Faculty of Engineering

Department of Textile Engineering

REPORT ON

Application of Line Balancing and Time Study to Minimize the Idle Time in Production Line.

Course Title: Project Thesis

Course Code: TE- 4214

Submitted By

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A Thesis Submitted in Partial Fulfillment of The Requirements For The Degree of Bachelor of Science in Textile Engineering.

Advance in Apparel Manufacturing Technology.

Fall 2022

LETTER OF APPROVAL

March 4, 2023

To

The Head

Daffodil International University

Daffodil Smart City, Birulia, Savar, Dhaka-1216

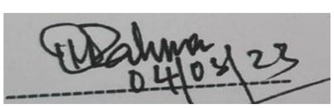
Subject: Approval of Project Report of B.Sc in TE Program.

Dear Sir,

I am just writing to let you know that this Research in "**Application Of Line Balancing And Time Study To Minimize The Idle Time In Production Line**" has been prepared by the student bearing ID 191-23-5600 , 191-23-5620 and 191-23-5551 is completed for final evaluation. The whole report is prepared based on the factory data with required belongings. The students were directly involved in their industrial attachment activities and the report become vital to spark of many valuable information for the readers.

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

Yours Sincerely



Supervisor
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DECLARATION

We hereby declare that the work which is being presented in this research entitled, "**Application Of Line Balancing And Time Study To Minimize The Idle Time In Production Line**" is original work of our own, has not been presented for a degree of any other university and all the resources of collected information for this report have been duly acknowledged. We further certify that this report and its components have not been submitted anywhere for the award of any courses.

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ACKNOWLEDGEMENT

Above all, we praise the almighty Allah who gave me his enabling grace to successfully complete this research work.

With sincerity, we extend my warm and deep appreciation and gratitude to our supervisor **Md. Mominur Rahman**, Assistant Professor and Head In-Charge, Department of Textile Engineering for his guidance and support to come up with this research work. Being working with him, I have not only earned valuable knowledge but was also inspired by his innovativeness which helped to enrich my experience to a greater extent. His ideas and way of working was truly remarkable. We believe that this research could not be finished if he did not help us continuously.

We also take the opportunity to express our sincerest gratitude and cordial thanks goes to **Engr. Akib Javed**, IE Manager & **Akteruzzaman Raju**, Senior Officer of IE. We would also like to thank all who responded to our questionnaires and interviews, which helped us in coming up with this research.

Finally, We express our sincere gratitude to our father, mother, brother and sister for their continuous support, ideas and love during our studies.

ABSTRACT

This research describes line balancing systems and how to reduce idle time by proper line balancing and time analysis. This article provided a brief description of the knit garment industry's line balancing technique. The objectives of this report is about the implementation of line balancing technique to minimize the idle time. This project explains how line balance may actually accelerate the manufacturing process. Firstly it has been observed that the total no of manpower which has been needed to complete the every operation of a garments before and after the line balancing. Here, the formula was used to calculate the cycle time. Then it has been observed the efficiency of that line. The times were recorded and improved by minimizing downtime and wastes. Because of the time saved, there will be more time available increasing the production. The various line balancing parameters were implemented in this work, and the outcomes were discussed. Process planning, production, and manufacturing in an industry will benefit from the line balancing method.

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List of Abbreviation

BPT= Basic Pitch Time.

SMV= Standard Minute Value.

SAM= Standard Allowed Minute.

CHAPTER 1:INTRODUCTION

1.1 Background of The Study

In order to eliminate bottlenecks and excess capacity, line balancing helps to balance the workload across all processes in a line stream. Production lines can be made more flexible to handle both internal and external imperfections by using line balancing. Balancing in the context of a textile line refers to the placement of a sewing machine in conformance with the style and design of a particular product. It is carried out to improve productivity.

Garments are produced in lines or by a large amount of machines instead of a single machine when bulk production is taken into consideration. A line could be an assembly line, a modular line or section, or one with both online and offline packaging and finishing capabilities. A line consists of numerous workstations with different work tasks. The amount of output produced per hour varies depending on the work content (average minutes per operation), the allocation of entire workforce to an operation, the operator's skill level and the machine's capacity. The bottleneck operation for that line is the one with the lowest production per hour.

For example, in a line of 50 machines, 15 workers are not operating without an extra bundle, yet the bundle is functioning as required. Assume that they all wait for the following bundle for 40 seconds. If they produced 500 pieces per day, a single operator will be idle for a total of 2000 seconds.

1.2 Objectives of The Study

a) To minimize the number of machine and manpower.
b) To minimize the cycle time and improve productivity.
c) To remove bottlenecks and idle time.
d) To maximize the workload smoothness.

1.3 Significance of The Study

a) Line balancing ensures in determining the new machine and total number of machine needed for the new style of every student.
b) It becomes faster to provide a specific work to each operator.
c) It also helps to learn about machine layout with actual production of an expert.
d) It also helps to reduce production time and increase productivity in any industry.

1.4 Limitations

a) Application of a data collection strategy.
b) Exclusion of relevant study in the field.
c) Face difficulties to get accurate data as per company policy.

CHAPTER 2: LITERATURE REVIEW

2.1 Line Balancing

In order to match the production rate to the takt time, line balancing involves balancing human and machine time. Takt time is the time at which components or goods must be produced to keep up with demand from customers.

Production time must match takt time perfectly for a given production line to be properly balanced. If not, resources should be redistributed or reconfigured in order to eliminate bottlenecks or excess capacity. To achieve the best production rate, the numbers of people and machines allocated to each activity in the line should be rebalanced.

On that line, the operation with the lowest production per hour is referred to as the bottleneck operation. The output of a line is controlled by its bottleneck operation. The production of bottleneck processes or operations must thus be increased for this reason.

2.1.1 Benefits of Line Balancing

a) Minimize inventory waste.
b) Minimize waiting time waste.
c) Maximum human and machine inputs.
d) Adapt to both internal and external disruptions.
e) Enhance profitability and cut production expenses.
f) Minimal processing period.
g) Reducing down time.
h) Highest productivity.

2.1.2 Line Balancing Steps

In any case, line balancing is concerned with two unique applications: "Opening the line" and "Operating the line." The method of line balancing might vary from factory to factory and depends on the garments developed.

a) Opening the line.
    - Calculation of labor requirements.
    - Operation breakdown.
    - Theoretical operation balance.
    - Initial balance.

b) Operating the line.
    - Balance control.

2.2 Idle Time

Operators must frequently wait for work between bundles in garment factories that use the line manufacturing system. We refer to this waiting period as idle time. This downtime is a period of little or no work between two bundles of work. The productivity and labor efficiency are both decreased by idle time.

2.2.1 What caused the idle time

a) Establishing a line.
b) Asymmetric cutting bundle.
c) Poor sewing quality.
d) Issue with cutting quality.
e) Load shedding.
f) Planning issue Extra time for material handling.

2.2.2 The necessity of keeping records of idle time

Although factories' best efforts, they occasionally fail to find a solution for efficiency improvement. For them, focusing on lowering idle time is a chance to boost manufacturing productivity. The majority of clothing manufacturing fail to track idle time. They simply let it pass. One explanation could be that management is trying to cover up their inefficiency by not maintaining a balanced line with adequate WIP at each workstation.

2.3 SMV/SAM

SMV for standard minute value, refers to the amount of time typically needed to complete a task using the most effective way.

2.3.1 Calculation of SAM through Time Study

Step 1: Choose one procedure for which you wish to perform SAM calculations.

Step 2: Take One stopwatch. Position yourself close to the operator. cycle time for the operation's capture. Cycle time is the overall amount of time required to accomplish all tasks for one operation. That refers to the interval between picking up the first piece's final portion and the subsequent piece. Perform time studies for five cycles in a row. If any cycle contains an irregular time, discard it. Compute the 5 cycles' average. Cycle time is the time you obtained from your time study. You must multiply cycle time by operator performance rating in order to convert this cycle time to basic time. Here, Basic Time = Cycle Time X performance Rating.

Step 3: Score for performance. When you see the operator's movement and work speed, you must now assign him a performance rating based on how well he completed the task. Consider an 80% operator performance rating. For example, 0.50 minute cycle time. Basic time = (0.50 X 80%) = 0.4 minutes.

Step 4: 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. Now you got Standard Minute value (SMV) or SAM. SAM= (0.4+0.04+0.08) = 0.52 minutes.

2.4 Time study

A qualified worker analyzes a certain task to determine the most efficient way to complete it in terms of time and effort. This process is known as time study. The study uses the best approach available to calculate the amount of time required for the work or job at hand.

2.5 Work study

Work study is the analysis of an activity-conducting strategy. It gauges the available resources, the performance of a given task, and its usual setup. Productivity is increased by work study.

2.6 Bottleneck

When input enters a process more quickly than the subsequent phase can use it to produce output, the process becomes bottlenecked. In Annexure 3, which is highlighted in light brown, we have identified the bottleneck operations that are marked as make and join care label, back neck elastic tape joint, match sleeve pair and sleeve and body, sleeve hem, hem raw edge cut, security tack and thread cut body turn. These seven workstations have slowed down production, and the bottleneck processes are still holding a lot of unfinished work.

2.6.1 Bottleneck occurs before input in line

a) If cutting material supplies from other sections and sub stores are not delivered in a timely manner.
b) If the material is delayed.
c) Serial number issue in the bundle.
d) Bundling fault.

2.6.2 Bottleneck occurs in line

a) Incorrect worker selection.
b) Incorrect order of the pieces.
c) Unbalanced elemental distribution.
d) Employee negligence at work.
e) Employee absence.
f) Machine stutters.
g) Absence of supply.

