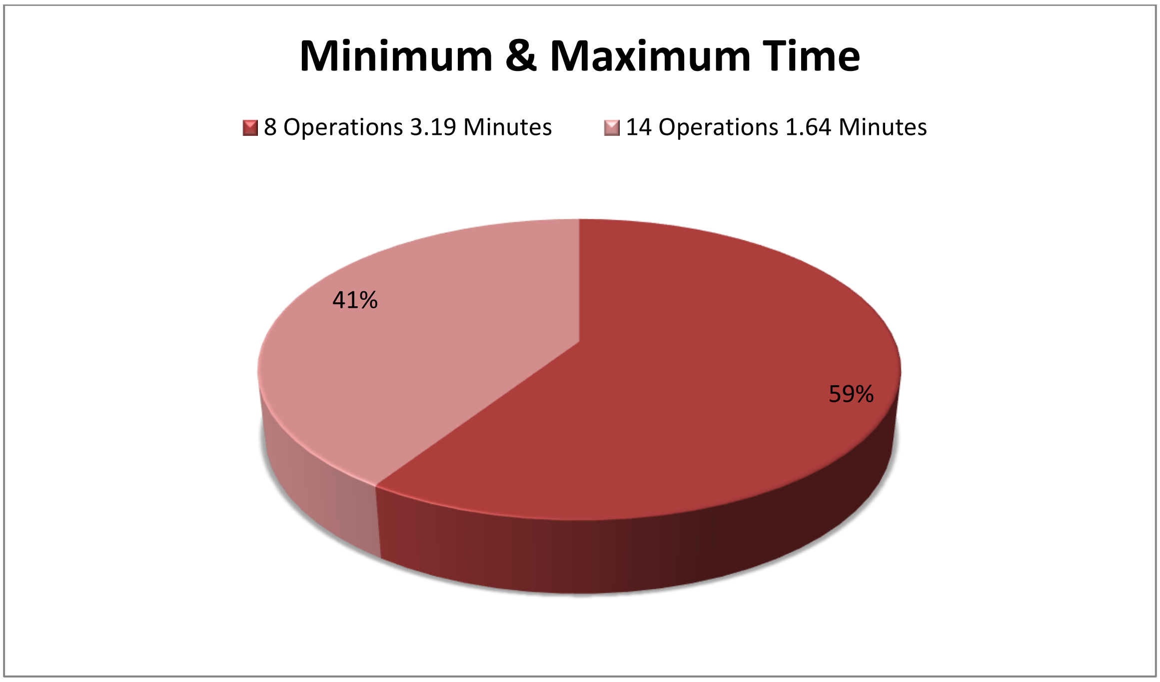


Chart-4.2.4: Differentiation between Maximum and Minimum SMV from Different Operation of Tilly Solid Table-3.2.1

4.2.4 Description

This pie chart is obtained from the data-2 of the Tilly Solid. Here we want to shown the time of maximum and minimum from the SMV values of the different operations appeared. So, here the style of the garment total 22th operations are to do completing and 8th operations took maximum SMV to did this job and 14th operations took minimum SMV which the total SMV is 5.74 including seven operations took 3.19 SMV and other operations took 1.64 SMV.

