Faculty of Engineering
Department of Textile Engineering

Productivity Analysis of Sewing Line in Readymade Garment Production by Applying IE Studies

Course code: TE-432 Course title: Project Thesis

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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

To

The Head

Department of Textile Engineering

Daffodil International University

Daffodil Smart City, Ashulia, Savar

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

Dear Sir

I am just writing to let you know that this report titled as **"Productivity Analysis of Sewing Section in Ready Made Garment Production by Applying IE Studies."** has been prepared by the student bearing ID: 191-23-5509; 191-23-5581 & 133-23-3713 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 thesis 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

Mr. Abdullah Al Mamun

Associate Professor

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Daffodil International University

DECLARATION

We hereby declare that the work which is being presented in this thesis entitled, **"Productivity Analysis of Sewing Section in Ready Made Garment Production by Applying IE Studies"** is original work of our own, has not been presented for a degree of any other university and all the resource of materials uses for this thesis have been duly acknowledged.

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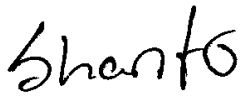

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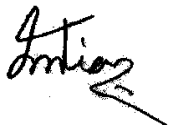

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

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Mr. Abdullah Al Mamun

Associate Professor, TE, FE, DIU

ACKNOWLEDGEMENT

First and foremost, we are grateful to the Almighty "ALLAH" for providing us with the power and skill to successfully complete the project. **Mr. Abdullah Al Mamun**, **Associate Professor, Department of Textile Engineering, Faculty of Engineering, Daffodil International University,** deserves our gratitude. This project could not have been completed without his inexhaustible patience, intellectual direction, constant encouragement, energetic supervision, constructive criticism, helpful suggestions, reviewing numerous subpar drafts and fixing them at every level. During our internship, Liz Fashion Industry Limited's Senior IE Executive Sakhawat Hossain, & Jr. Executive KM Junayed were extremely courteous and helpful. We are also grateful to them to help us by allowing to collect the necessary data for the project. We are also grateful to each and every faculty member, registrar, coordinator, and staff member of Daffodil International University. We are ecstatic to offer our respect and appreciation to the esteemed Associate Professor Mr. Abdullah Al Mamun for his outstanding support. Finally, we would want to express our gratitude to our parents and friends for their emotional support, fortitude, and aid over the duration of our project.

ABSTRACT

Sewing section is the heart of a readymade garment industry. The productivity of the sewing section is directly effect on their annual income & the chances to get the orders. This project is about "Productivity analysis of sewing line of readymade garment industry by applying IE studies. In garment industry several types of dept. like as Production Team, IE Team, HR Admin Team, Technical Team, Mechanic Team & Maintenance Team. works in sewing line at a time. Every dept. is concern about the productivity label of sewing section. But only the IE team works for increasing the productivity of a sewing section by implementing new process, techniques & methods. In this project we have showed the increasing label of productivity of a specific sewing line of sewing section. We have applied some IE studies like Time study, Production study, finding bottle neck process, motion study etc. & made a good productivity label. The efficiency increased day by day. We observed 7 days of production. From Day-1 to Day-2, production was very low & the average cycle time & capacity of bottleneck process was very low. By applying motion study, from Day-3 the capacity of bottleneck process has been increased. From Day-4 the bottleneck process has been replaced to another one. We have tried to increase the capacity of that process. But it was not possible to hit the targeted efficiency with only 1 manpower on that process. So, we added one extra manpower on that process. Then we got the improvement. Our targeted efficiency was 65%. Though we didn't hit the target efficiency but we balanced the line in 63%.

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LIST OF ABBREVIATION

BNP : Bottleneck Process 15
BOL : Bill of Operation List 8
IE : Industrial Engineering 1
LBR : Line Balancing Rate 4
MP : Manpower 12
NPT : Non Productive Time 4
OT : Over Time 25
QC : Quality Control 16
SMV : Standard Minute Value 8

CHAPTER 1: INTRODUCTION

1.1 Objectives of the Analysis

In sewing floor of a garment industry, every second is important. Because here the bulk production is running. Every order has a shipment date. All the production needs to complete before shipment. On time shipment is mostly depends of sewing floor. If they take more time to complete the production, then it is not possible to heat the on time shipment. In that case industry losses their profit. That's why it is very important to check the productivity label of sewing line every day. By this analysis, we can understand how much earlier we can produce a garment. Also we will be able to identify the mistakes & lacking have made during layout & manpower allocation.

1.2 Aim of the Analysis

By this analysis, we can understand that how much efficiently a layout can be done. And also we will find the factors, those are affecting the productivity & efficiency of a sewing line. If we identify those problems, next time we can reduce those before starting any layout. It's very important to make a stable & sustainable production rate & efficiency.

1.3 Background of IE Studies

Industrial Engineering is the one of the most popular section in garment industry. Because only this section is works for increasing the efficiency by executing new plans, implementing new techniques & methods. The most important job of IE is proper use of man, machine & material. If the man, machine & materials are using properly, obviously it will reduce the excess cost of a garment industry & increase the high productivity & efficiency. IE have some studies like Capacity Study, Time Study, Production Study, Motion Study, Method Development etc. by which an IE can identify the excess works, man, machines, materials & motions. After identifying those things an IE reduce them & tries to make a better solution.

1.4 Limitations of IE Studies

IE studies are most popular in the world. But in Bangladesh it is very new. Still now, most of the industry doesn't know about IE broadly. It is not implemented in all over the industry of Bangladesh. That's why it's a little difficult to bring a new change in our production industry. The whole culture needs to change. Production team works for maintaining the production. They concern about the smooth flow of production. But they need a proper guideline to achieve the highest efficiency by proper utilization of man, machine & materials. But sometimes they don't agree with the study of IE. Because IE concern about the work how much effectively can be done. In our garment industry still now most of the people are illiterate. That's why they don't believe that the work can be done in different ways also. Some times for find out the NPT, IE needs to take sign from different types of sections. But they don't agree to sign. Because if they sign, the higher authority will warn them.

CHAPTER 2: LITERATURE REVIEW

2.1 Productivity

Productivity is a measurable term which can be measure by the ration of output against the input. [1] In garment industry, every sewing line is maintaining by separate item. Each item has different operation bulletin or process breakdown. According to the process breakdown the layout is done & also the right operator needs to appointed to the right process. Because every processes are not same. Critical process needs more skilled operator than others. By maintaining all these things, we can measure the productivity of a sewing line. If we don't follow the skill matrix of workers to set the layout we will not get the productivity. The flow of that line will be fail.

2.2 Layout

Layout is the first thing where the scope of development is huge. Because, according to process breakdown, layout has been set up. When IE made the paper layout, he can reduce some extra process or can combine 2/3 process. As a result, the machine & the allocated manpower will be reduced. Sometimes we don't understand the combining process during making paper layout. But when we go for the set up a layout, it visualizes easily that, how can reduce the extra man, machine & materials. At that time, we can apply that improvement. Sometimes we need to add extra manpower in bottleneck process to maintain the flow of production of that line. Considering all these things we can improve the productivity of a sewing line.

2.3 Line Balancing

Line balancing is the term which ensure the flow of the production of a sewing line. It can be done in many ways. Sometimes we can balance the line with sharing job, combining 2/3 processes, adding manpower without machine or with machine etc. [2] But most efficient ways are finding bottle neck process & try to share the job with the process of highest capacity of that line. For new layout first time it should be balance with adding right operators in right process. It needs to be sort out with the help of skill

matrix, which is also a study of IE. After completing the line balance, we need to calculate the LBR % of that line to achieve the highest efficiency. We will be able to achieve the highest efficiency if the productivity is going well.

2.4 Time Study

Time study is the study of IE by which we can measure the capacity of every operator & helper of each process individually. After measuring the capacity, we can calculate the line balancing rate & get the information about how much balance the line is. [4] To get the LBR % we need to take 5 cycle times of each process & then make the average cycle time of that process. After getting the average cycle time we get the capacity of that operator for that specific process. There is a formula to calculate the capacity of each process.

$$\text{Capacity} = \frac{3600}{\text{Average Cycle Time}} \qquad [1 \text{ Hour} = 3600 \text{ Sec}]$$

$$\text{LBR \%} = \frac{\text{SMV X 60 X Bottle Neck Process Manpower}}{\text{Total Manpower X Bottle Neck Process Avg. Cycle Time}} \text{ X } 100\%$$

2.5 Production Study

Production study is a lengthy process where an IE measure the production of an operator for 1 hour standing beside her. Basically this study is needed when we notice that an operator is doing less production then his/her capacity. In that case we need to find out the NPT (Not Productive Time) & Productive Time of that process of the specific operator. By finding NPT, we can easily find out where the operator is wasting his/her time & where he/she needs to improve. Generally, this production study is applying in bottleneck process of a line. Because bottleneck process is the process where we get the lowest production.

2.6 Bottleneck Process

Bottleneck process is the process where an operator is doing the lowest production of a specific line. [3] Every line has the bottleneck. It is not removable. But it can be improving day by day. If the capacity of the bottleneck is less than the line target, then it's a big problem. But if the capacity of the bottleneck process is equal or more than the line target, then it's ok. But fulfill the line target is not the end. We need to improve the capacity, productivity & efficiency as much as possible. Generally, the most critical process of a sewing line turns into the bottleneck process. Sometimes we add manpower with machine or without machine to reduce the bottleneck of critical process. Then the bottleneck process is being changed to another process. So, bottleneck process is not fixed for a specific process for a line. It can be changed again & again.

Bottleneck can reduce in 5 ways.

1. By Motion Improvement
2. By Method Improvement
3. By Process Sharing
4. By Adding Manpower with Machine or without Machine
5. By Increasing Capacity

2.7 Motion Study

Motion study is the most effective way to find out the excess motion an operator uses in a specific process. There are 6 types of basic motions which are needed to complete a process. From first operation an operator doesn't know the standard way to complete a process. In that case we need to take a video or observe the process. Then find out the excess motions. After find out the excess motions we need to reduce them or improve the motions. After reducing the motions, we need to take the cycle time again and check that how much time we have saved.