2.6.3 Method for minimizing the bottleneck

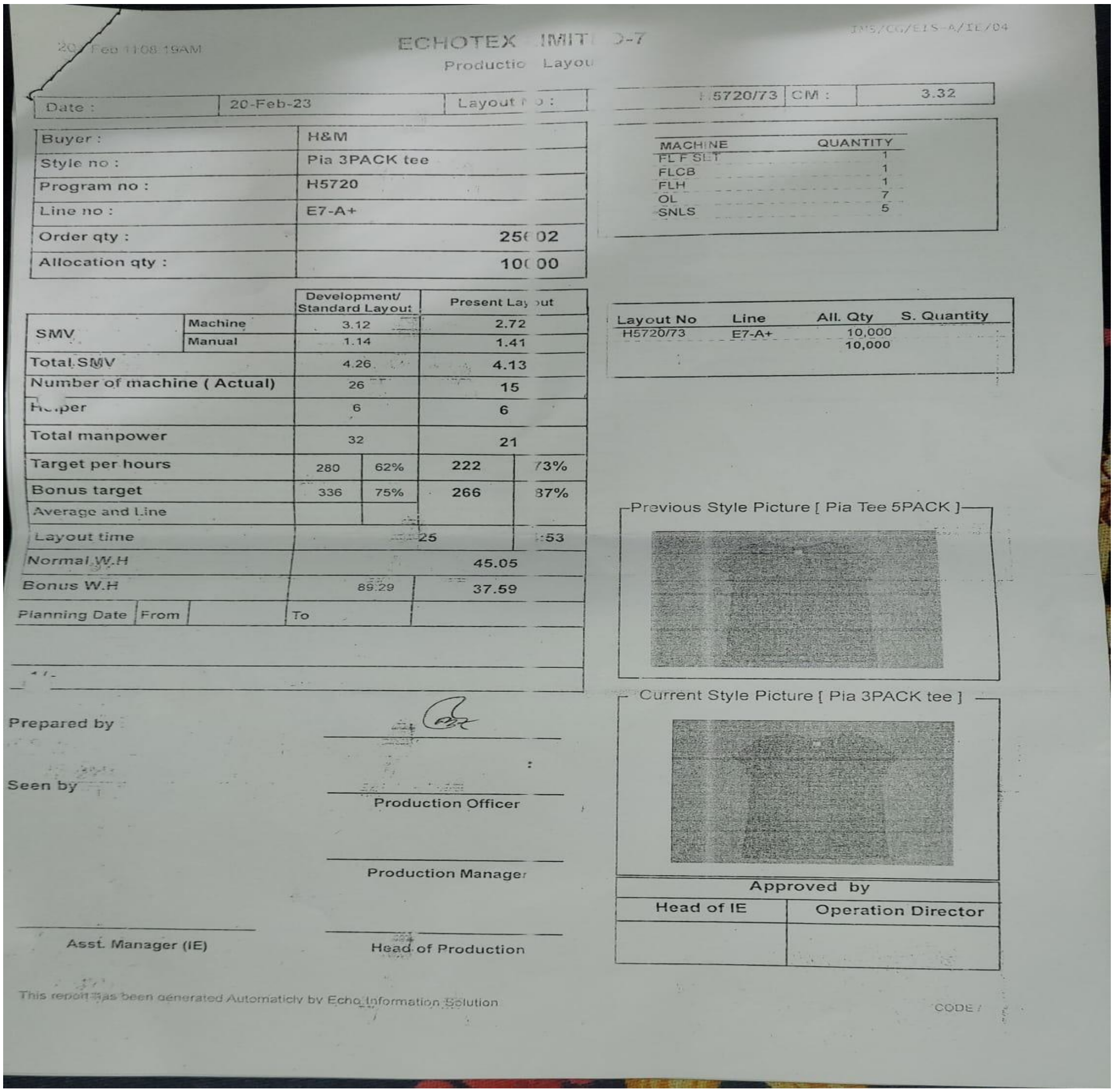
a) To schedule a meeting before production.
b) Before entry into the line, prepare the layout sheet.
c) Before releasing items into the line, to inspect textiles and accessories.
d) To better prepare, the layout sheet should be submitted to the maintenance section at least 2-3 days in advance.
e) Before supplying the line, to inspect the pattern.
f) To choose the best employees for the job.
g) To maintain supply timely attainable.
h) To preserve the serial number. Rejected clothing shouldn't be distributed.
i) After verifying, the supply should be forwarded.
j) Warning when bundling (maintain serial number).
k) By enhancing the representation of employees.

CHAPTER 3: EXPERIMENTAL DETAILS

3.1 Experiment: 01

Item: Basic T-Shirt

Buyer: H&M



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ECHOTEX IMIT D-7

Productio Layou

IMS/CG/EIS-A/IE/04

Date :	20-Feb-23	Layout No :	5720/73	CM :	3.32

Buyer :	H&M
Style no :	Pia 3PACK tee
Program no :	H5720
Line no :	E7-A+
Order qty :	25(02
Allocation qty :	10(00

MACHINE	QUANTITY
FL F SET	1
FLCB	1
FLH	1
OL	7
SNLS	5

		Development/ Standard Layout		Present Layout	
SMV	Machine	3.12		2.72	
	Manual	1.14		1.41	
Total SMV		4.26		4.13	
Number of machine (Actual)		26		15	
Helper		6		6	
Total manpower		32		21	
Target per hours		280	62%	222	73%
Bonus target		336	75%	266	87%
Average and Line					
Layout time		25			:53
Normal W.H				45.05	
Bonus W.H		89.29		37.59	
Planning Date	From	To			

Layout No	Line	All. Qty	S. Quantity
H5720/73	E7-A+	10,000	
		10,000	

Previous Style Picture [Pia Tee 5PACK]

Current Style Picture [Pia 3PACK tee]

Prepared by

Seen by

Production Officer

Production Manager

Asst. Manager (IE)

Head of Production

Approved by	
Head of IE	Operation Director

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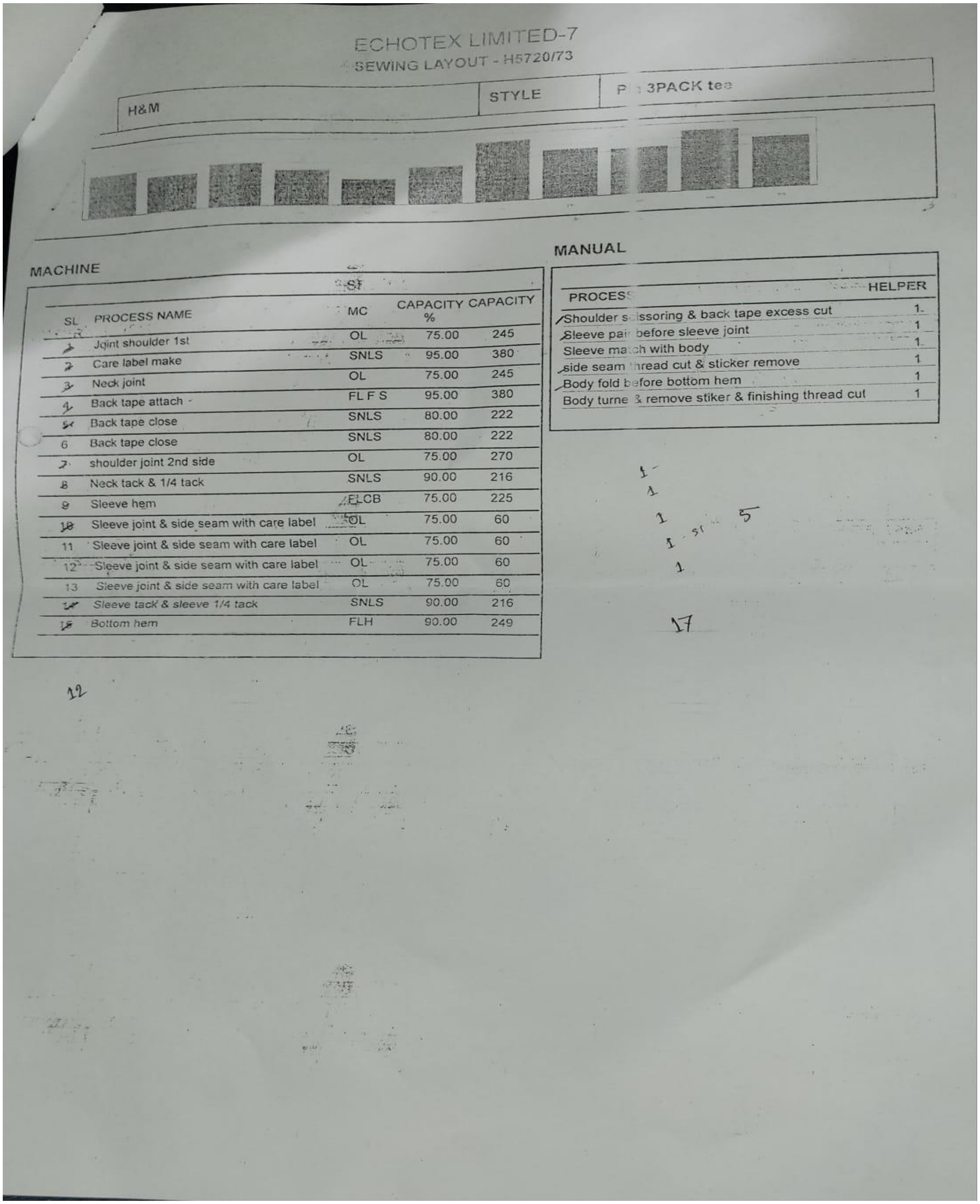
Figure 3.1 Experiment: 01



ECHOTEX LIMITED-7

SEWING LAYOUT - H5720/73

H&M	STYLE	P[illegible] 3PACK tee

MACHINE

SL	PROCESS NAME	MC	CAPACITY %	CAPACITY
1	Joint shoulder 1st	OL	75.00	245
2	Care label make	SNLS	95.00	380
3	Neck joint	OL	75.00	245
4	Back tape attach	FL F S	95.00	380
5	Back tape close	SNLS	80.00	222
6	Back tape close	SNLS	80.00	222
7	shoulder joint 2nd side	OL	75.00	270
8	Neck tack & 1/4 tack	SNLS	90.00	216
9	Sleeve hem	ELCB	75.00	225
10	Sleeve joint & side seam with care label	OL	75.00	60
11	Sleeve joint & side seam with care label	OL	75.00	60
12	Sleeve joint & side seam with care label	OL	75.00	60
13	Sleeve joint & side seam with care label	OL	75.00	60
14	Sleeve tack & sleeve 1/4 tack	SNLS	90.00	216
15	Bottom hem	FLH	90.00	249

MANUAL

PROCESS	HELPER
Shoulder scissoring & back tape excess cut	1
Sleeve pair before sleeve joint	1
Sleeve match with body	1
side seam thread cut & sticker remove	1
Body fold before bottom hem	1
Body turne & remove stiker & finishing thread cut	1

Figure 3.2 Experiment: 01

According to the factory data, It has been observed that

The Standard SMV Of The Basic T-SHIRT = 4.13

Here,

BPT = SMV/ Total No. Of Process

= 4.13/17

= 0.24 Min.