4.3 Analysis of Capacity Diagram Erik Basic Fit Tank Top from Data-3.3.1

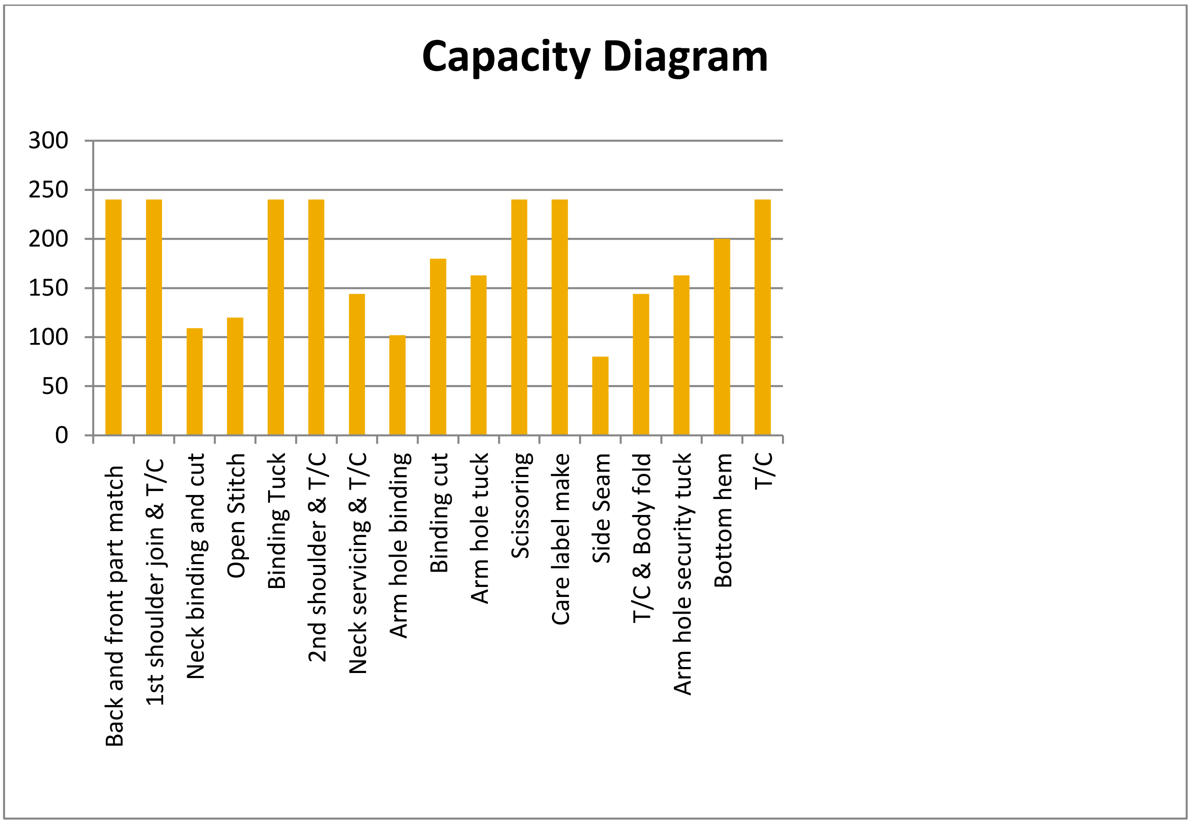


Chart-4.3.1: Analysis of Different Capacity Diagram from Erik Basic Fit Tank Top Table-3.3.1

4.3.1 Description of the Capacity Diagram Chart

Here we see that different capacities are shown in the diagram along the different operations of this Erik Basic Fit Tank Top style of the garment. In diagram chart each operations are shown also higher and lower production ability of back & front part match make 240 pieces per hour and other operation side seam only 80 pieces per hourly. The capacity mainly depends on the operations SMV and efficiency.