2.7.1 Basic Motions

1. Pick up
2. Put under the presser feed
3. Align

4. Sewing
5. Remove under the presser feed
6. Dispose

2.7.2 Principles of Motion Economy

Through the pioneering work of Gilbreth, Ralph M. Barnes and other investigators, certain rules for motion economy and efficiency have been developed. Some of the more important of these principles are the following:

- The movements of the two hands should be balanced and the two hands should begin and end their motions simultaneously.
- The hands should be doing productive work and should not be idle at the same time except during rest periods.
- Motions of the hands should be made in opposite and symmetrical directions and at the same time.
- The work should be arranged to permit it to be performed with an easy and natural rhythm.
- Momentum and ballistic-type movements should be employed wherever possible in order to reduce muscular effort.
- There should be a definite location for all tools and materials, and they should be located in front of and close to the worker.
- Bins or other devices should be used to deliver the materials close to the point of use.
- The workplace should be designed to ensure adequate illumination, proper workplace height, and provision for alternate standing and sitting by the operator.
- Wherever possible, jigs, fixtures, or other mechanical devices should be used to relieve the hands of unnecessary work.
- Tools should be prepositioned wherever possible in order to facilitate grasping them.
- Objects should be handled, and information recorded. Only once.

2.8 Method Improvement

Method improvement is one of the vital concern of IE. Method improvement means how much efficient method a process can be done. Reducing man power without hampering production & efficiency is one kind of method improvement. To control the productivity of a sewing line, sometimes we can develop some method. Method improvement reduce the cycle time, increase capacity & production. So, efficiency will be increased.

2.9 Over Capacity

Over capacity means, an operator doing the production more than her capacity. Or, one operator is doing highest production, but the next operator is not capable to give that production. As a result, gathering is happens & line turns into unbalance. So, from this kind of situation we can say that over capacity is one kind of wastage.

CHAPTER 3: METHODOLOGY & EXPERIMENTAL WORKS

3.1 Introduction of Item

This study was taken from a reputed readymade garment industry; Liz Fashion Industry Limited. Here we have selected a specific style of a polo shirt. Firstly, we had to complete some pre-production preparation for set up the layout properly & maintain the flow of production. After getting the plan from planning section, we have received the BOL (Bill of Operation List) paper. Then according to the BOL we have made the Paper Layout of that line. According to the paper layout the layout has been done. Our selected item details are here –

Buyer: Peak Performance

Style No: G78449

SMV: 20.713

Product Category: LS/SS Polo – All (Performance Wear Top)

Item Description: M Classic Cotton Polo R53 ORANGE FLARE S

Style Indicator: M Classic Cotton Polo

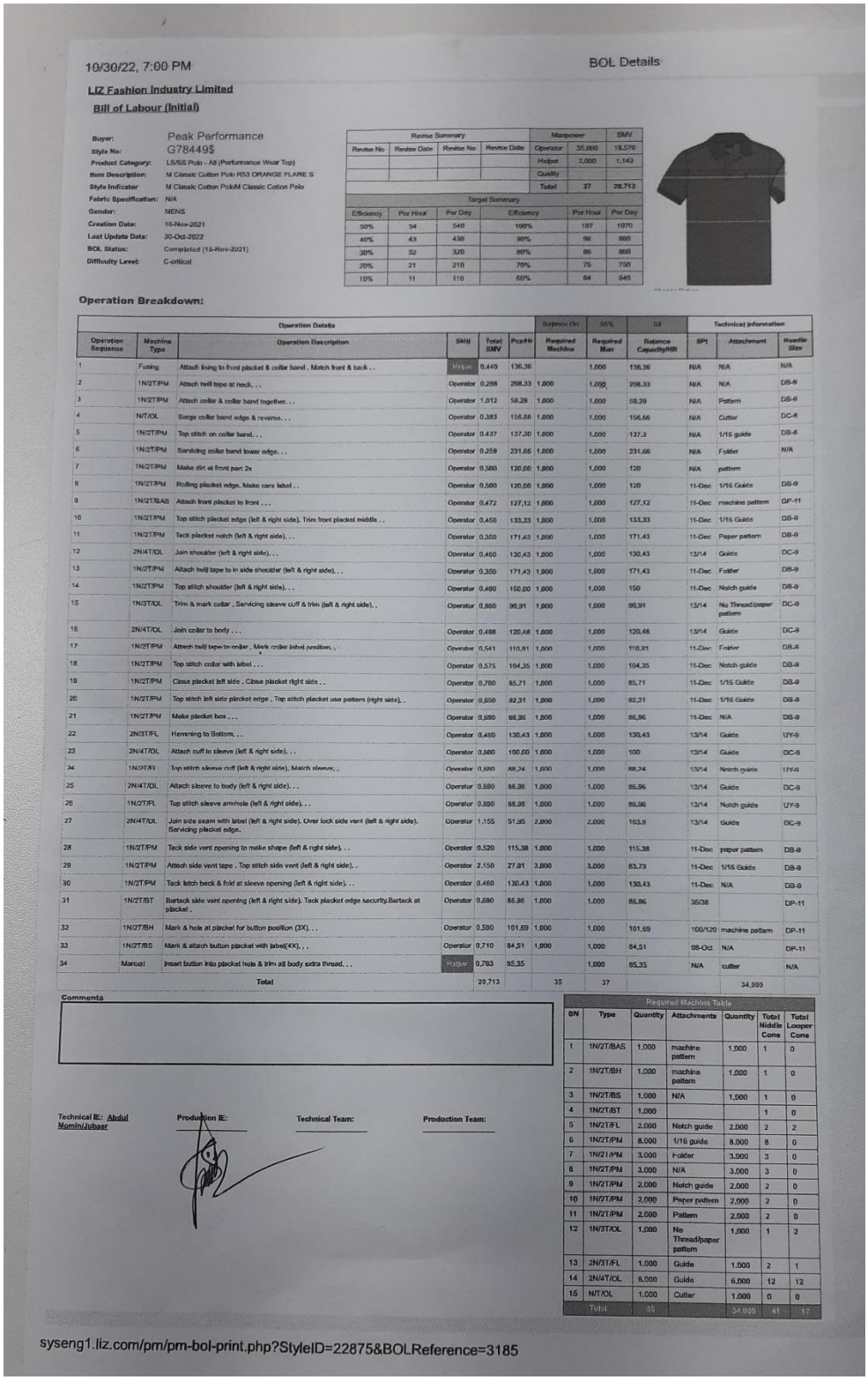
Gender: Men's

Difficulties Level: C – Critical

Figure 1 Polo Shirt

This item is a critical item. There are 34 processes of this item. "Join collar to body" is the most critical process of this style.

3.2 BOL (Bill of Operation List)



10/30/22, 7:00 PM BOL Details

LIZ Fashion Industry Limited

Bill of Labour (Initial)

Buyer: Peak Performance
Style No: G78449$
Product Category: LS/SS Polo - All (Performance Wear Top)
Item Description: M Classic Cotton Polo R53 ORANGE FLARE S
Style Indicator: M Classic Cotton PoloM Classic Cotton Polo
Fabric Specification: N/A
Gender: MENS
Creation Date: 16-Nov-2021
Last Update Date: 30-Oct-2022
BOL Status: Completed (16-Nov-2021)
Difficulty Level: C-critical

Revise Summary				Manpower		SMV
Revise No	Revise Date	Revise No	Revise Date	Operator	35.000	19.570
				Helper	2.000	1.143
				Quality		
				Total	37	20.713

Target Summary					
Efficiency	Per Hour	Per Day	Efficiency	Per Hour	Per Day
50%	54	540	100%	107	1070
40%	43	430	90%	96	860
30%	32	320	80%	86	860
20%	21	210	70%	75	750
10%	11	110	60%	64	640

Operation Breakdown:

Operation Details						Balance On	85%	58	Technical Information		
Operation Sequence	Machine Type	Operation Description	Skill	Total SMV	Pcs/Hr	Required Machine	Required Man	Balance Capacity/HR	SPI	Attachment	Needle Size
1	Fusing	Attach lining to front placket & collar band . Match front & back . .	Helper	0.440	136.36		1.000	136.36	N/A	N/A	N/A
2	1N/2T/PM	Attach twill tape at neck. . .	Operator	0.288	208.33	1.000	1.000	208.33	N/A	N/A	DB-9
3	1N/2T/PM	Attach collar & collar band together. . .	Operator	1.012	59.28	1.000	1.000	59.29	N/A	Pattern	DB-9
4	N/T/OL	Serge collar band edge & reverse. . .	Operator	0.383	156.66	1.000	1.000	156.66	N/A	Cutter	DC-6
5	1N/2T/PM	Top stitch on collar band. . .	Operator	0.437	137.30	1.000	1.000	137.3	N/A	1/16 guide	DB-8
6	1N/2T/PM	Servicing collar band lower edge. . .	Operator	0.259	231.66	1.000	1.000	231.66	N/A	Folder	N/A
7	1N/2T/PM	Make dirt at front part 2x	Operator	0.500	120.00	1.000	1.000	120	N/A	pattern	
8	1N/2T/PM	Rolling placket edge. Make care label . .	Operator	0.500	120.00	1.000	1.000	120	11-Dec	1/16 Guide	DB-9
9	1N/2T/BAS	Attach front placket to front . . .	Operator	0.472	127.12	1.000	1.000	127.12	11-Dec	machine pattern	DP-11
10	1N/2T/PM	Top stitch placket edge (left & right side). Trim front placket middle . .	Operator	0.450	133.33	1.000	1.000	133.33	11-Dec	1/16 Guide	DB-9
11	1N/2T/PM	Tack placket notch (left & right side). . .	Operator	0.350	171.43	1.000	1.000	171.43	11-Dec	Paper pattern	DB-9
12	2N/4T/OL	Join shoulder (left & right side). . .	Operator	0.460	130.43	1.000	1.000	130.43	13/14	Guide	DC-9
13	1N/2T/PM	Attach twill tape to in side shoulder (left & right side). . .	Operator	0.350	171.43	1.000	1.000	171.43	11-Dec	Folder	DB-9
14	1N/2T/PM	Top stitch shoulder (left & right side). . .	Operator	0.400	150.00	1.000	1.000	150	11-Dec	Notch guide	DB-9
15	1N/3T/OL	Trim & mark collar , Servicing sleeve cuff & trim (left & right side). .	Operator	0.660	90.91	1.000	1.000	90.91	13/14	No Thread/paper pattern	DC-9
16	2N/4T/OL	Join collar to body . . .	Operator	0.488	120.48	1.000	1.000	120.48	13/14	Guide	DC-9
17	1N/2T/PM	Attach twill tape to collar , Mark collar label position. .	Operator	0.541	110.91	1.000	1.000	110.91	11-Dec	Folder	DB-9
18	1N/2T/PM	Top stitch collar with label . . .	Operator	0.575	104.35	1.000	1.000	104.35	11-Dec	Notch guide	DB-9
19	1N/2T/PM	Close placket left side , Close placket right side . .	Operator	0.700	85.71	1.000	1.000	85.71	11-Dec	1/16 Guide	DB-9
20	1N/2T/PM	Top stitch left side placket edge , Top stitch placket use pattern (right side). .	Operator	0.650	92.31	1.000	1.000	92.31	11-Dec	1/16 Guide	DB-9
21	1N/2T/PM	Make placket box . . .	Operator	0.690	86.96	1.000	1.000	86.96	11-Dec	N/A	DB-9
22	2N/3T/FL	Hemming to Bottom. . .	Operator	0.460	130.43	1.000	1.000	130.43	13/14	Guide	UY-9
23	2N/4T/OL	Attach cuff to sleeve (left & right side). . .	Operator	0.600	100.00	1.000	1.000	100	13/14	Guide	DC-9
24	1N/2T/FL	Top stitch sleeve cuff (left & right side). Match sleeve. .	Operator	0.680	88.24	1.000	1.000	88.24	13/14	Notch guide	UY-9
25	2N/4T/OL	Attach sleeve to body (left & right side). . .	Operator	0.690	86.96	1.000	1.000	86.96	13/14	Guide	DC-9
26	1N/2T/FL	Top stitch sleeve armhole (left & right side). . .	Operator	0.690	86.96	1.000	1.000	86.96	13/14	Notch guide	UY-9
27	2N/4T/OL	Join side seam with label (left & right side). Over lock side vent (left & right side). Servicing placket edge.	Operator	1.155	51.95	2.000	2.000	103.9	13/14	Guide	DC-9
28	1N/2T/PM	Tack side vent opening to make shape (left & right side). . .	Operator	0.520	115.38	1.000	1.000	115.38	11-Dec	paper pattern	DB-9
29	1N/2T/PM	Attach side vent tape . Top stitch side vent (left & right side). .	Operator	2.150	27.91	3.000	3.000	83.73	11-Dec	1/16 Guide	DB-9
30	1N/2T/PM	Tack latch back & fold at sleeve opening (left & right side). . .	Operator	0.460	130.43	1.000	1.000	130.43	11-Dec	N/A	DB-9
31	1N/2T/BT	Bartack side vent opening (left & right side). Tack placket edge security.Bartack at placket .	Operator	0.690	86.96	1.000	1.000	86.96	35/38		DP-11
32	1N/2T/BH	Mark & hole at placket for button position (3X). . .	Operator	0.590	101.69	1.000	1.000	101.69	100/120	machine pattern	DP-11
33	1N/2T/BS	Mark & attach button placket with label(4X). . .	Operator	0.710	84.51	1.000	1.000	84.51	08-Oct	N/A	DP-11
34	Manual	Insert button into placket hole & trim all body extra thread. . .	Helper	0.703	85.35		1.000	85.35	N/A	cutter	N/A
		Total		20.713		35	37			34.000	

Comments

Technical IE: Abdul Momin/Jubaer
Production IE:
Technical Team:
Production Team:

Required Machine Table

SN	Type	Quantity	Attachments	Quantity	Total Niddle Cons	Total Looper Cone
1	1N/2T/BAS	1.000	machine pattern	1.000	1	0
2	1N/2T/BH	1.000	machine pattern	1.000	1	0
3	1N/2T/BS	1.000	N/A	1.000	1	0
4	1N/2T/BT	1.000			1	0
5	1N/2T/FL	2.000	Notch guide	2.000	2	2
6	1N/2T/PM	8.000	1/16 guide	8.000	8	0
7	1N/2T/PM	3.000	Folder	3.000	3	0
8	1N/2T/PM	3.000	N/A	3.000	3	0
9	1N/2T/PM	2.000	Notch guide	2.000	2	0
10	1N/2T/PM	2.000	Paper pattern	2.000	2	0
11	1N/2T/PM	2.000	Pattern	2.000	2	0
12	1N/3T/OL	1.000	No Thread/paper pattern	1.000	1	2
13	2N/3T/FL	1.000	Guide	1.000	2	1
14	2N/4T/OL	6.000	Guide	6.000	12	12
15	N/T/OL	1.000	Cutter	1.000	0	0
	Total	35		34.000	41	17

syseng1.liz.com/pm/pm-bol-print.php?StyleID=22875&BOLReference=3185

Figure 2 BOL of Polo Shirt; Style: G78449

Table 1 BOL of the Item

SL NO	M/C type	Operation Description	SMV
1	Fusing	Attach ling to front placket & collar band, match front & back	0.440
2	1N/2T/PM	Attach twill tape at neck	0.288
3	1N/2T/PM	Attach collar & collar band together	1.012
4	N/T/OL	Serge collar band edge & reverse	0.383
5	1N/2T/PM	Top stitch at collar band	0.437
6	1N/2T/PM	Servicing collar band lower edge	0.259
7	1N/2T/PM	Make dirt at front part 2X	0.500
8	1N/2T/PM	Rolling placket edge. Make care label	0.500
9	1N/2T/BAS	Attach front placket to front	0.472
10	1N/2T/PM	Top stitch placket edge (left & right edge). Trim front placket middle	0.450
11	1N/2T/PM	Tack placket notch (left & right side)	0.350
12	2N/4T/OL	Join shoulder (left & right side)	0.450
13	1N/2T/PM	Attach twill tape to inside shoulder (left & right side)	0.350
14	1N/2T/PM	Top stitch shoulder (left & right side)	0.400
15	1N/3T/OL	Trim & mark collar. Servicing sleeve cuff & trim (left & right side)	0.660
16	2N/4T/OL	Join collar to body	0.498
17	1N/2T/PM	Attach twill tape to collar. Mark collar joint position	0.541
18	1N/2T/PM	Top stitch collar with label	0.575
19	1N/2T/PM	Class placket left side. Close placket right side	0.700
20	1N/2T/PM	Top stitch left side placket edge. Top stitch placket use pattern (right side)	0.650
21	1N/2T/PM	Make placket box	0.690

22	2N/3T/FL	Hemming to bottom	0.460
23	2N/4T/OL	Attach cuff to sleeve (left & right side)	0.600
24	1N/2T/FL	Top stitch sleeve cuff (left & right side). Match sleeve	0.680
25	2N/4T/OL	Attach sleeve to body (left & right side)	0.690
26	1N/2T/FL	Top stitch sleeve armhole (left & right side)	0.690
27	2N/4T/OL	Join side seam with label (left & right side). Over lock side vent (left & right side). Servicing placket edge.	1.155
28	1N/2T/PM	Tack side vent opening to make shape (left & right side)	0.520
29	1N/2T/PM	Attach side vent tape. Top stitch side vent (left & right side)	2.150
30	1N/2T/PM	Tack latch back & fold at sleeve opening (left & right side)	0.460
31	1N/2T/BT	Bar Tack side vent opening (left & right side). Tack placket edge security. Bar Tack at placket	0.690
32	1N/2T/BH	Mark & hole at placket for button position (3XL)	0.590
33	1N/2T/BS	Mark & attach button placket with label (4XL)	0.710
34	MANUEL	Insert button into placket hole & trim all body extra thread	0.703
Total			20.713

3.3 Paper Layout of the Item

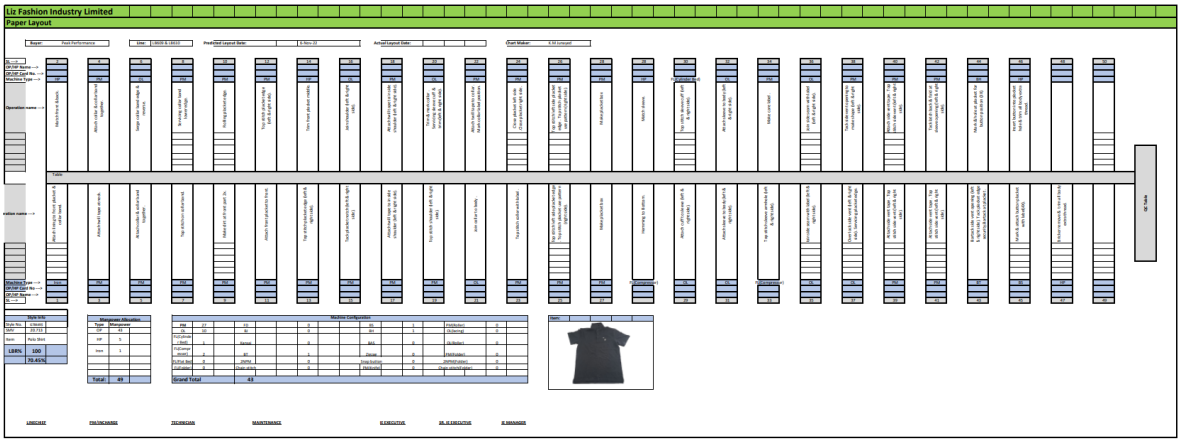


Figure 3 Paper Layout of the Line

3.4 Target of The Line

Targeted Efficiency: 65%

Target = (Total MP x Working Hour x 60) / SMV

= (36 x 8 x 60) / 20.713

= 834 pcs pcs/day

= 104 pcs/hour (For 100% Target Efficiency)

But in Liz Fashion Industry, according to their Ladder Paper, the targeted efficiency of SMV 20.713 is 65%.