So, Line Production Target = 60/ BPT

= 60/ 0.24

= 250

Before Balancing:

Table 3.1 Before Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	1st shoulder join	OL	1	10.2	300	250	50	510
2	**Shoulder thread cut**	**Helper**	**1**	**5.25**	**582**	**250**	**332**	**1743**
3	Neck joint	OL	1	11.9	257	250	7	83.3
4	Back tape attach	FLFS	1	11.8	259	250	9	106.2
5	**Back tape excess cut**	**Helper**	**1**	**5.5**	**556**	**250**	**306**	**1683**
6	Back tape close with label	SNLS	1	12.05	253	250	3	36.15
7	2nd side shoulder joint	OL	1	11.75	260	250	10	117.5
8	Neck tack & ¼ tack	SNLS	1	11.9	257	250	7	83.3
9	Sleeve hem	FLCB	1	12.1	252	250	2	24.2
10	**Sleeve hem thread cut**	**Helper**	**1**	**5.3**	**577**	**250**	**327**	**1733.1**
11	Care label make	SNLS	1	12	255	250	5	60
12	**Sleeve joint**	**OL**	**1**	**34.57**	**88**	**250**	**-162**	**-5600**

13	**Side seam with care label**	**OL**	**1**	**24.2**	**126**	**250**	**-124**	**-3000**
14	**Side seam thread cut**	**Helper**	**1**	**5.45**	**561**	**250**	**311**	**1695**
15	Sleeve tack & ¼ tack	SNLS	1	12.07	253	250	3	36.21
16	Body fold before bottom hem	Helper	1	11.37	269	250	19	216.03
17	Bottom hem	FLH	1	12.11	252	250	2	24.22
	Total		17	209.52				8151.41

Before balancing, It has been observed that different process have different capacity in production line. It has been also found that the bottleneck points in identified operation. For that It has been observed more idle time produced. Generally It decreased the production and line efficiency.

Here,

Sum Of Total Idle Time = 8151.41 Sec

= 2.3 Hour

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 209.52 / 17 * 34.57

= 35.7 %

Balancing Rate = (Minimum Output / Target Output)* 100%

= 88 / 250 * 100%

= 35 %

After Balancing:

Table 3.2 After Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	1st shoulder join	OL	1	10.2	300	250	50	510
2	Neck joint	OL	1	11.9	257	250	7	83.3
3	Back tape attach	FLFS	1	11.8	259	250	9	106.2
4	**Back tape excess cut & Shoulder thread cut**	**Helper**	**1**	**10.75**	**334**	**250**	**84**	**903**
5	Back tape close with label	SNLS	1	12.05	253	250	3	36.15
6	2nd side shoulder joint	OL	1	11.75	260	250	10	117.5
7	Neck tack & ¼ tack	SNLS	1	11.9	257	250	7	83.3
8	Sleeve hem	FLCB	1	12.1	252	250	2	24.2
9	Care label make	SNLS	1	12	255	250	5	60
10	Sleeve joint	OL	3	34.57	264	250	14	484

11	Side seam with care label	OL	2	24.2	252	250	2	48.4
12	**Sleeve hem thread cut & Side seam thread cut**	**Helper**	**1**	**10.8**	**333**	**250**	**82**	**855**
13	Sleeve tack & ¼ tack	SNLS	1	12.07	253	250	3	36.21
14	Body fold before bottom hem	Helper	1	11.37	269	250	19	216.03
15	Bottom hem	FLH	1	12.11	252	250	2	24.22
	Total		18	302.91				3617.51

After balancing, It has been observed that In production line, every process have the capacity were nearly closed. Here It has been found that the idle time and bottleneck points were reduced by the increasing number of machine, manpower and sharing the process among the same machine.

Reduce Helper:

Table 3.3 Reduce Helper

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	Shoulder thread cut & Back tape excess cut	Helper	1	10.75	334	250	84	903

2	Sleeve hem thread cut & Side seam thread cut	Helper	1	10.8	333	250	82	885

Before balancing, It has been observed that the identifying four helpers were more idle in production line. For that there were two helpers reduced to achieve the line target. For that there were minimized idle time and increased line efficiency.

Here,

Sum of total idle time = 3617.51 Sec

= 1 Hour

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 302.91 / 18 * 34.57

= 49 %

Balancing Rate = (Minimum Output / Target Output)* 100%

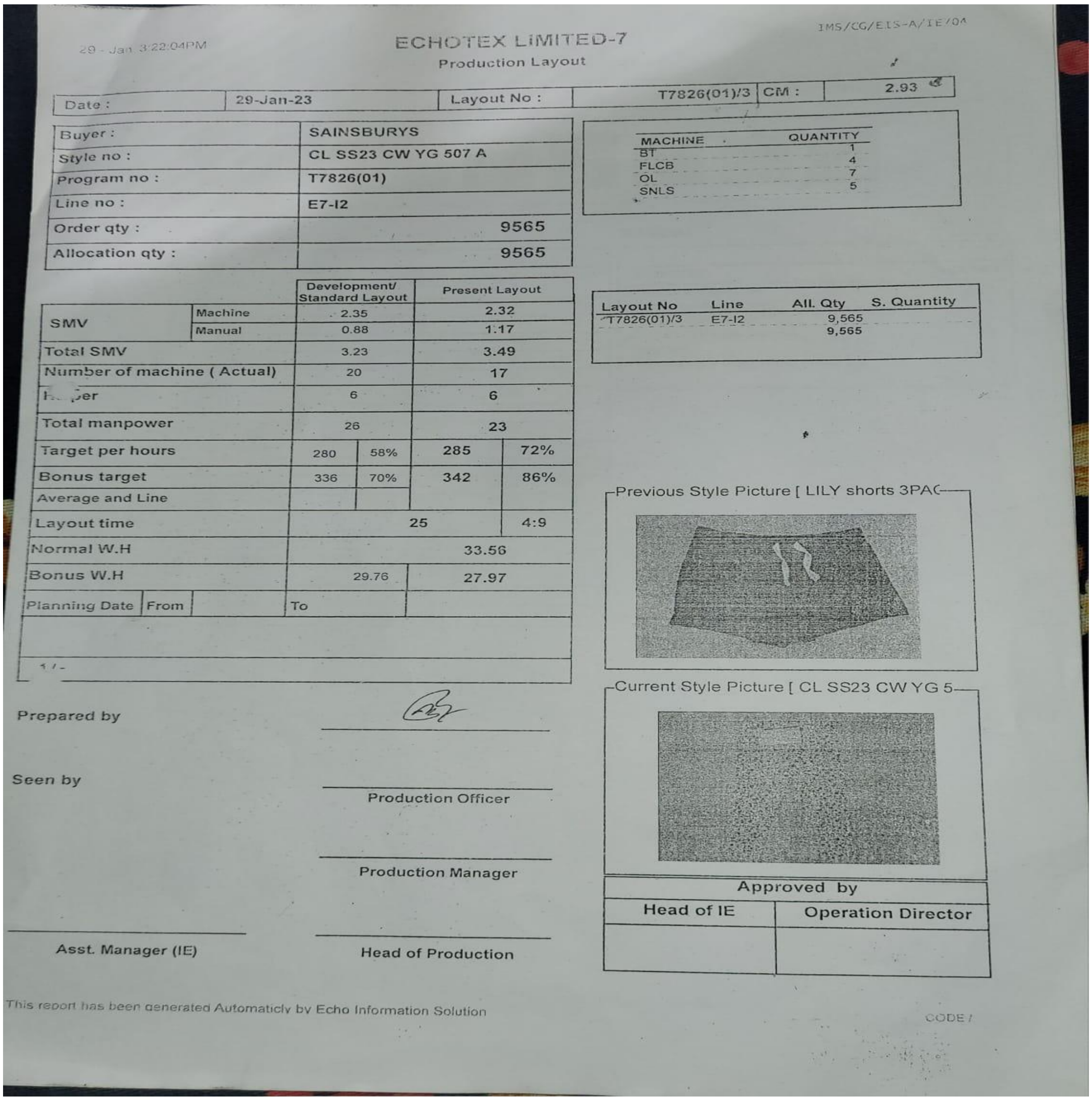
= 252 / 250 * 100%

= 100 %

3.2 Experiment: 02

Item: LEGGINGS

Buyer: SAINSBURYS



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ECHOTEX LIMITED-7

Production Layout

Date :	29-Jan-23	Layout No :	T7826(01)/3	CM :	2.93

Buyer :	SAINSBURYS
Style no :	CL SS23 CW YG 507 A
Program no :	T7826(01)
Line no :	E7-I2
Order qty :	9565
Allocation qty :	9565

MACHINE	QUANTITY
BT	1
FLCB	4
OL	7
SNLS	5

		Development/ Standard Layout		Present Layout	
SMV	Machine	2.35		2.32	
	Manual	0.88		1.17	
Total SMV		3.23		3.49	
Number of machine (Actual)		20		17	
H[illegible]per		6		6	
Total manpower		26		23	
Target per hours		280	58%	285	72%
Bonus target		336	70%	342	86%
Average and Line					
Layout time		25			4:9
Normal W.H		33.56			
Bonus W.H		29.76		27.97	
Planning Date	From		To		

Layout No	Line	All. Qty	S. Quantity
T7826(01)/3	E7-I2	9,565	
		9,565	

Previous Style Picture [LILY shorts 3PAC

Current Style Picture [CL SS23 CW YG 5

Prepared by

Seen by

Production Officer

Production Manager

Asst. Manager (IE)