4.3.2 Analysis of SMV from Different Operation Erik Basic Fit Tank Top Data-3.3.1

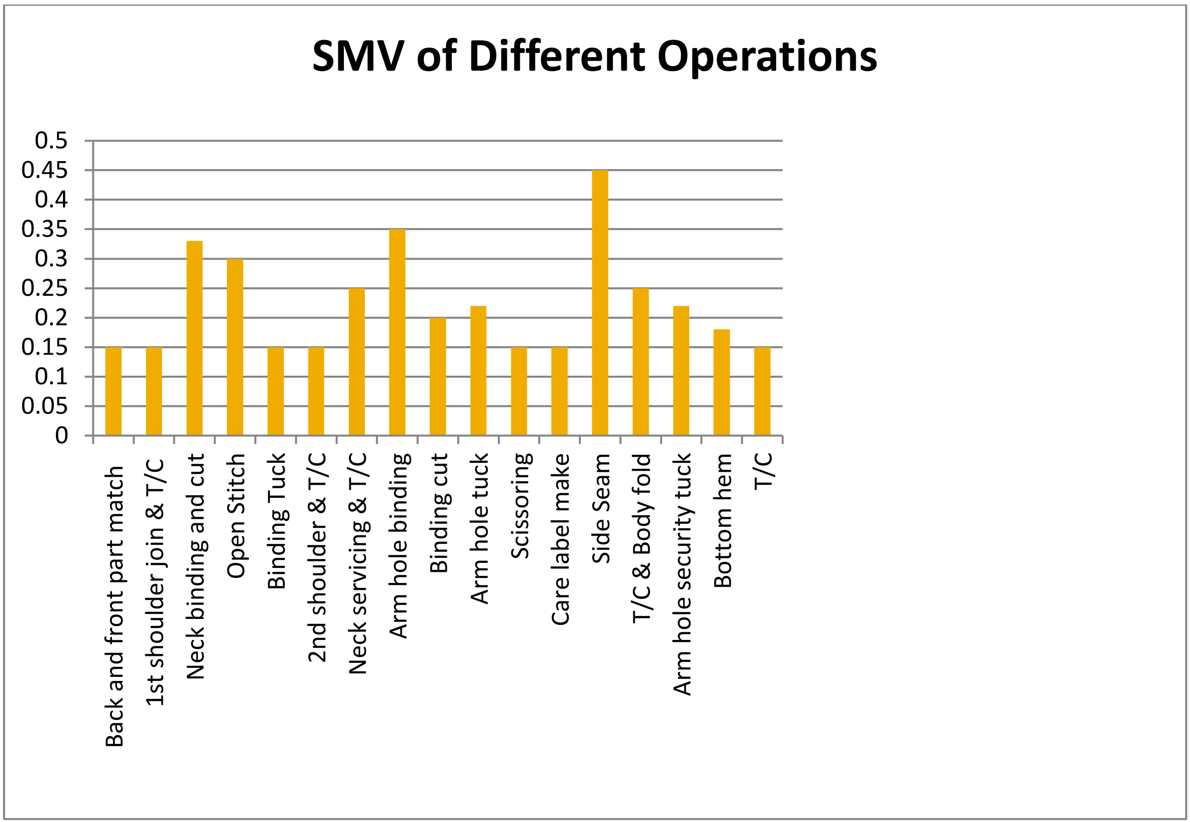


Chart-4.3.2: Analysis of SMV from Different Operation of Erik Basic Fit Tank Top Table-3.3.1

4.3.2 Description

The SMV chart shown the different types of SMV values with different types of operation required to produced Erik Basic Fit Tank Top garment. Here in the shown values from the data-3 also present their highest and lowest values of SMV each different operation. So, here the highest SMV value is 0.45 operation of the side seam and another care label make shown lowest SMV value as 0.15. This SMV values variation directly effect on the production capacity which may increase or decrease. If total SMV value of a style of garments is less so the manufacturer get higher production, if total SMV value of a style of garment is high so the manufacturer get lower production.

4.3.3: Efficiency Wise Target Production Analysis from Erik Basic Fit Tank Top Data-3.3.1

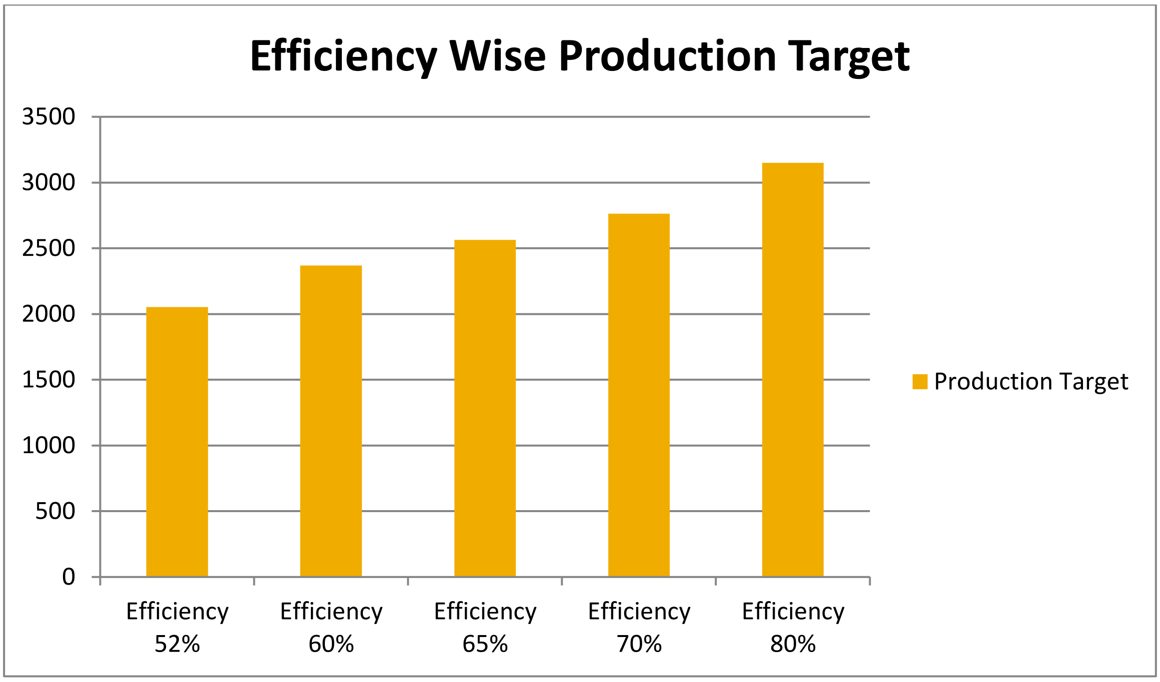


Chart-4.3.3: Efficiency Wise Target Production Analysis from Erik Basic Fit Tank Top Data-3.3.1

4.3.3 Description

In sewing line, the industrial engineers are given production target daily, weekly and monthly according to their capacity and efficiency wise. The target production directly depends on efficiency. If efficiency is higher, so the higher production can be possible. If efficiency is lower, the production of the sewing line is less.