So, for 65% efficiency, Target = 68 pcs/hour

3.5 Time Study of the Item

Table 2 Time Study of the Item

Date: 24th Nov 2022						
Sr No	Name	Operation Description	M/C type	Avg. Cycle Time	capacity	Total capacity
01	Najnin	Attach lining to front pocket and collar hand. Match front & back	Fusing	42	73	73
02	Nargis	Make dirt at front & trim	1N/1T/ PM	43	71	71
03	Alpona	Attach front placket to front	1N/1T/ PM	41	75	75
04	Lovely	Top stitch placket edge	1N/1T/ PM	49.5	62	62
05	Joripa	Rolling placket edge & trim	1N/1T/ PM	48.2	63	63
06	Airen	Top stitch placket edge	1N/1T/ PM	49	62	62
07	Rashida	Tack placket notch	1N/1T/ PM	48	64	64
08	Rina	Shoulder Join	2N/4T/ OL	47.6	64	64
09	moriom	Attach twill tap to Shoulder join	1N/1T/ PM	28	109	109
10	Resmi	Top stitch shoulder	1N/1T/ PM	31.8	96	96
11	Mila	Attach twill tap with neck band	1N/1T/ PM	26.6	115	115
12	Sufia	Trim placket edge	Manual	34.4	89	89

13	Aleya	Join collar to body	1N/1T/ PM	202.4	15	63
14	Shirina	Join collar to body	1N/1T/ PM	234.4	13	
15	Rimu	Join collar to body	1N/1T/ PM	184	17	
16	Sumaiya	Join collar to body	1N/1T/ PM	171.6	18	
17	komola	Top stitch collar	1N/1T/ PM	42.3	72	72
18	Moriom	Trim collar edge	OL	45	68	68
19	Morjina	Tack collar and attach label	1N/1T/ PM	46	67	67
20	Asma	Top stitch at neck join	1N/1T/ PM	78	39	61
21	Aklima	Top stitch at neck join	1N/1T/ PM	141	22	
22	Sumi	Match all cut piece	Manuel	12	255	255
23	Aklima	Make label	1N/1T/ PM	21.8	140	140
24	Kohinur	Sleeve joining (both)	2N/4T/ OL	48.6	63	63
25	Rohiton	Heming button	3N/4T/ FL	48	64	64
26	Dolly	Side seam with label(both)	2M/4T/ OL	95	32	65
27	Marufa	Side seam with label(both)	2M/4T/ OL	93.4	33	
28	Moyna	Tack side vent opening to make shape	1N/1T/ PM	46.2	66	66

29	Ripa	Make side vent top	1N/1T/ PM	23.4	131	131
30	Parvin	Attach side vent top in both side	1N/1T/ PM	47	65	65
31	Kulsum	Top stitch side vent	1N/1T/ PM	63	49	93
32	Rubina	Top stitch side vent	1N/1T/ PM	68	44	
33	Soniya	Tack sleeve edge and placket	1N/1T/ PM	41	75	75
34	Ayesa	bar tack at side vent & placket edge	1N/1T/ BT	47.3	65	65
35	Laily	Button hole at placket	1N/1T/ BH	39	78	78
36	Yeasmin	Button attaching with marking	1N/1T/ BA	48	64	64

Here,

All the capacity has been calculated with considering 15% allowance. With 15% allowance total 1 hour = 3060 sec.

Bottle Neck Process is “Top Stitch at Neck”.

Average cycle time of BNP is 109.5 sec

Total Capacity of BNP is 61 pcs/hour

Total MP = 36

BNP MP = 2

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

= (20.713*60*2*100) / (36*109.5)

= 63% (without allowance)

The line balancing rate is 63%. It is the latest LBR% of that line. Initially Line balancing rate was very poor. Day by day, it has been increased by improving worker capacity & implementing different kind of methods.

Initially the total manpower was 34. But we couldn't meet the target efficiency with this number of MP. As a result, we had to add 2 more operators in bottleneck process.

3.2 Day 1 - Production

Date: 13th Nov 2022

Line No: 610

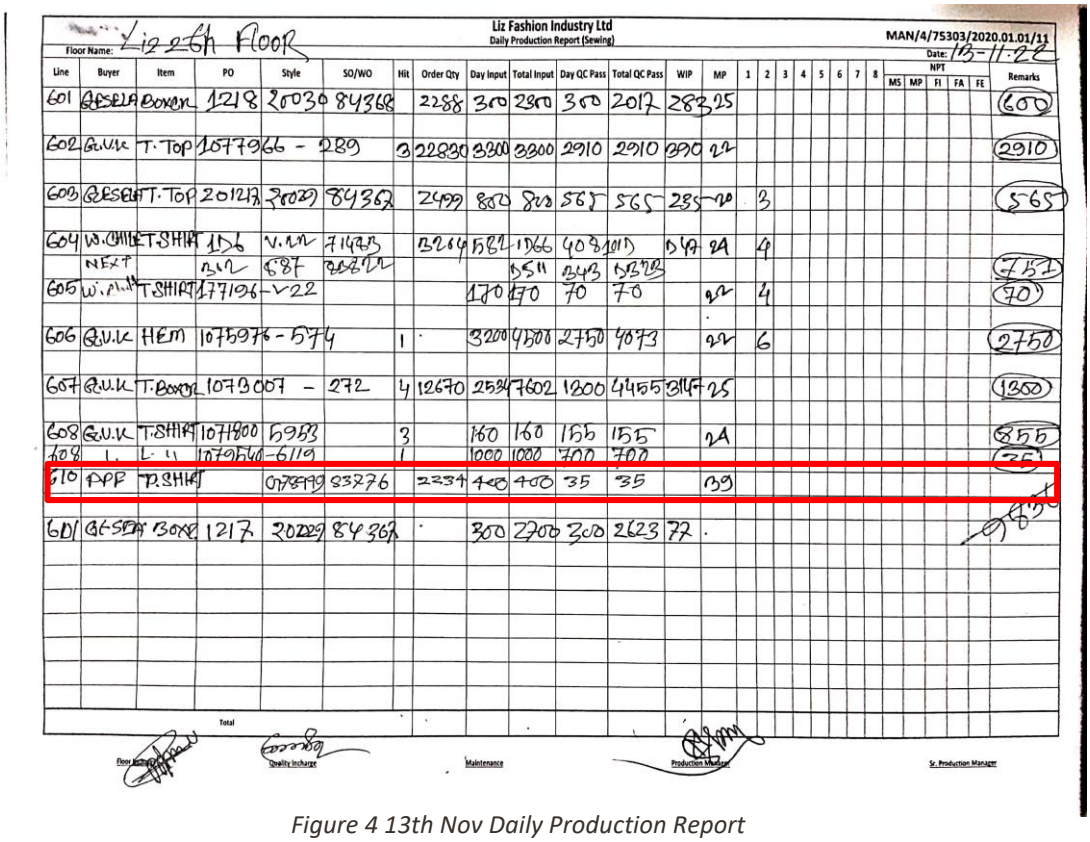


Figure 4 13th Nov Daily Production Report

3.2.1 Summary of Day 1

Table 3 Summery of Day-1 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
400	35	65%	4%	8.75%

3.2.2 LBR of Day 1

Total MP was 34

Bottleneck Process was “Join Collar to Body”

Table 4 Bottleneck of Day 1

Sr. No	Name	Process	M/C Types	Avg. Cycle Time (Sec)	Capacity	Total Capacity
1	Aleya	Join collar to body	1N/1T/PM	723	4	12
2	Shirina	Join collar to body	1N/1T/PM	809	4	
3	Rimu	Join collar to body	1N/1T/PM	683	4	

Average cycle time of BNP is 738 seconds

Total Capacity of BNP is 12 pcs/hour

Total MP = 34

BNP MP = 3

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

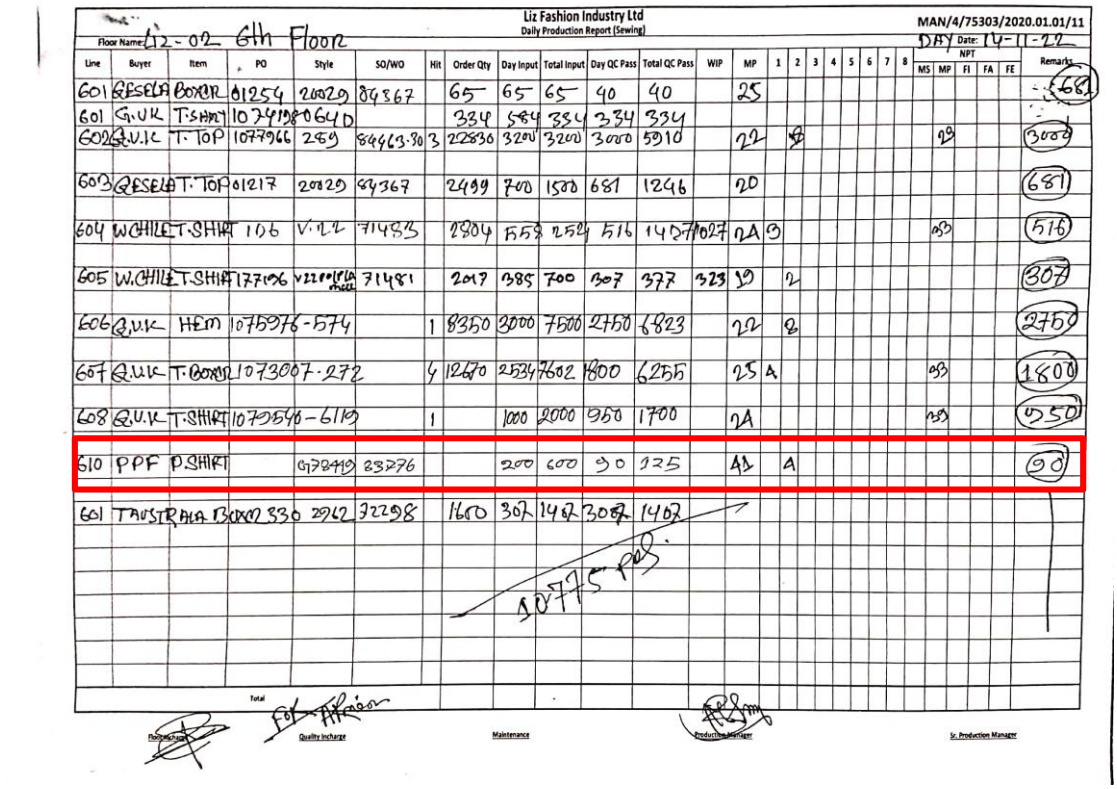
= (20.713*60*3*100) / (34*738)