Head of Production

Approved by	
Head of IE	Operation Director

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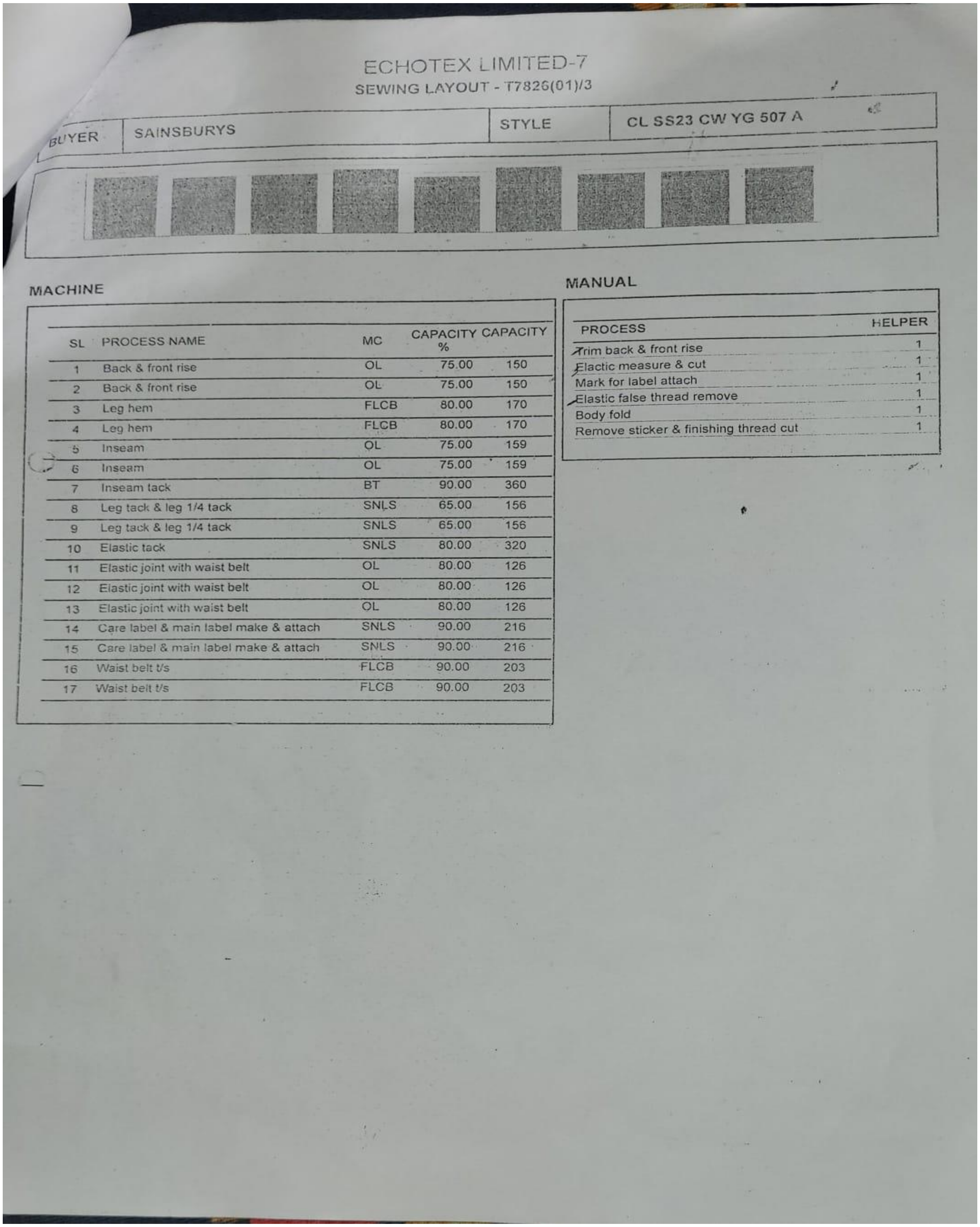
Figure 3.3 Experiment: 02



ECHOTEX LIMITED-7
SEWING LAYOUT - T7826(01)/3

BUYER	SAINSBURYS	STYLE	CL SS23 CW YG 507 A

MACHINE

SL	PROCESS NAME	MC	CAPACITY %	CAPACITY
1	Back & front rise	OL	75.00	150
2	Back & front rise	OL	75.00	150
3	Leg hem	FLCB	80.00	170
4	Leg hem	FLCB	80.00	170
5	Inseam	OL	75.00	159
6	Inseam	OL	75.00	159
7	Inseam tack	BT	90.00	360
8	Leg tack & leg 1/4 tack	SNLS	65.00	156
9	Leg tack & leg 1/4 tack	SNLS	65.00	156
10	Elastic tack	SNLS	80.00	320
11	Elastic joint with waist belt	OL	80.00	126
12	Elastic joint with waist belt	OL	80.00	126
13	Elastic joint with waist belt	OL	80.00	126
14	Care label & main label make & attach	SNLS	90.00	216
15	Care label & main label make & attach	SNLS	90.00	216
16	Waist belt t/s	FLCB	90.00	203
17	Waist belt t/s	FLCB	90.00	203

MANUAL

PROCESS	HELPER
Trim back & front rise	1
Elactic measure & cut	1
Mark for label attach	1
Elastic false thread remove	1
Body fold	1
Remove sticker & finishing thread cut	1

Figure 3.4 Experiment: 02

According to the factory data, It has been observed that

The Standard SMV Of The LEGGINGS = 3.49

Here,

BPT = SMV/ Total No. Of Process

= 3.49/15

= 0.23 Min.

So, Line Production Target = 60/ BPT

= 60/ 0.23

= 261

Before Balancing:

Table 3.4 Before Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	**Back & front rise**	**OL**	**1**	**21.2**	**144**	**261**	**-117**	**-2480.4**
2	Trim back & front rise	Helper	1	11.15	274	261	13	145
3	**Leg hem**	**FLCB**	**1**	**20.2**	**151**	**261**	**-110**	**-2222**
4	**Leg hem raw edge cut**	**Helper**	**1**	**19.3**	**158**	**261**	**-103**	**-1988**
5	Elastic measure & cut	Helper	1	10.75	284	261	23	247.25
6	Elastic tack	SNLS	1	8.6	355	261	94	808.4
7	**Elastic joint with waist belt**	**OL**	**1**	**20.4**	**150**	**261**	**-111**	**-2264.4**
8	Mark for label attach	Helper	1	8.4	364	261	103	865.2
9	**Care & main label attach**	**SNLS**	**1**	**20.6**	**148**	**261**	**-113**	**-2327.8**
10	**Waist belt top stitch**	**FLCB**	**1**	**18.4**	**166**	**261**	**-95**	**-1748**
11	Body fold sticker	Helper	1	11.3	270	261	9	101.7
12	**Inseam**	**OL**	**1**	**23.2**	**131**	**261**	**-130**	**-3016**
13	Inseam tack	BT	1	8.8	347	261	86	756.8

14	**Leg tack & leg ¼ tack**	**SNLS**	**1**	**19.8**	**154**	**261**	**-107**	**-2118.6**
15	Finishing thread cut	Helper	1	11.5	266	261	5	57.5
	Total		15	233.6				

Before balancing, It has been observed that different process have different capacity in production line. It has been also found that the bottleneck points in identified operation. For that It has been observed more idle time produced. Generally It decreased the production and line efficiency.

Here,

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 233.6 / 15 * 23.2

= 67 %

Balancing Rate = (Minimum Output / Target Output)* 100%

= 131 / 261 * 100%

= 50 %

After Balancing:

Table 3.5 After Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	Back & front rise	OL	2	21.2	288	261	27	572.4
2	Trim back & front rise	Helper	1	11.15	274	261	13	145
3	Leg hem	FLCB	2	20.2	302	261	41	828.2
4	Leg hem raw edge cut	Helper	2	19.3	316	261	55	1061.5
5	Elastic measure & cut	Helper	1	10.75	284	261	23	247.25
6	Elastic tack	SNLS	1	8.6	355	261	94	808.4
7	Elastic joint with waist belt	OL	2	20.4	300	261	39	795.6
8	Mark for label attach	Helper	1	8.4	364	261	103	865.2
9	Care & main label attach	SNLS	2	20.6	296	261	35	721
10	Waist belt top stitch	FLCB	2	18.4	332	261	71	1306.4
11	Body fold sticker	Helper	1	11.3	270	261	9	101.7
12	Inseam	OL	2	23.2	262	261	1	23.2
13	Inseam tack	BT	1	8.8	347	261	86	756.8
14	Leg tack & leg ¼ tack	SNLS	2	19.8	308	261	47	930.6

15	Finishing thread cut	Helper	1	11.5	266	261	5	57.5
	Total		23	396.7				9220.75

After balancing, It has been observed that In production line, every process have the capacity were nearly closed. Here It has been found that the idle time and bottleneck points were reduced by the increasing number of machine, manpower and sharing the process among the same machine.