Here the efficiency wise target production chart is shown the how to increase the production if had higher efficiency and also shown how to less production is appeared if the efficiency is lower. So here the chart is from the Erik Basic Fit Tank Top datas oriented accordingly 52%, 60%, 65%, 70% and 80% efficiency which indicates the higher and lower production target.

4.3.4 Analysis of Maximum & Minimum SMV from Different Operation Erik Basic Fit Tank Top Data-3.3.1

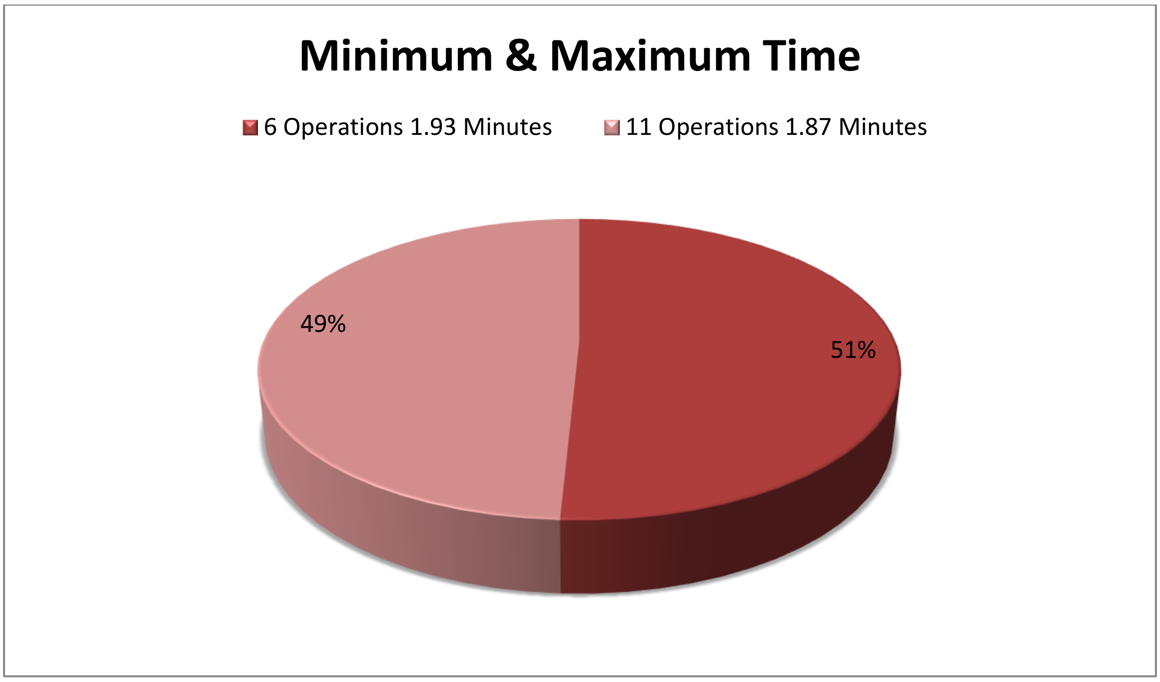


Chart-4.3.4: Differentiation between Maximum and Minimum SMV from Different Operation of Erik Basic Fit Tank Top

4.3.4 Description

This pie chart is obtained from the data-3 of the Erik Basic Fit Tank Top. Here we want to shown the time of maximum and minimum from the SMV values of the different operations appeared. So, here the style of the garment total 17^{th} operations are to do completing and 6^{th} operations took maximum SMV to did this job and 11^{th} operations took minimum SMV which the total SMV is 3.80 including six operations took 1.93 SMV and other operations took 1.87 SMV.