= 15% (without allowance)

3.3 Day 2 - Production

Date: 14th Nov 2022

Line No: 610



Liz Fashion Industry Ltd
Daily Production Report (Sewing)
MAN/4/75303/2020.01.01/11

Floor Name: 12-02 6th Floor
DAY Date: 14-11-22

Line	Buyer	Item	PO	Style	SO/WO	Hit	Order Qty	Day Input	Total Input	Day QC Pass	Total QC Pass	WIP	MP	1	2	3	4	5	6	7	8	NPT MS	NPT MP	NPT FI	NPT FA	NPT FE	Remarks
601	QESELA	BOXER	01254	20029	84367		65	65	65	40	40		25														68
601	G.U.K	T.SHIRT	1074198064D				334	584	334	334	334																
602	G.U.K	T-TOP	1077966	259	84463-30	3	22830	3200	3200	3080	5910		22										22				3080
603	QESELA	T-TOP	01217	20029	84367		2499	700	1580	681	1246		20														681
604	W.CHILE	T.SHIRT	106	V-22	71483		2804	553	2524	516	1457	1027	22										03				516
605	W.CHILE	T.SHIRT	177106	V22	71481		2017	385	700	307	377	323	19		2												307
606	G.U.K	HEM	1075976-574			1	8350	3000	7500	2750	6823		22		8												2750
607	G.U.K	T-BOXER	1073007-272			4	12670	2534	7602	1800	6255		25	4									03				1800
608	G.U.K	T-SHIRT	1075546-6110			1		1000	2000	950	1700		22										03				550
610	PPF	P.SHIRT		G72449	23776			200	600	90	125		22		4												90
601	TAUSTRALIA	BOXER	330	2942	32298		1680	307	1467	3087	1467																

10775 pcs

Total

Floor In-charge | Quality Incharge | Maintenance | Production Manager | Sr. Production Manager

Figure 5 14th Nov Daily Production Report

3.3.1 Summary of Day 2

Table 5 Summery of Day-2 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
200	90	65%	11%	45%

3.3.2 LBR of Day 2

Total MP was 34

Bottleneck Process was “Join Collar to Body”

Table 6 Bottleneck of Day-2

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Aleya	Join collar to body	1N/1T/ PM	702	4	13
2	Shirina	Join collar to body	1N/1T/ PM	789	4	
3	Rimu	Join collar to body	1N/1T/ PM	657	5	

Average cycle time of BNP is 716 seconds

Total Capacity of BNP is 13 pcs/hour

Total MP = 34

BNP MP = 3

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

= (20.713*60*3*100) / (34*716)

= 15% (Without allowance)

3.2.3 What Have We Did?

The bottleneck process, "Join Collar to Body" was the most critical process in this line. They were using acrylic pattern for this process. It was not the requirement of Buyer. It's just a policy of this company. That's why the top management didn't allow us to do the process without pattern. If they allowed it, the capacity would have been definitely increased.

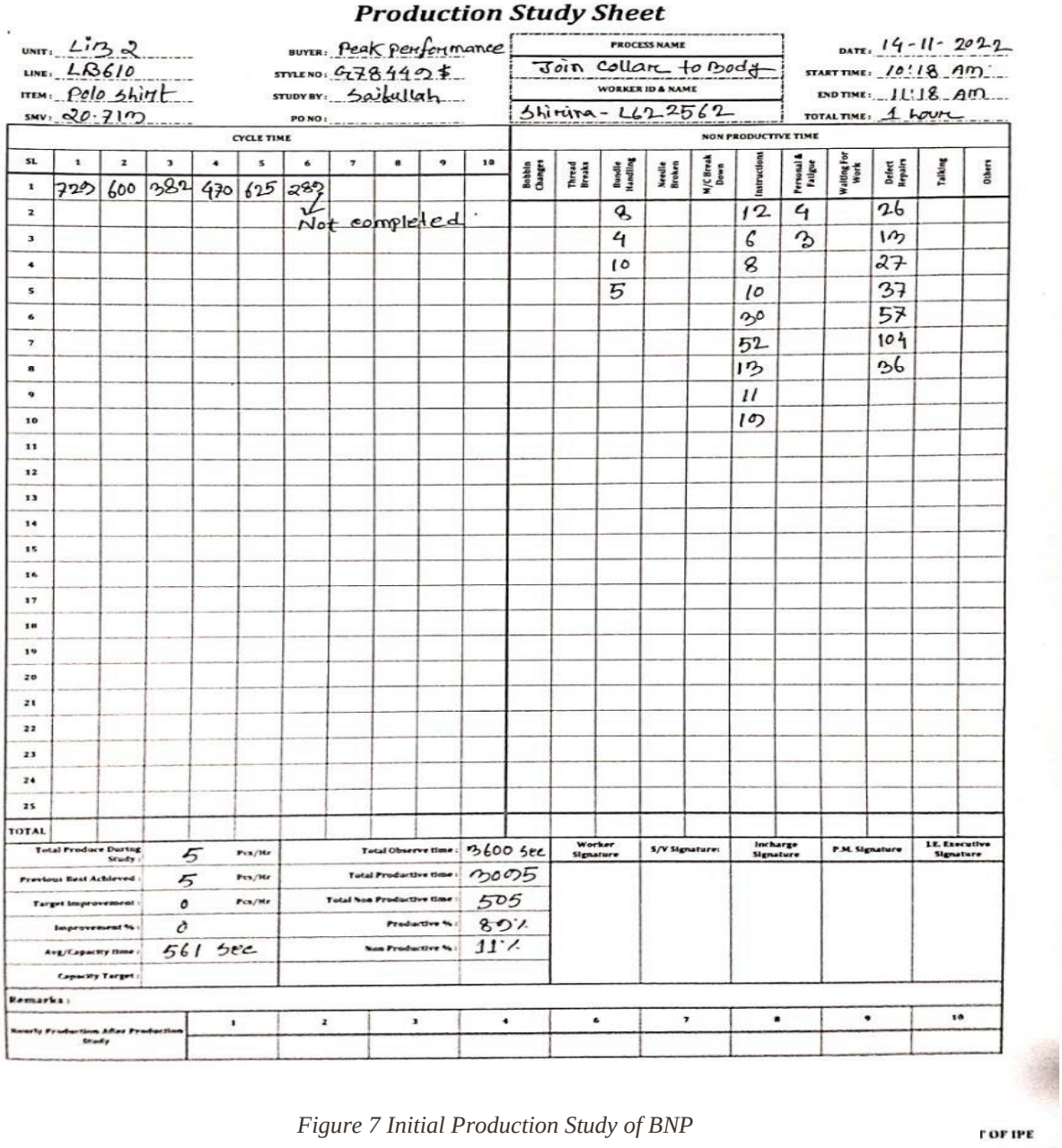
Figure 6 Process - Join Collar to Body

As per rule, we can't break the rules, then we have tried to increase the capacity of the operators by improving some motions. Firstly, we observed one operator, Shirina; Card No: L622562 & noticed that the cycle time of this process is too high because of using some excess motions those are not necessary to complete the process. She needs almost 789 seconds in average. Then we decided to do a production study of that operator to find out the problems, productive time & nonproductive time. But before starting the production study we have tried to improve the process by removing some excess motions those are taken by the operator during the operation. The following excess motions we removed from that process.

1. She was taking too much time to attach the both side gum tap in pattern. We told her not to attach the both side gum tap for each 2 body parts. As a result, the cycle time was updated.
2. She was aligning more & more for accuracy. But too much aligning is not necessary for accuracy. So, we told her to reduce the excess align motions. After reducing the excess align motion, her capacity was increased more.
3. After completing the process, she was checking the body parts again & again. We called a line QC to check the quality of the body part. The QC told there is no issue. So, we told the operator not to check the body part again & again. Just check it one time & dispose it. As a result, the capacity was increased more.

After removing these excess motions, we took a production study of that operator for that particular process.