Here,

Sum of total idle time = 9220.75 Sec

= 2.5 Hour

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 396.7 / 23 * 23.2

= 74 %

Balancing Rate = (Minimum Output / Target Output)* 100%

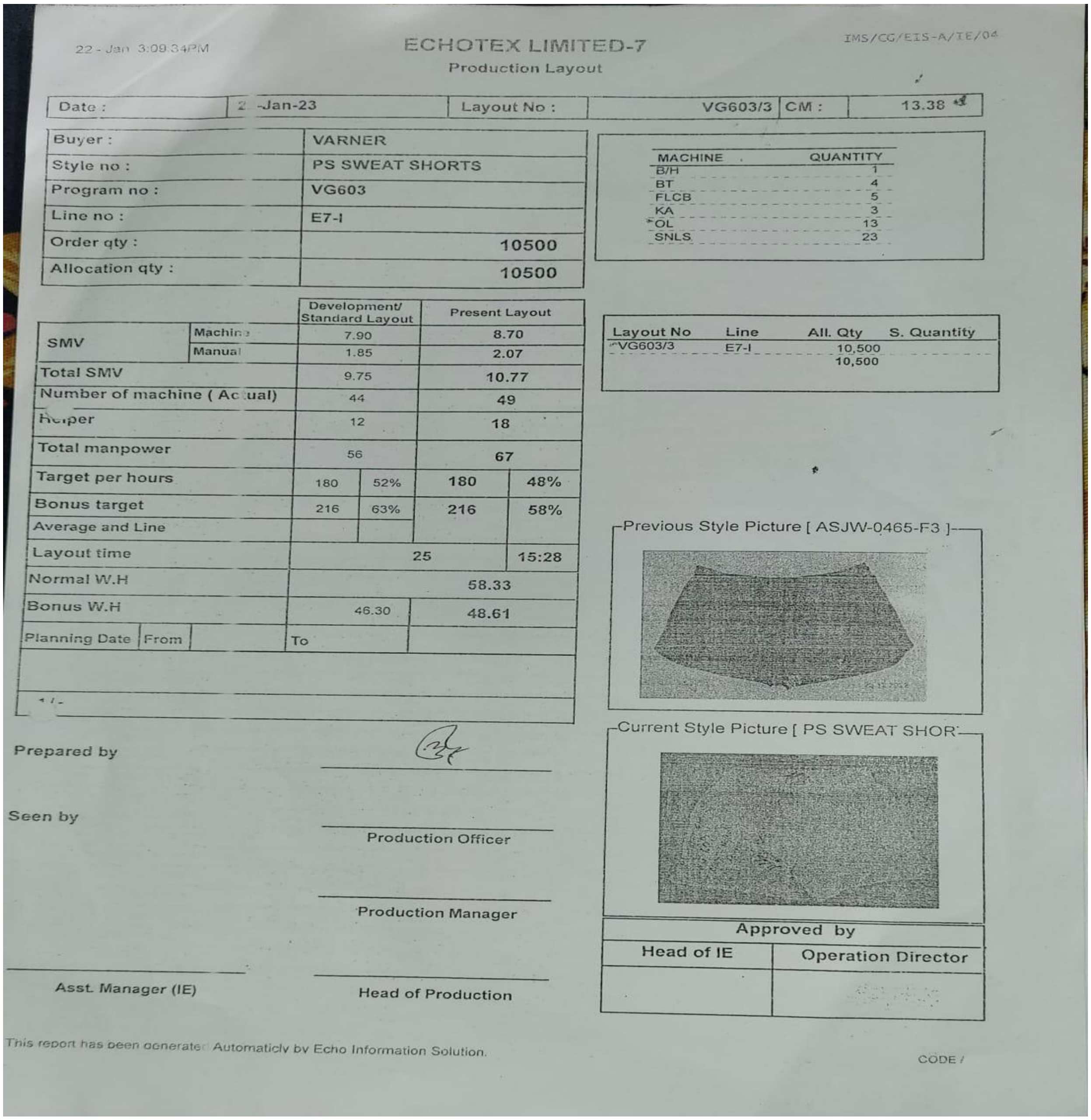
= 262 / 261 * 100%

= 100 %

3.3 Experiment: 03

Item: SWEAT SHORTS

Buyer: VARNER



22 - Jan 3:09:34PM

ECHOTEX LIMITED-7

Production Layout

IMS/CG/EIS-A/TE/04

Date :	2 -Jan-23	Layout No :	VG603/3	CM :	13.38

Buyer :	VARNER
Style no :	PS SWEAT SHORTS
Program no :	VG603
Line no :	E7-I
Order qty :	10500
Allocation qty :	10500

MACHINE	QUANTITY
B/H	1
BT	4
FLCB	5
KA	3
OL	13
SNLS	23

		Development/ Standard Layout		Present Layout	
SMV	Machine	7.90		8.70	
	Manual	1.85		2.07	
Total SMV		9.75		10.77	
Number of machine (Actual)		44		49	
Helper		12		18	
Total manpower		56		67	
Target per hours		180	52%	180	48%
Bonus target		216	63%	216	58%
Average and Line					
Layout time		25			15:28
Normal W.H		58.33			
Bonus W.H		46.30		48.61	
Planning Date	From	To			

Layout No	Line	All. Qty	S. Quantity
VG603/3	E7-I	10,500	
		10,500	

Previous Style Picture [ASJW-0465-F3]

Current Style Picture [PS SWEAT SHOR

Prepared by

Seen by

Production Officer

Production Manager

Asst. Manager (IE)

Head of Production

Approved by	
Head of IE	Operation Director

This report has been generated Automaticly by Echo Information Solution.

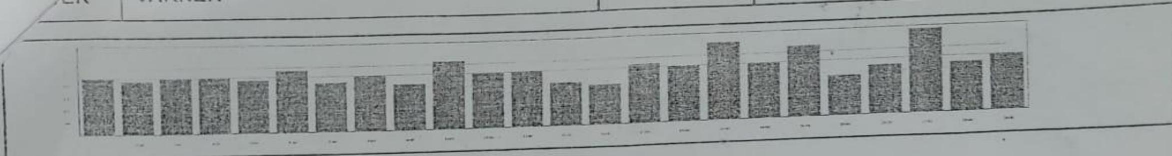
CODE /

Figure 3.5 Experiment: 03

ECHOTEX LIMITED-7

SEWING LAYOUT - VG603/3

ER	VARNER	STYLE	PS SWEAT SHORTS



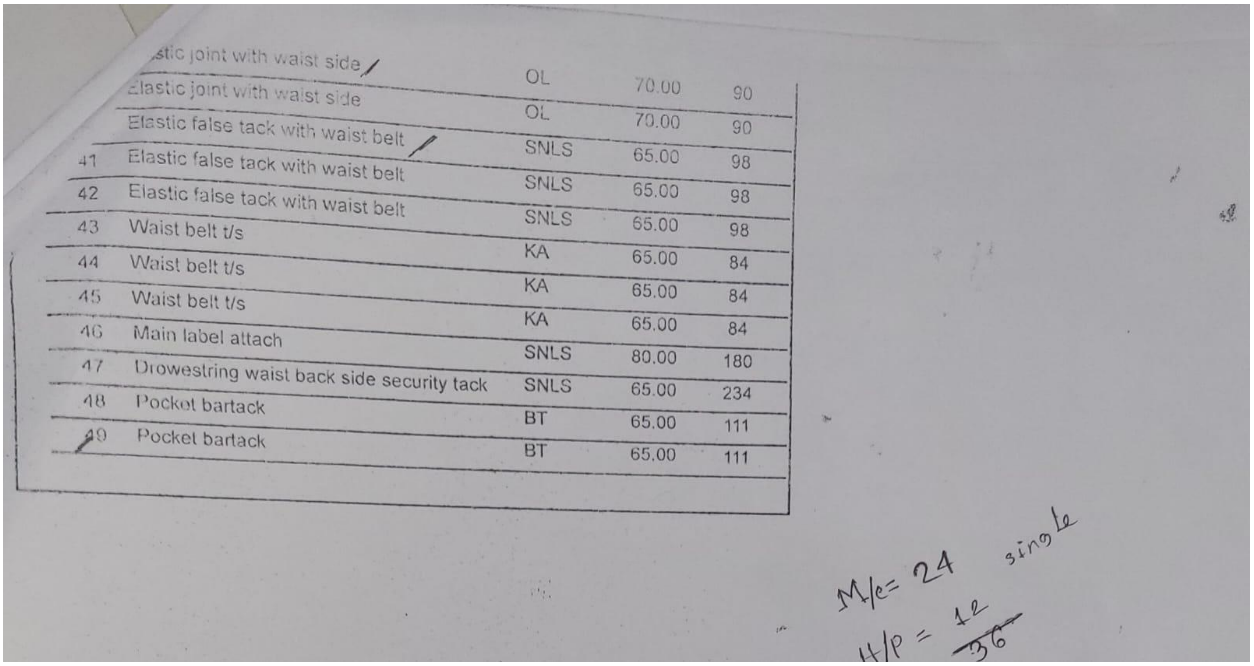
MACHINE

SL	PROCESS NAME	MC	CAPACITY %	CAPACITY
1	Back & front rise	OL	65.00	107
2	Back & front rise	OL	65.00	107
3	Back & front rise t/s	FLCB	65.00	117
4	Back & front rise t/s	FLCB	65.00	117
5	Pocketing attach	SNLS	65.00	107
6	Pocketing attach	SNLS	65.00	107
7	Pocketing t/s	SNLS	65.00	107
8	Pocketing t/s	SNLS	65.00	107
9	Pocket tack with body	SNLS	65.00	75
10	Pocket tack with body	SNLS	65.00	75
11	Pocket tack with body	SNLS	65.00	75
12	Pocket beg close	OL	70.00	105
13	Pocket beg close	OL	70.00	105
14	Pocket side tack & waist side attach	SNLS	65.00	84
15	Pocket side tack & waist side attach	SNLS	65.00	84
16	Pocket side tack & waist side attach	SNLS	65.00	84
17	Inseam	OL	65.00	111
18	Inseam	OL	65.00	111
19	Inseam tack	BT	70.00	280
20	Leg servicing	OL	70.00	97
21	Leg servicing	OL	70.00	97
22	Leg hem	FLCB	65.00	73
23	Leg hem	FLCB	65.00	73
24	Leg hem	FLCB	65.00	73
25	Side seam with vent	OL	65.00	71
26	Side seam with vent	OL	65.00	71
27	Side seam with vent	OL	65.00	71
28	Care label make & attach	SNLS	65.00	138
29	Care label make & attach	SNLS	65.00	138
30	Side vent tack	SNLS	65.00	146
31	Side vent tack	SNLS	65.00	146
32	Side vent t/s	SNLS	65.00	67
33	Side vent t/s	SNLS	65.00	67
34	Side vent t/s	SNLS	65.00	67
35	Side vent bartack	BT	70.00	229
36	Waist side hole	B/H	80.00	192
37	Elastic tack	SNLS	65.00	213

MANUAL

PROCESS	HELPER
Trim back & front rise	1
Trim inseam	1
Mark for label attach	1
Drowestring measure,cut & mark	2
Drawcord knot make & insert	2
Elastic measure & cut	2
Hole mark	1
Pocket mark	2
Side vent mark	1
Waist belt false thread remove	2
Remove sticker & finishing thread cut	2
Trim side seam	1

Figure 3.6 Experiment: 03



	Elastic joint with waist side	OL	70.00	90
	Elastic joint with waist side	OL	70.00	90
	Elastic false tack with waist belt	SNLS	65.00	98
41	Elastic false tack with waist belt	SNLS	65.00	98
42	Elastic false tack with waist belt	SNLS	65.00	98
43	Waist belt t/s	KA	65.00	84
44	Waist belt t/s	KA	65.00	84
45	Waist belt t/s	KA	65.00	84
46	Main label attach	SNLS	80.00	180
47	Drowestring waist back side security tack	SNLS	65.00	234
48	Pocket bartack	BT	65.00	111
49	Pocket bartack	BT	65.00	111

M/c= 24 single
H/P = 12 ~~36~~

Figure 3.7 Experiment: 03

According to the factory data, It has been observed that

The Standard SMV Of The SWEAT SHORTS = 10.77

Here,

BPT = SMV/ Total No. Of Process

= 10.77/37

= 0.29 Min.