4.4 Analysis of Capacity Diagram Gabbi Tank from Table-3.4.1

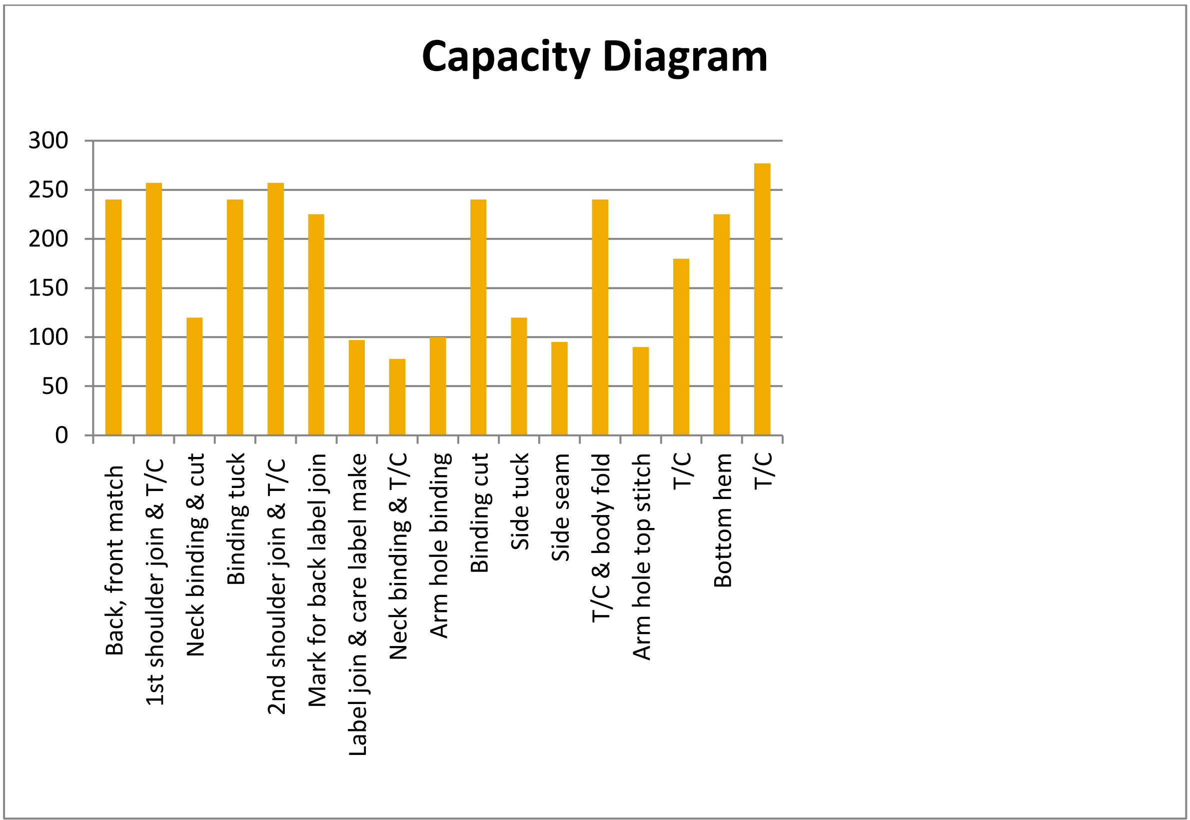


Chart-4.4.1: Analysis of Capacity Diagram from Gabbi Tank Table-3.4.1

4.4.1 Description of the Capacity Diagram Chart

Here we see that different capacities are shown in the diagram along the different operations of this Gabbi Tank style of the garment. In diagram chart each operations are shown also higher and lower production ability of T/C make 277 pieces per hour and other operation neck binding Ts only 78 pieces per hourly. The capacity mainly depends on the operations SMV and efficiency.