Here, the lowest cycle time was 382 second. But in average it was around 561 second. Here, if we look after the production study sheet, we can see that the operator was taken



Production Study Sheet

UNIT: Lin 2 | BUYER: Peak performance | PROCESS NAME: Join Collar to Body | DATE: 14-11-2022
LINE: LB610 | STYLE NO: G78442$ | WORKER ID & NAME: Shirina - L62-2562 | START TIME: 10:18 AM
ITEM: Polo shirt | STUDY BY: Saikullah | END TIME: 11:18 AM
SMV: 20.71m | PO NO: | TOTAL TIME: 1 hour

SL	CYCLE TIME 1	2	3	4	5	6	7	8	9	10	NON PRODUCTIVE TIME: Bobbin Changes	Thread Breaks	Bundle Handling	Needle Broken	M/C Break Down	Instructions	Personal & Fatigue	Waiting For Work	Defect Repairs	Talking	Others
1	729	600	382	470	625	289 ✓ Not completed							8			12	4		26		
2													4			6	3		13		
3													10			8			27		
4													5			10			37		
5																30			57		
6																52			104		
7																13			36		
8																11					
9																10					
10																					
11																					
12																					
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17																					
18																					
19																					
20																					
21																					
22																					
23																					
24																					
25																					
TOTAL																					

Total Produce During Study: 5 Pcs/Hr	Total Observe time: 3600 Sec	Worker Signature	S/V Signature:	Incharge Signature	P.M. Signature	I.E. Executive Signature
Previous Best Achieved: 5 Pcs/Hr	Total Productive time: 3095					
Target Improvement: 0 Pcs/Hr	Total Non Productive time: 505					
Improvement %: 0	Productive %: 89%					
Avg/Capacity time: 561 Sec	Non Productive %: 11%					
Capacity Target:						

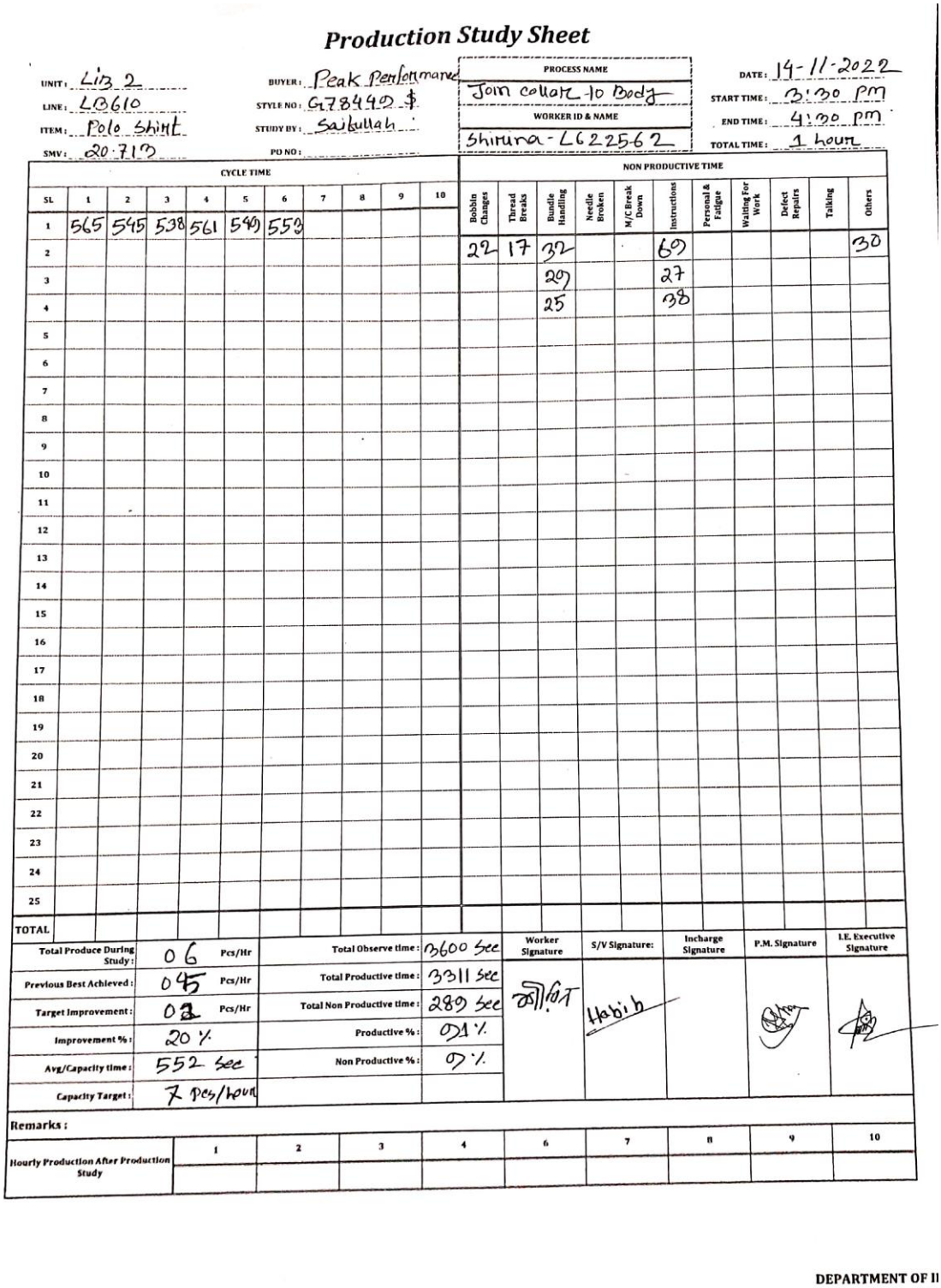
Remarks:

Hourly Production After Production Study	1	2	3	4	6	7	8	9	10

Figure 7 Initial Production Study of BNP

so many Non Productive Time. We have tried to decrease the NPT for this process.

After improving the motions of the process of that operator, we did another production study of that operator for 30 minutes.



Production Study Sheet

UNIT: Lib 2 | BUYER: Peak Performance | PROCESS NAME: Join collar to Body | DATE: 14-11-2022
LINE: LB610 | STYLE NO: G78442D-$ | WORKER ID & NAME: Shirina - LG22562 | START TIME: 3:30 PM
ITEM: Polo Shirt | STUDY BY: Saikullah | END TIME: 4:30 PM
SMV: 20.713 | PO NO: | TOTAL TIME: 1 hour

SL	CYCLE TIME 1	2	3	4	5	6	7	8	9	10	NON PRODUCTIVE TIME: Bobbin Changes	Thread Breaks	Bundle Handling	Needle Broken	M/C Break Down	Instructions	Personal & Fatigue	Waiting For Work	Defect Repairs	Talking	Others
1	565	545	538	561	540	553					22	17	32			69					30
2													29			27					
3													25			38					
4																					
5																					
6																					
7																					
8																					
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19																					
20																					
21																					
22																					
23																					
24																					
25																					
TOTAL																					

Total Produce During Study:	06 Pcs/Hr	Total Observe time:	3600 Sec	Worker Signature	S/V Signature:	Incharge Signature	P.M. Signature	I.E. Executive Signature
Previous Best Achieved:	045 Pcs/Hr	Total Productive time:	3311 Sec		Habib			
Target Improvement:	02 Pcs/Hr	Total Non Productive time:	289 Sec					
Improvement %:	20 %	Productive %:	91 %					
Avg/Capacity time:	552 Sec	Non Productive %:	9 %					
Capacity Target:	7 Pcs/Hour							

Remarks:

Hourly Production After Production Study	1	2	3	4	6	7	8	9	10

DEPARTMENT OF I

Figure 8 Production Study After Improvement

Here we got 6 pcs/hour & the average cycle time was 552 second. Though the difference between previous & after study is not too much, but if we compare with the previous day situation, we can understand that the improvement of that process is good. On previous day, operator gave 4 pcs/hour. But in previous day, it was just 4 pcs/hour. If

every operator gives 2 pcs more production, then the line capacity & efficiency will increase very much.

3.4 Day 3 - Production

Date: 15th Nov 2022

Line No: 610

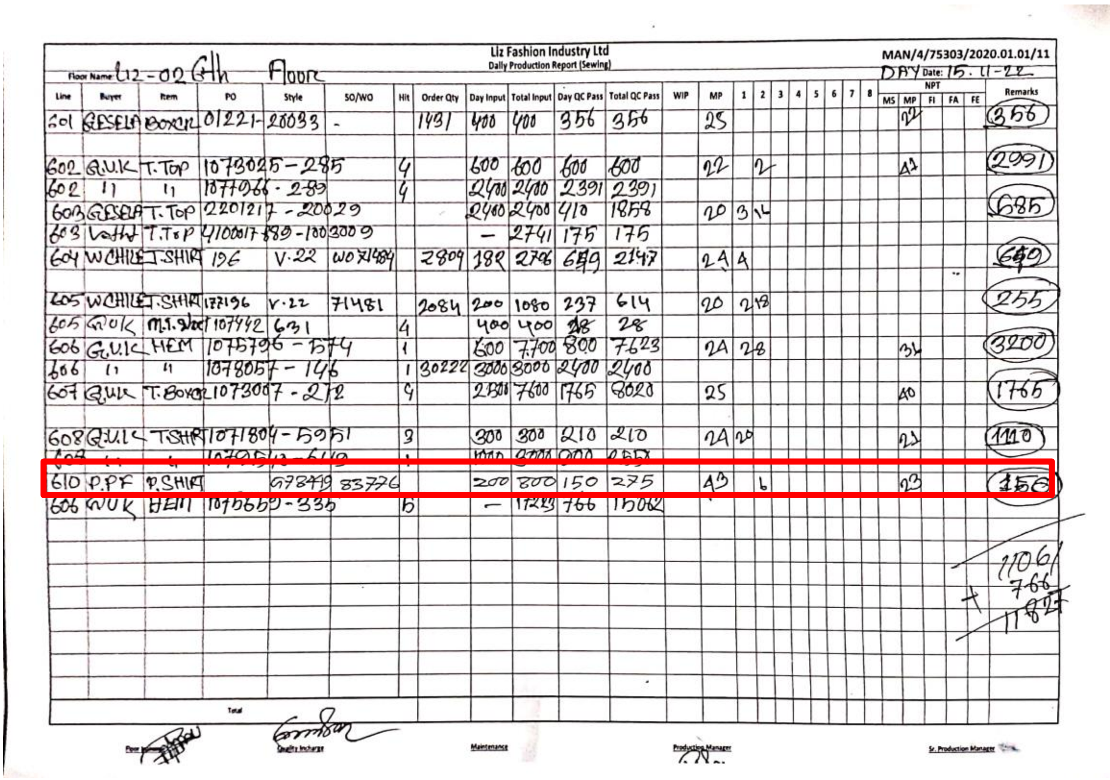


Figure 9 15th Nov Daily Production Report

3.4.1 Summary of Day 3

Table 7 Summery of Day-3 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
200	150	65%	19%	75%

3.4.2 LBR of Day 3

Total MP was 34

Bottleneck Process was “Join Collar to Body”

Table 8 Bottleneck of Day-3

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Aleya	Join collar to body	1N/1T/ PM	436	7	21
2	Shirina	Join collar to body	1N/1T/ PM	539	6	
3	Rimu	Join collar to body	1N/1T/ PM	406	8	

Average cycle time of BNP is 460 seconds

Total Capacity of BNP is 21 pcs/hour

Total MP = 34

BNP MP = 3

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

= (20.713*60*3*100) / (34*460)

= 24% (Without allowance)

Here, we noticed that, it is not possible to achieve the target efficiency with 3 manpower in the bottleneck process which is “Join Collar to Body”. That’s why decided to add one more manpower to this process. From next day, it was implemented.