So, Line Production Target = 60/ BPT

= 60/ 0.29

= 207

Before Balancing:

Table 3.6 Before Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	Back & front rise	OL	1	25.8	118	207	-89	-2296.2
2	Trim back & front rise	Helper	1	11.13	274	207	67	745.71
3	Back & front rise t/s	FLCB	1	24.75	123	207	-83	-2063.2
4	**Pocket cut**	**Helper**	**1**	**8.2**	**373**	**207**	**166**	**1361.2**
5	**Pocket mark**	**Helper**	**1**	**6.25**	**489**	**207**	**282**	**1762.5**
6	Pocketing attach	SNLS	1	40.9	74	207	-133	-5439.7
7	Pocketing t/s	SNLS	1	29.4	104	207	-103	-3028.2
8	Pocket tack with body	SNLS	1	25.2	121	207	-86	-2167.2
9	Pocket beg close	OL	1	25.71	119	207	-88	-2262.4
10	Pocket side tack & waist side attach	SNLS	1	13.9	220	207	13	180.7
11	Pocket bar tack	BT	1	14.2	215	207	8	113.6
12	Inseam	OL	1	27.9	109	207	-97	-2706.3
13	**Trim inseam**	**Helper**	**1**	**7.6**	**402**	**207**	**195**	**1482**
14	Inseam tack	BT	1	10.8	283	207	76	820.8
15	Leg servicing	OL	1	28.2	108	207	-99	-2791.8
16	Leg hem	FLCB	1	29.2	105	207	-102	-2978.4

17	Body fold and thread cut	Helper	1	14.6	209	207	2	29.2
18	Side vent mark	Helper	1	13.45	227	207	20	269
19	Side seam with vent	OL	1	57.8	52	207	-155	-8959
20	**Trim side seam**	**Helper**	**1**	**7**	**437**	**207**	**230**	**1610**
21	Care label make & attach	SNLS	1	14.5	211	207	4	58
22	Side vent tack	SNLS	1	28.4	107	207	-100	-2840
23	Side vent t/s	SNLS	1	58.6	52	207	-155	-9083
24	Side vent bar tack	BT	1	11.2	273	207	66	739.2
25	**Hole mark**	**Helper**	**1**	**7.25**	**422**	**207**	**215**	**1558.75**
26	Waist side hole	B/H	1	29.4	104	207	-103	-3028.2
27	Elastic measure & cut	Helper	1	13.75	222	207	15	206.25
28	Elastic tack	SNLS	1	11.85	258	207	51	604.35
29	Elastic joint with waist side	OL	1	29.4	104	207	-103	-3028.2
30	Elastic false tack with waist belt	SNLS	1	28.6	106	207	-101	-2888.6
31	Waist belt t/s	KA	1	29.2	104	207	-103	-3007.6
32	Drowestring measure, cut & mark	Helper	1	14.2	215	207	8	113.6

33	Drawcord knot make & insert	Helper	1	26.2	116	207	-91	-2384.2
34	**Mark for label attach**	**Helper**	**1**	**7.37**	**415**	**207**	**208**	**1533**
35	Main label attach	SNLS	1	14.7	208	207	1	14.7
36	Drowestring waist back side sequrity tack	SNLS	1	12.8	239	207	32	409.6
37	Remove sticker & finishing thread cut	Helper	1	14.6	209	207	2	29.2
	Total		37	774.01				13509.86

Before balancing, It has been observed that different process have different capacity in production line. It has been also found that the bottleneck points in identified operation. For that It has been observed more idle time produced. Generally It decreased the production and line efficiency.

Here,

Sum of total idle time = 13509.86 Sec

= 3.75 Hour

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 774.01 / 37 * 58.6

= 35 %

Balancing Rate = (Minimum Output / Target Output)* 100%

= 52 / 207 * 100%

= 25 %

After Balancing:

Table 3.7 After Balancing

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	Back & front rise	OL	2	25.8	236	207	29	748.2
2	Trim back & front rise	Helper	1	11.13	274	207	67	745.71
3	Back & front rise t/s	FLCB	2	24.75	246	207	39	965.25
4	**Pocket cut & Pocket mark**	**Helper**	**1**	**14.45**	**211**	**207**	**4**	**57.8**
5	Pocketing attach	SNLS	3	40.9	222	207	15	613.5
6	Pocketing t/s	SNLS	2	29.4	208	207	1	29.4
7	Pocket tack with body	SNLS	2	25.2	242	207	35	882
8	Pocket beg close	OL	2	25.71	238	207	31	797.01
9	Pocket side tack & waist side attach	SNLS	1	13.9	220	207	13	180.7
10	Pocket bar tack	BT	1	14.2	215	207	8	113.6
11	Inseam	OL	2	27.9	218	207	11	306
12	Inseam tack	BT	1	10.8	283	207	76	820.8
13	Leg servicing	OL	2	28.2	216	207	9	253.8
14	Leg hem	FLCB	2	29.2	210	207	3	87.6

15	Body fold and thread cut	Helper	1	14.6	209	207	2	29.2
16	Side vent mark	Helper	1	13.45	227	207	20	269
17	Side seam with vent	OL	4	57.8	211	207	4	231.2
18	**Trim inseam & Trim side seam**	**Helper**	**1**	**14.6**	**209**	**207**	**2**	**29.2**
19	Care label make & attach	SNLS	1	14.5	211	207	4	58
20	Side vent tack	SNLS	2	28.4	214	207	7	198.8
21	Side vent t/s	SNLS	4	58.6	208	207	1	58.6
22	Side vent bar tack	BT	1	11.2	273	207	66	739.2
23	**Hole mark & Mark for label attach**	**Helper**	**1**	**14.62**	**209**	**207**	**2**	**29.24**
24	Waist side hole	B/H	2	29.4	208	207	1	29.4
25	Elastic measure & cut	Helper	1	13.75	222	207	15	206.25
26	Elastic tack	SNLS	1	11.85	258	207	51	604.35
27	Elastic joint with waist side	OL	2	29.4	208	207	1	29.4
28	Elastic false tack with waist belt	SNLS	2	28.6	212	207	5	143
29	Waist belt t/s	KA	2	29.2	208	207	1	29.2

30	Drowestring measure, cut & mark	Helper	1	14.2	215	207	8	113.6
31	Drawcord knot make & insert	Helper	2	26.2	232	207	25	655
32	Main label attach	SNLS	1	14.7	208	207	1	14.7
33	Drowestring waist back side sequrity tack	SNLS	1	12.8	239	207	32	409.6
34	Remove sticker & finishing thread cut	Helper	1	14.6	209	207	2	29.2
	Total		56	1592.37				9285.41

After balancing, It has been observed that In production line, every process have the capacity were nearly closed. Here It has been found that the idle time and bottleneck points were reduced by the increasing number of machine, manpower and sharing the process among the same machine.

Reduce Helper:

Table 3.8 Reduce Helper

SL No.	Process Name	M/C Type	Work station	Average Time	Capacity 85%	Line Target	Idle Pcs	Idle Time
1	Pocket cut & Pocket mark	Helper	1	14.45	211	207	4	57.8
2	Trim inseam & Trim side seam	Helper	1	14.6	209	207	2	29.2
3	Hole mark & Mark for label attach			14.62	209	207	2	29.24

Before balancing, It has been observed that the identifying six helpers were more idle in production line. For that there were three helpers reduced to achieve the line target. For that there were minimized idle time and increased line efficiency.

Here,

Sum of total idle time = 9285.41 Sec

= 2.5 Hour

Line Efficiency = Sum Of Task Time / Work Station * Max. Working Time * 100%

= 1592.37 / 56 * 58.6

= 49 %

Balancing Rate = (Minimum Output / Target Output)* 100%

= 208 / 207 * 100%

= 100 %

CHAPTER 4: DISCUSSION OF RESULTS

4.1 Experiment 1: Capacity Graph

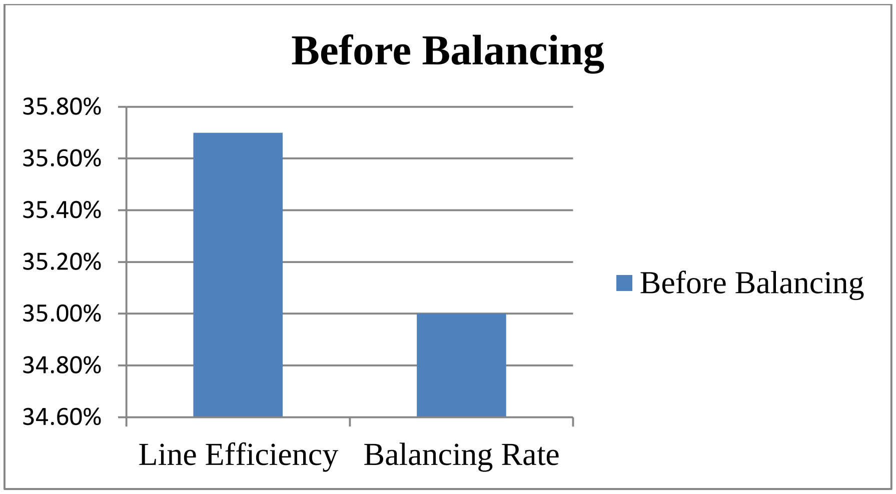
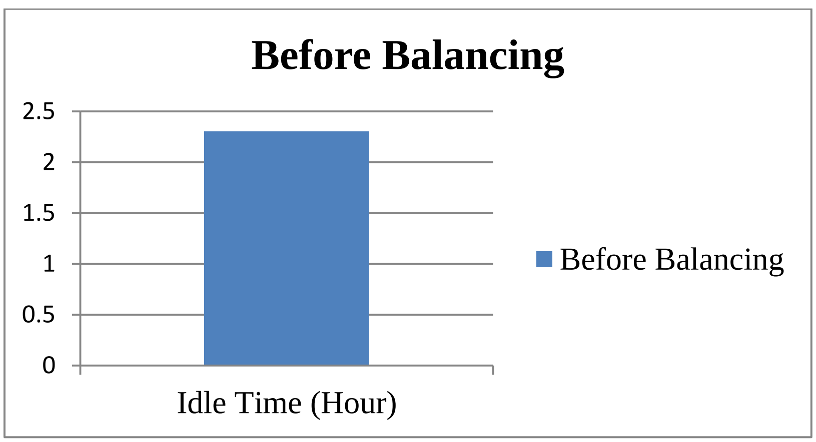


Figure 4.1 Capacity Before Balancing



It has been observed that every process have different capacity before balancing. Because it has been used 1 operator in every single process and maximum operator did not fill up their target output. For that bottleneck points were produced and Line efficiency and Balancing rate were decreased. In the table, It has been found that 4 helpers were more idle in production line. Their output production was much higher than the target production. For that more idle time were produced. Before balancing In this graph, It has been found that the Idle Time was 2.3 Hour where as the Line Efficiency 35.7% and Balancing Rate 35%.