4.4.2 Analysis of SMV from Different Operation of Gabbi Tank Data-3.4.1

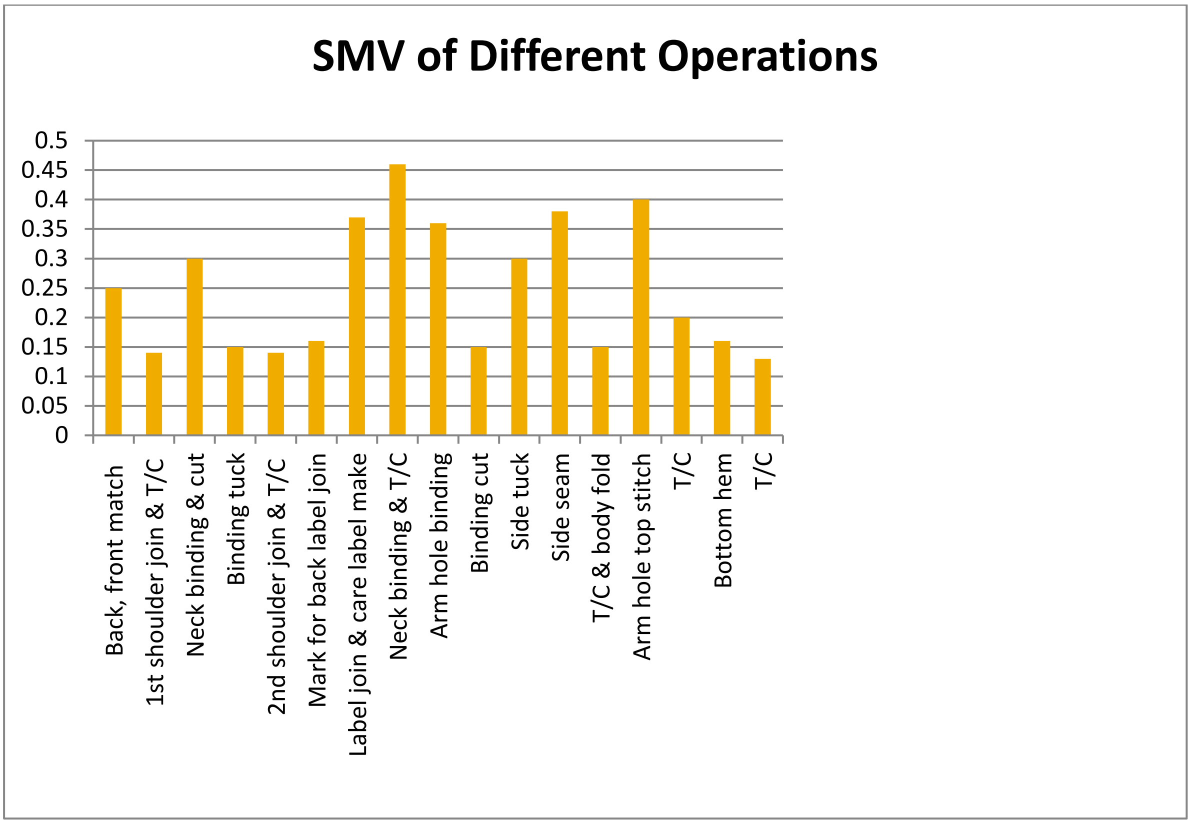


Chart-4.4.2: Analysis of SMV from Different Operation of Gabbi Tank data

4.4.2 Description

The SMV chart shown the different types of SMV values with different types of operation required to produced Gabbi Tank garment. Here in the shown values from the data-4 also present their highest and lowest values of SMV each different operation. So, here the highest SMV value is 0.46 operation of the neck binding Ts & T/C and another 1st shoulder join & T/C shown lowest SMV value as 0.14. This SMV values variation directly effect on the production capacity which may increase or decrease. If total SMV value of a style of garments is less so the manufacturer get higher production, if total SMV value of a style of garment is high so the manufacturer get lower production.