3.5 Day 4 - Production

Date: 19th Nov 2022

Line No: 610

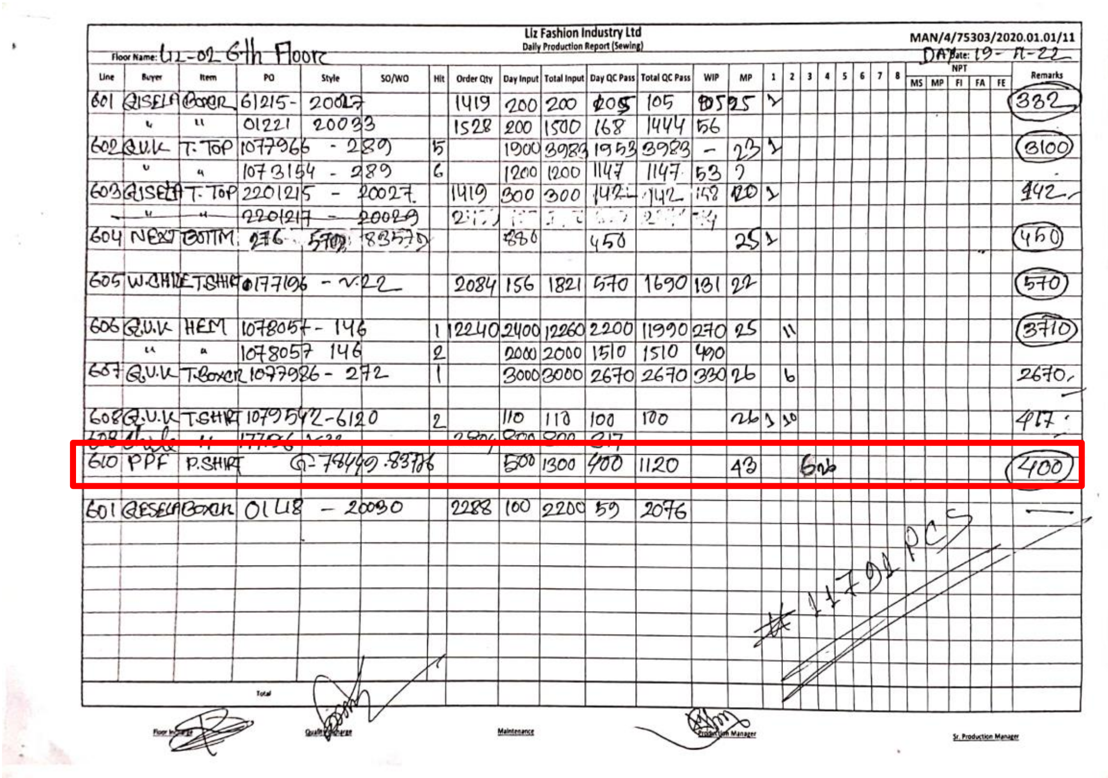


Figure 10 19th Nov Daily Production Report

3.5.1 Summary of Day 4

Here, 400 is not for only general 8 hours. This day 16 manpower were allocated for 3 hour OT. So, considering 3 hour OT for 16 manpower, the efficiency was,

Efficiency = (400*20.713*100) / {(35*8*60) + (16*3*60)}

Efficiency = 42%

So, the summery is,

Table 9 Summery of Day-4 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
500	400	65%	42%	80%

3.5.2 LBR of Day 4

After allocating new 1 more manpower at previous bottleneck process, “Join Collar to Body” the bottleneck has been changed. Now Bottleneck Process is “Top Stitch at Neck Join”

Table 10 Bottleneck of Day-4

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Asma	Top Stitch at Neck Join	1N/1T/ PM	83	37	37

Average cycle time of BNP is 83 seconds

Total Capacity of BNP is 37 pcs/hour

Total MP = 35

BNP MP = 1

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

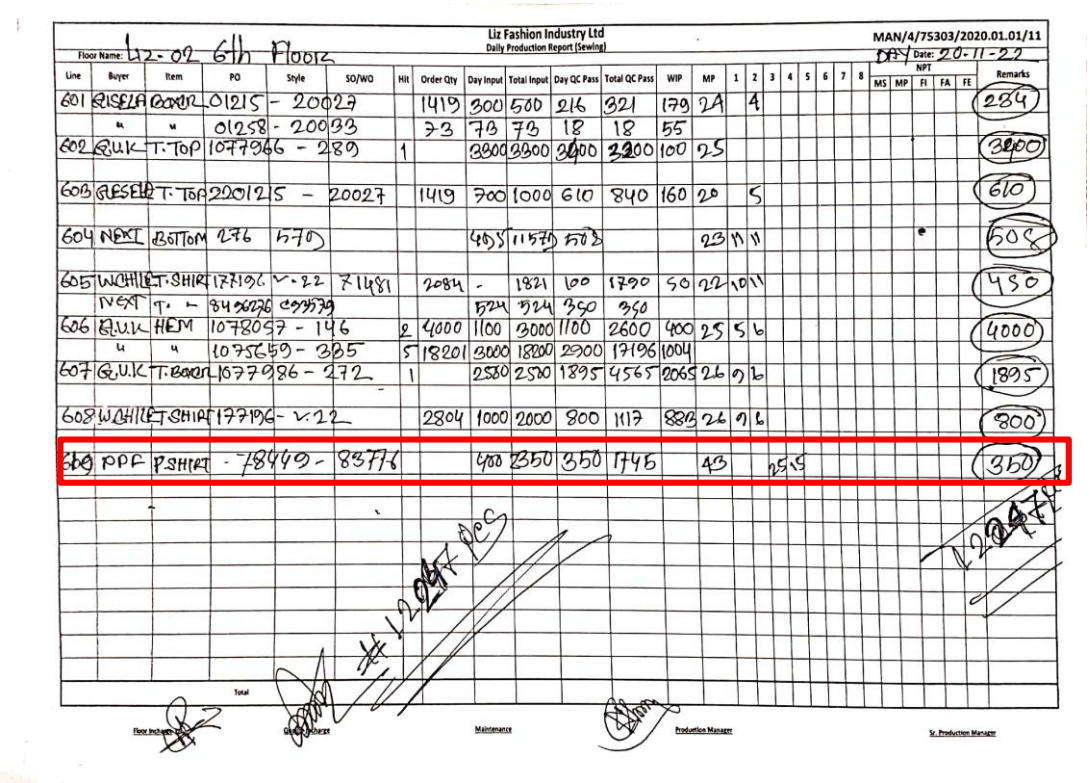
= (20.713*60*1*100) / (35*83)

= 43% (Without allowance)

3.6 Day 5 - Production

Date: 20th Nov 2022

Line No: 610



Liz Fashion Industry Ltd
Daily Production Report (Sewing)
MAN/4/75303/2020.01.01/11

Floor Name: 12-02 6th Floor | Date: 20-11-22

Line	Buyer	Item	PO	Style	SO/WO	Hit	Order Qty	Day Input	Total Input	Day QC Pass	Total QC Pass	WIP	MP	1	2	3	4	5	6	7	8	NPT MS	NPT MP	NPT FI	NPT FA	NPT FE	Remarks
601	RISELA	COVER	01215 - 20027				1419	300	500	216	321	179	24		4												284
	"	"	01258 - 20033				73	73	73	18	18	55															
602	Q.U.K	T. TOP	1077966 - 289			1		3300	3300	2400	2200	100	25														3300
603	RESELA	T. TOP	2201215 - 20027				1419	700	1000	610	840	160	20		5												610
604	NEXT	BOTTOM	276 - 570					465	1157	508			23	11	11												508
605	WHITE SHIRT		177196 - V22 - 71481				2084	-	1821	600	1790	50	22	10	11												450
	NEXT	T. -	84 36026 C99379					324	324	350	350																
606	Q.U.K	HEM	1078057 - 146			2	4000	1100	3000	1100	2600	400	25	5	6												4000
	"	"	1075659 - 385			5	18201	3000	18800	2900	17196	1004															
607	Q.U.K	T. BODY	1077986 - 272			1		2580	2580	1895	4565	2065	26	9	6												1895
608	WHITE SHIRT		177196 - V22				2804	1000	2000	800	1117	883	26	9	6												800
609	PPF	PSHIRT	- 78449 - 83776					400	2350	350	1745		43			25	9										350

Total

Floor In-charge | Quality In-charge | Maintenance | Production Manager | Sr. Production Manager

Figure 11 20th Nov Daily Production Report

3.6.1 Summary of Day 5

Here, 350 is not for only general 8 hours. This day 8 manpower were allocated for 1.5 hour OT. So, considering 1.5 hour OT for 8 manpower, the efficiency was,

Efficiency = (350*20.713*100) / {(35*8*60) + (8*1.5*60)}

Efficiency = 41%

So, the summery is,

Table 11 Summery of Day-5 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
400	350	65%	41%	88%

3.6.2 LBR of Day 5

Total MP was 35 & OT MP was 8

Bottleneck Process was “Top Stitch at Neck Join”

Table 12 Bottleneck of Day-5

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Asma	Top Stitch at Neck Join	1N/1T/ PM	80	38	38

Average cycle time of BNP is 80 seconds

Total Capacity of BNP is 38 pcs/hour

Total MP = 35

BNP MP = 1

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

= (20.713*60*1*100) / (35*80)

= 44% (Without allowance)

Here, we noticed that, it is not possible to achieve the target efficiency with only 1 manpower in the bottleneck process which is “Top Stitch at Neck”. That’s why decided to add one more manpower to this process. From next day, it was implemented.