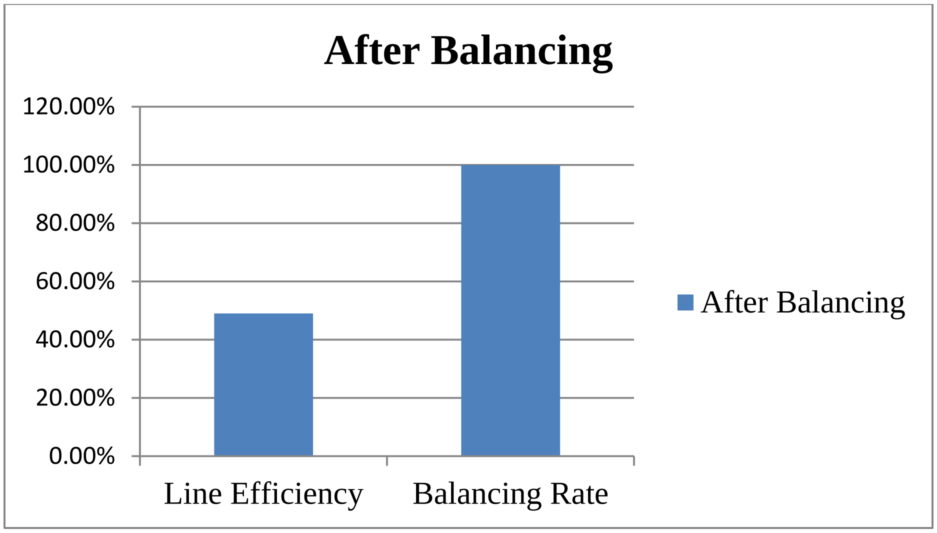
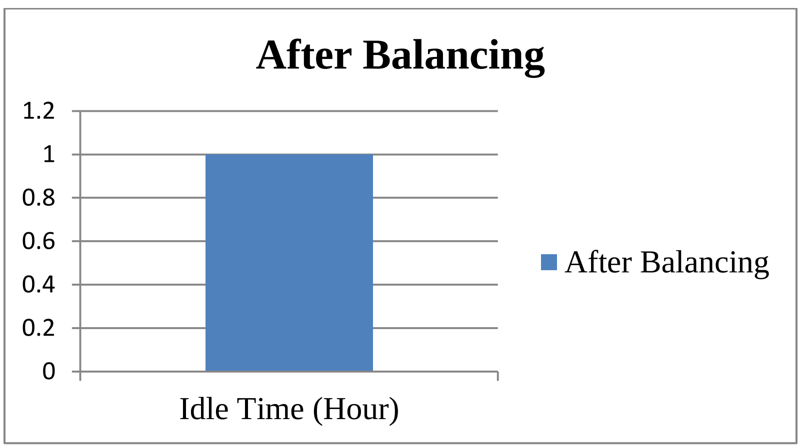


Figure 4.2 Capacity After Balancing



After balancing, It has been observed that every process have the capacity were nearly closed. Because it has been used required number of operator in every single process. For that every operator were filled up their target output and reduced bottleneck point. For that Line Efficiency and Balancing Rate were increased. After balancing, It has been observed that there were 2 helpers were reduced to minimize the idle time. Because 2 operators have been able to do same work that 4 operators did. In this graph, After balancing It has been found that the Idle Time was 1 Hour where as the Line Efficiency 49% and Balancing Rate 100%.

4.2 Experiment 2: Capacity Graph

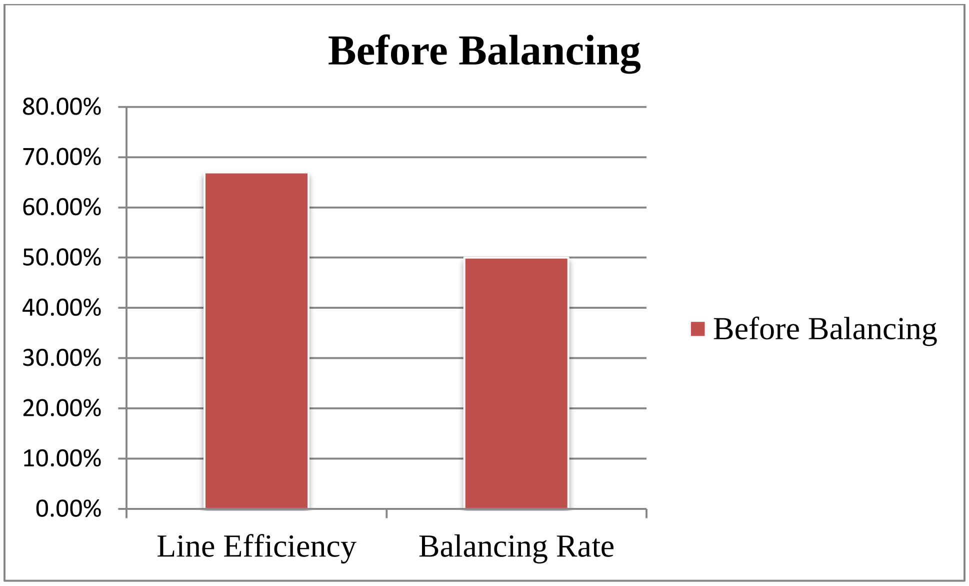


Figure 4.3 Capacity Before Balancing

It has been observed that every process have different capacity before balancing. Because it has been used 1 operator in every single process and maximum operator did not fill up their target output. For that bottleneck points were produced and Line efficiency and Balancing rate were decreased. For that It has been observed more idle time produced. In this graph, It has been found that the Line Efficiency 67% and Balancing Rate 50%.

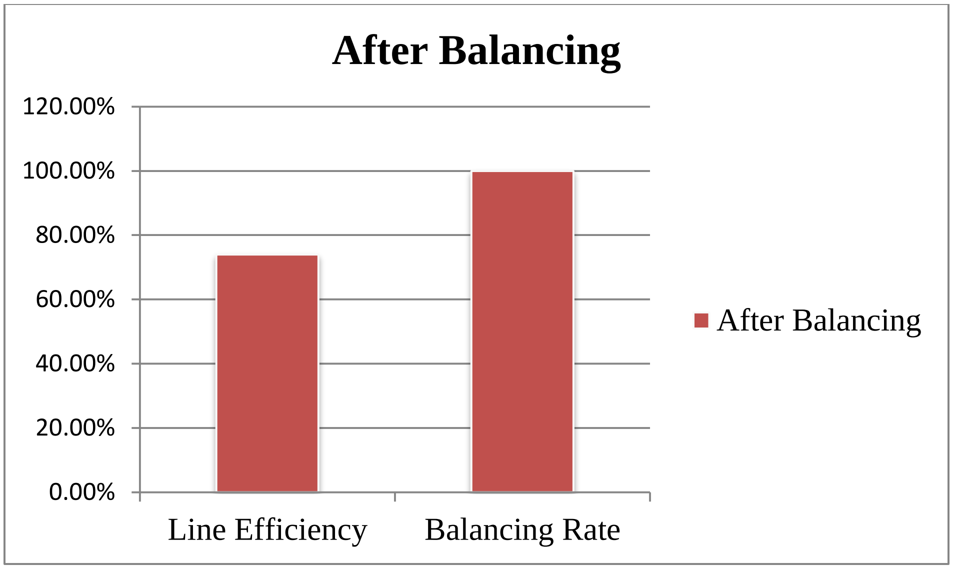
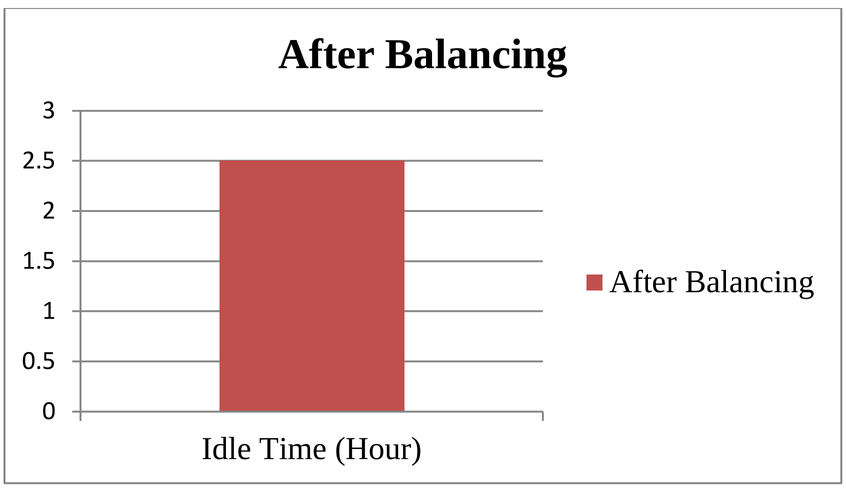


Figure 4.4 Capacity After Balancing



After balancing, It has been observed that every process have the capacity were nearly closed. Because it has been used required number of machine and operator in every single process. For that every operator were filled up their target output and reduced bottleneck point. For that Line Efficiency and Balancing Rate were increased. Here Idle time were reduced by increasing number of machine and manpower. In this graph, It has been found that the Idle Time was 2.5 Hour where as the Line Efficiency 74% and Balancing Rate 100%.