4.4.3 Analysis of Efficiency Wise Production Target Gabbi Tank Data-3.4.1

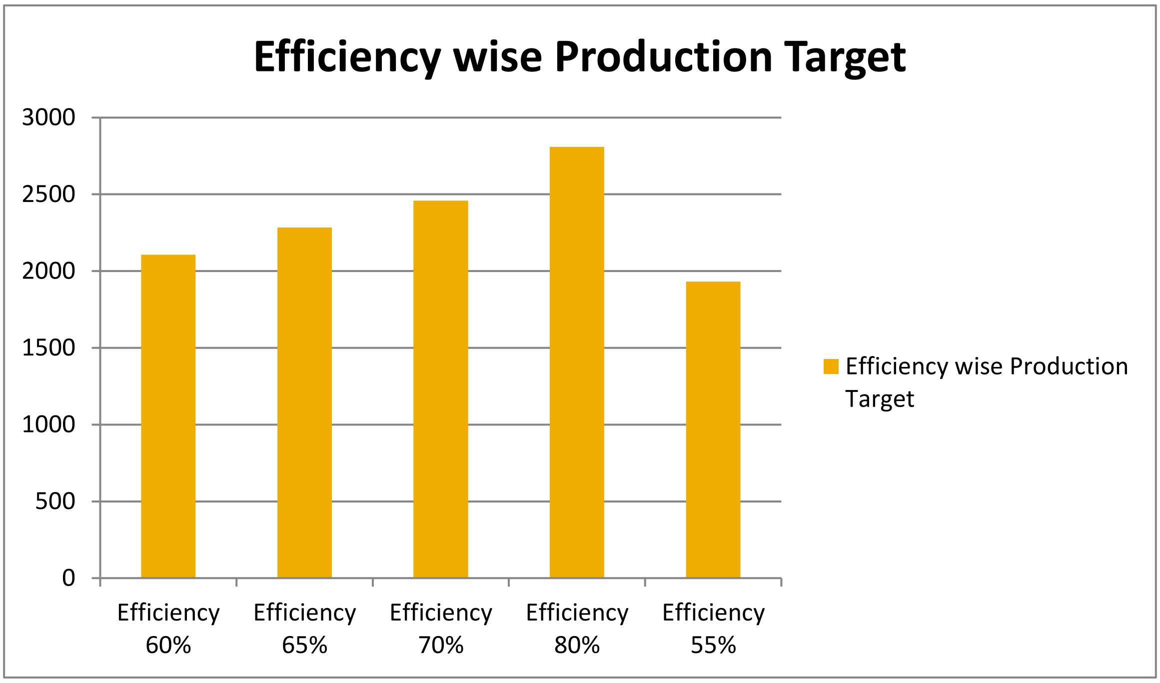


Chart-4.4.3: Efficiency Wise Target Production Analysis from Gabbi Tank.

4.4.3 Description

In sewing line, the industrial engineers are given production target daily, weekly and monthly according to their capacity and efficiency wise. The target production directly depends on efficiency. If efficiency is higher, so the higher production can be possible. If efficiency is lower, the production of the sewing line is less.

Here the efficiency wise target production chart is shown the how to increase the production if had higher efficiency and also shown how to less production is appeared if the efficiency is lower. So here the chart is from the Gabbi Tank datas oriented accordingly 55%, 60%, 65%, 70% and 80% efficiency which indicates the higher and lower production target.

4.4.4 Analysis of Maximum & Minimum SMV Different Operation from Gabbi Tank Data-3.4.1

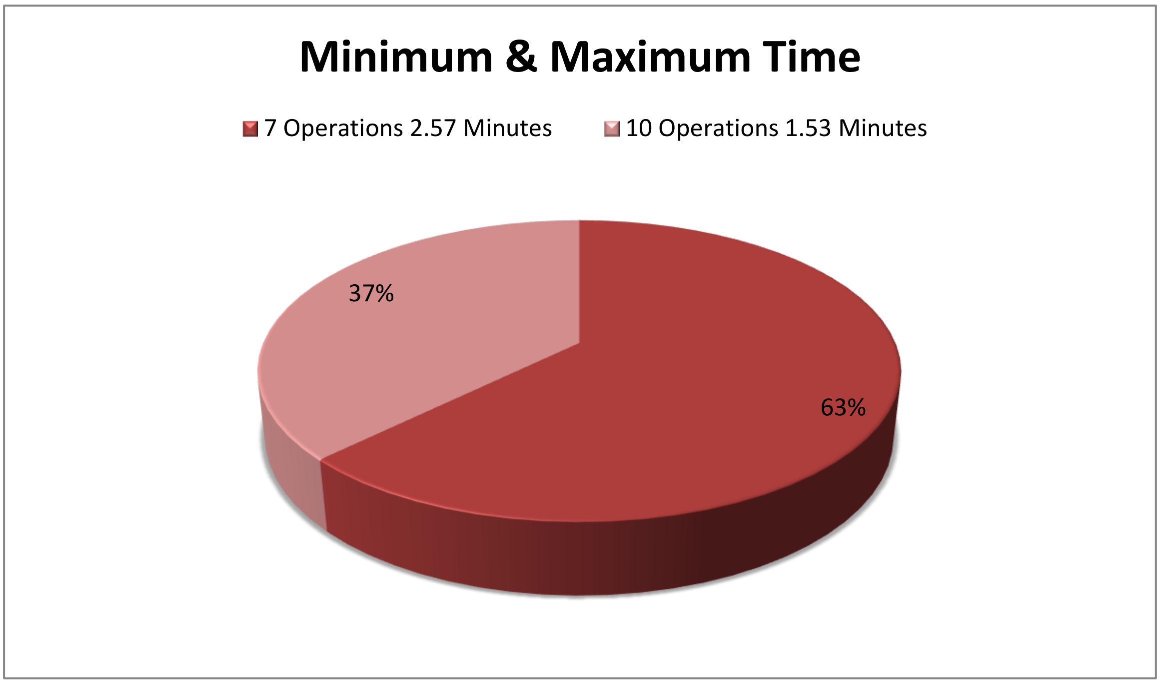


Chart-4.4.4: Differentiation between Maximum and Minimum SMV from Different Operation of Gabbi Tank.