4.3 Experiment 3: Capacity Graph

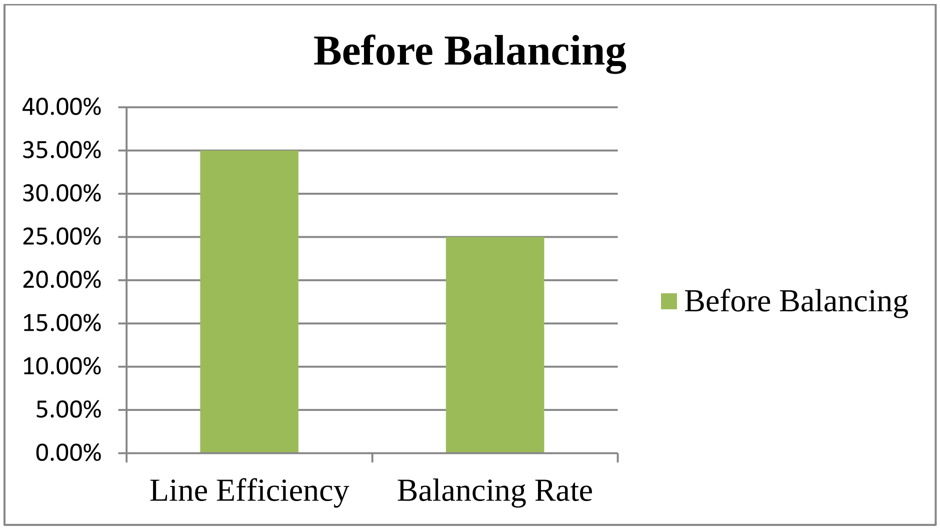
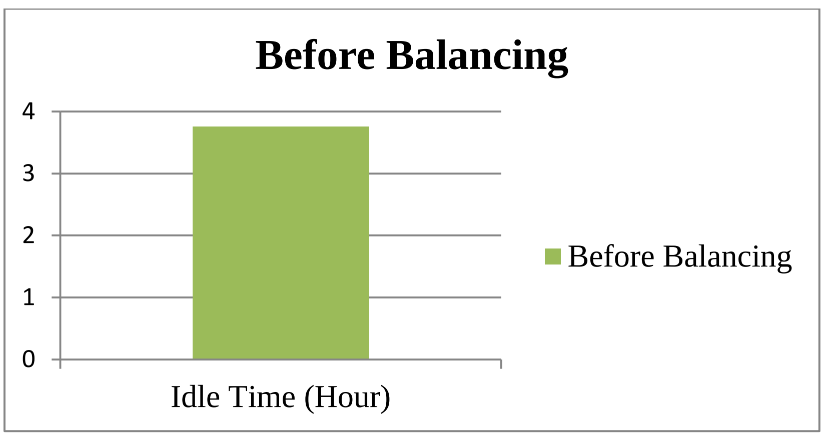


Figure 4.5 Capacity Before Balancing



Before balancing It has been observed that every process have different capacity. Because it has been used number of 1 machine and helper in every single process and maximum operator did not fill up their target output. For that bottleneck points were produced and Line efficiency and Balancing rate were decreased. In the table, It has been found that 6 helpers were more idle in production line. Their output production was much higher than the target production. For that more idle time were produced. Before balancing In this graph, It has been found that the Idle Time was 3.75 Hour where as the Line Efficiency 35 % and Balancing Rate 25%.

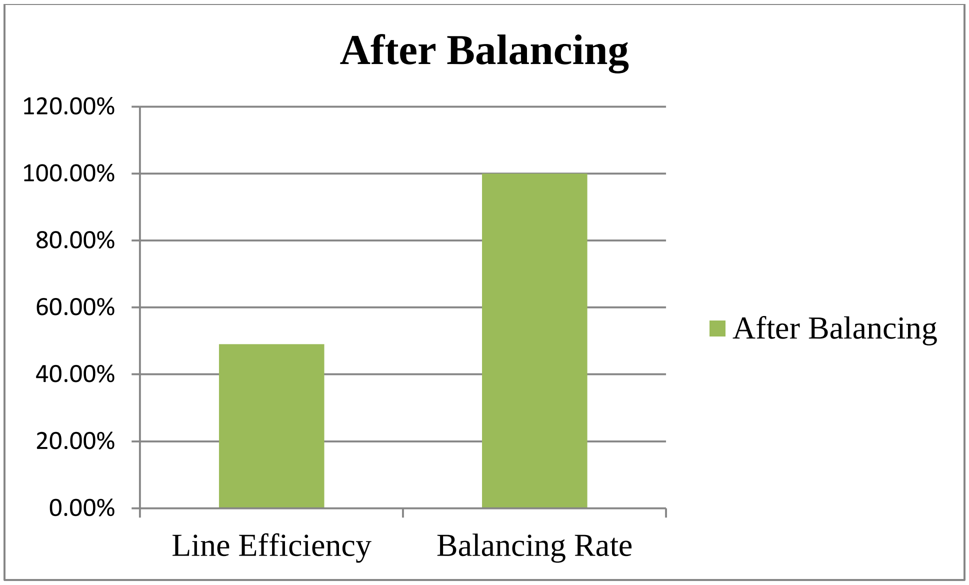
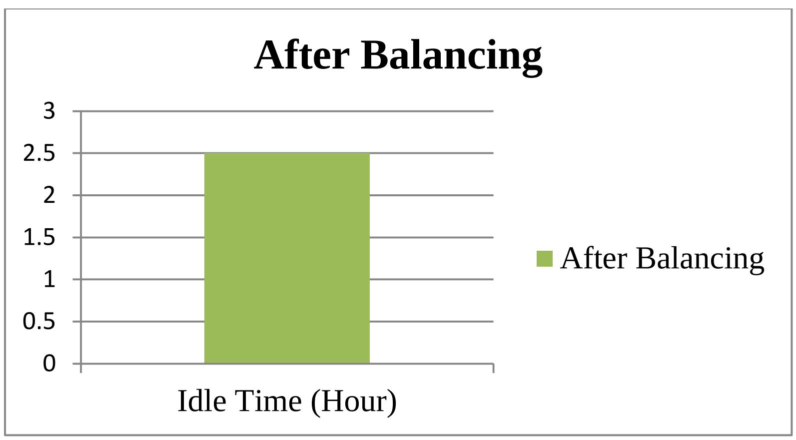


Figure 4.6 Capacity After Balancing



After balancing, It has been observed that every process have the capacity were nearly closed. Because it has been used required number of operator in every single process. For that every operator were filled up their target output and reduced bottleneck point. For that Line Efficiency and Balancing Rate were increased. After balancing, It has been observed that there were 3helpers were reduced to minimize the idle time. Because 3 operators have been able to do same work that 6 operators did. After balancing In this graph, It has been found that the Idle Time was 2.5 Hour where as the Line Efficiency 49% and Balancing Rate 100%.

CHAPTER 5:PROFESSIONAL RESPONSIBILITIES, HEALTH, SAFETY, SOCIO-CULTURAL AND ENVIRONMENTAL CONSIDERATION.

5.1 Codes And Standards Used

One of Bangladesh's well-known textile companies is Echotex Ltd. The majority of Echotex customers are well-known individuals who care about the environment. As a result, maintaining all international standards of conduct and abiding by BSCI and CSR rules and regulations is a requirement for their order. Zero tolerance for underage labor, in order to prevent unique issues. Maintain ISO 9001 as well which outlines the global norm for quality management. The ETP process needs to be maintained. Thus that the amount of water needed from sample manufacturing to bulk production cannot have a negative impact on the environment.

5.2 Ethical Principles and Professional Commitment

The core element and commitment is to conduct ourselves properly while preserving the environment's health for future generations. Consider creating sustainable products. Making clothing with organic cotton yarn is a common practice. Using high-quality dye chemicals that are safe for the health and the environment. Avoid harassment and abuse while working. After the primary task, you're not required to work part-time for a while. Discrimination against women and men must end.

Preferably once per month, a fire drill. And to make sure that everyone leaves the factory in only six minutes.

5.3 Impact on Society, Health, Safety, Legal and Cultural Issues

The upkeep of international organizations' codes of behavior benefits society. For instance, all of the worker benefits are guaranteed when the BSCI standards are followed. After a specified obligation, no further workers may be assigned to overtime. The standards of BSCI include timely payment of salaries, abstaining from using child labor, and rigorously monitoring any instances of harassment or abuse of female employees. Even now, maintaining BSCI standards is a necessity for the majority of customers. By doing this, employers ensure that employees receive their just benefits, benefiting society as a whole. Another international organization's norms and regulations apply to CSR operations. All societal issues are guaranteed here. For instance, make sure that female employees receive benefits like maternity leave. Create a mosque or a school next to where there are businesses. It consequently has a favorable effect on society. Social audits are used to keep track of safety concerns in various businesses. Because of this, industries are always ready to put out a fire. This includes installing fire alarms all around the place, creating a few emergency exits, and always keeping a few employees in the facility to put out a fire. The social audit also looks at the workplace's properness and whether or not the employees have access to a standard restroom. Here, both the working environment and the workers' safety are taken into consideration.

5.4 Impact on Environment

The term "ETP" is now widely used in the textile industry. We are aware that making clothes uses a lot of water. Also, the ecology is seriously harmed if these waters are discharged in the same state in which they were utilised. This is eliminated with the introduction of ETP Process. The environment is not harmed as a result of the treatment and release of the water into the environment. The ecology is benefiting greatly from this ETP procedure. Yet, the industry is making an effort to create sustainable products. To make it functional, dry wash is being used. the use of organic yarn. The ecosystem is benefiting greatly from all of these efforts.

CHAPTER 6: CONCLUSION

The most crucial stage in the manufacturing of clothing is line balancing. Following analyzing, it was discovered that line balancing approach, as well as reduced idle time, increasing efficiency and balancing rate. The resulting value of this research-

a) Minimized of Idle time by reducing the number of manpower, helper.
b) Fulfilled the target output and balancing rate 100%.
c) Line efficiency was increased by increasing the number of machine and manpower to get required output.

Remarks: After balancing, It has been observe that there were a small amount of idle time remains which time should be used in others machine and helping process. For that this idle time should be strongly minimized.

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