4.4.4 Description

This pie chart is obtained from the data-4 of the Gabbi Tank. Here we want to shown the time of maximum and minimum from the SMV values of the different operations appeared. So, here the style of the garment total 17th operations are to do completing and 7th operations took maximum SMV to did this job and 10th operations took minimum SMV which the total SMV is 4.10 including seven operations took 2.57 SMV and other operations took 1.53 SMV.

4.5 Analysis of Total Production from Different Style of Garments and SMV

Style Name	Total SMV	Total Production/Day
Naomi Is Top	4.37	1812
Tilly Solid	5.74	1739
Erik Basic Fit Tank Top	3.80	2053
Gabbi Tank	4.10	1932

Table-4.5.1: SMV Wise Production of Different Style of Garments

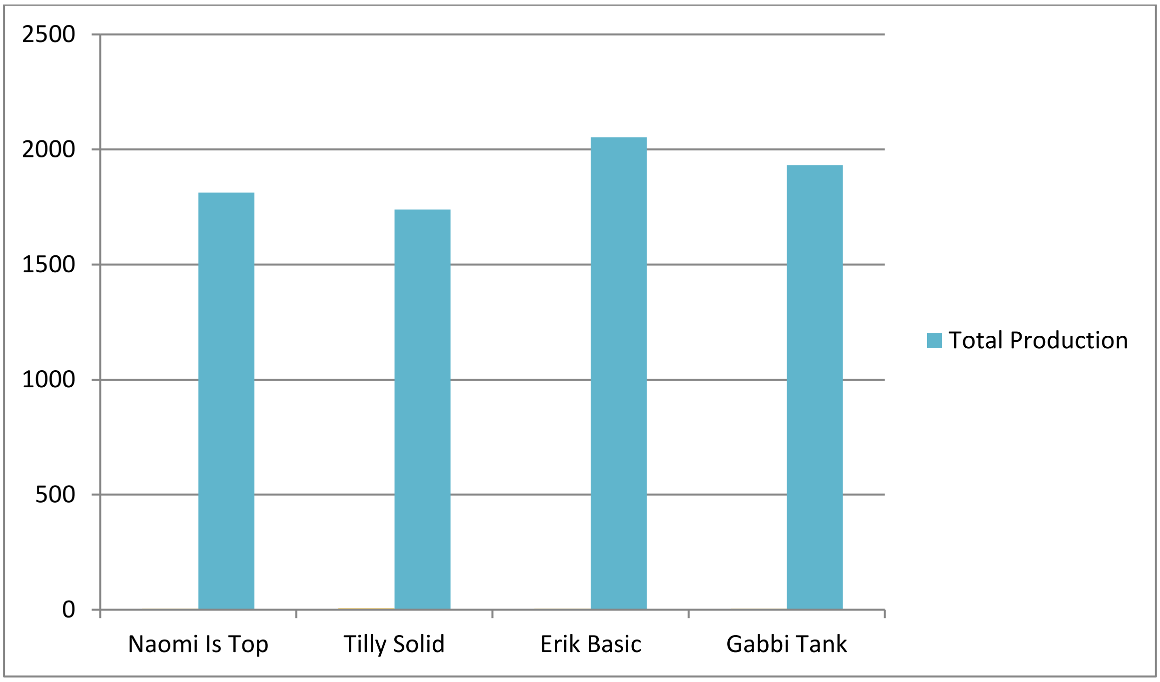


Chart-4.5.1: Different Style of Garments Production

4.5.1 Description

Here we studied about the analyzing of different style of garments production according to their total SMV. In the chart we see that Tilly Solid style of the garment is lowest production among all and SMV is 5.74 also higher. But Erik Basic Fit Tank Top is shown higher production among all and SMV is 3.80 also lower. After studied this data we got the information about if SMV is higher, the production is lower. If SMV is lower, the production is higher.

CHAPTER-5: CONCLUSION

5.1 Conclusion

We have done our academic project (thesis) by the collecting SMV, efficiency and operation breakdown its related process information from the Robintex Group. This project helps us to know about the production, SMV, efficiency, target production, method study, productivity, time study related formula and also their rectified method. We also think this report helps us to gained knowledge about industrial engineering of a garments industry. This project gives us an opportunity to enlarge our knowledge of textile administration, production, planning, procurement system, production process and machineries and teach us to adjust with the industry life. We also able to know the working procedures of this IE department as the sewing floor of the Just in Time (JIT line). In future hope it will helps us to build our professional career in the textile and garments industry.

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