3.7 Day 6 - Production

Date: 22th Nov 2022

Line No: 610

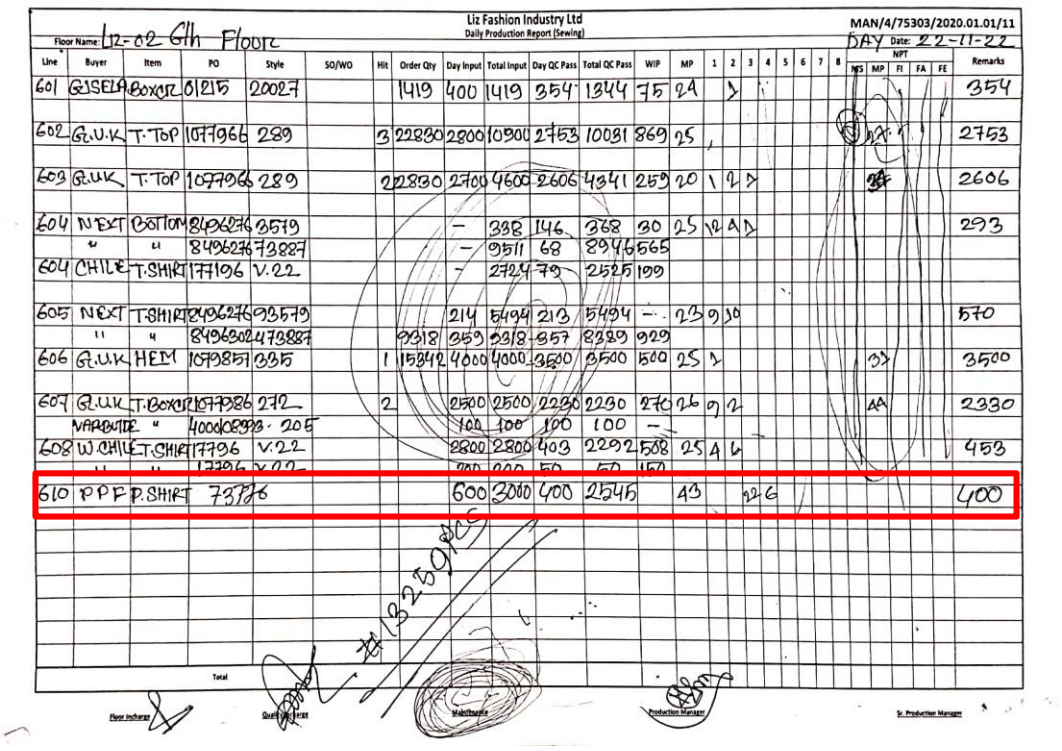


Figure 12 22th Nov Daily Production Report

3.7.1 Summary of Day 6

Table 13 Summery of Day-6 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
600	400	65%	48%	67%

3.7.2 LBR of Day 6

After adding 1 more manpower in bottleneck process “Top Stitch at Neck”, the capacity of the line has been increased & the Line Balancing Rate & Efficiency also increased. But still the Bottleneck Process was “Top Stitch at Neck Join”.

Table 14 Bottleneck of Day-6

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Asma	Top Stitch at Neck Join	1N/1T/ PM	78	39	60
2	Aklima	Top stitch at neck join	1N/1T/ PM	145	21	

Average cycle time of BNP is 111.5 seconds

Total Capacity of BNP is 60 pcs/hour

Total MP = 36

BNP MP = 2

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

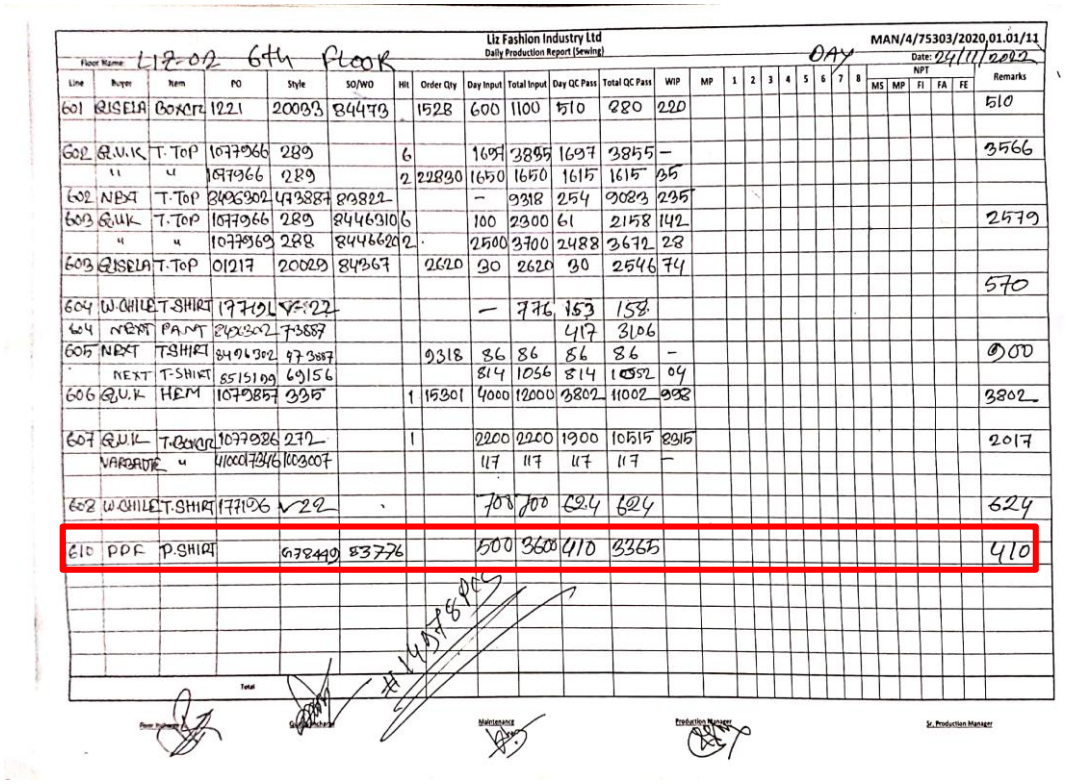
= (20.713*60*2*100) / (36*111.5)

= 62% (Without allowance)

3.8 Day 7 - Production

Date: 24th Nov 2022

Line No: 610



Liz Fashion Industry Ltd
Daily Production Report (Sewing)
MAN/4/75303/2020.01.01/11

Line	Buyer	Item	PO	Style	SO/WO	Hit	Order Qty	Day Input	Total Input	Day QC Pass	Total QC Pass	WIP	MP	Remarks
601	GISELA	BOXER	1221	20033	84479		1528	600	1100	510	880	220		510
602	Q.U.K	T-TOP	1077966	289		6		1697	3855	1697	3855	–		3566
	"	"	1077966	289		2	22830	1650	1650	1615	1615	35		
602	NEXT	T-TOP	8405302	473887	83822			–	9318	254	9023	235		
603	Q.U.K	T-TOP	1077966	289	84463106			100	2300	61	2158	142		2579
	"	"	1077969	288	84466202			2500	3700	2488	3672	28		
603	GISELA	T-TOP	01217	20029	84367		2620	90	2620	90	2546	74		
														570
604	W.CHILE	T-SHIRT	177191	V-22				–	776	153	158			
64	NEXT	PANT	8405302	473887						417	3106			
605	NEXT	TSHIRT	8405302	473887			9318	86	86	86	86	–		900
	NEXT	T-SHIRT	8515109	69156				814	1056	814	1052	04		
606	Q.U.K	HEM	1079857	335		1	15301	4000	12000	3802	11002	998		3802
607	Q.U.K	T-SHIRT	1077986	272		1		2200	2200	1900	10515	2915		2017
	VARSITY	"	4100473846	1003007				117	117	117	117	–		
602	W.CHILE	T-SHIRT	177196	V-22				700	700	624	624			624
610	PDF	P.SHIRT		678449	83776			500	3600	410	3365			410

Figure 13 24th Nov Daily Production Report

3.8.1 Summary of Day 7

Table 15 Summery of Day-7 Production

Day Input	Day QC Pass	Day Target Efficiency	Day Achieved Efficiency	Day Achieved Productivity
500	410	65%	49%	82%

3.8.2 LBR of Day 7

Total MP was 36

Bottleneck Process was “Top Stitch at Neck Join”

Table 16 Bottleneck of Day-7

Sr. No	Name	Process	M/C Types	Avg. Cycle Time	Capacity	Total Capacity
1	Asma	Top Stitch at Neck Join	1N/1T/ PM	78	39	61
2	Aklima	Top stitch at neck join	1N/1T/ PM	141	22	

Average cycle time of BNP is 109.5 seconds

Total Capacity of BNP is 61 pcs/hour

Total MP = 36

BNP MP = 2

LBR% = (SMV*60*Bottleneck Process Manpower*100) / (Total Manpower*BNP Avg. Cycle Time)

= (20.713*60*2*100) / (36*109.5)

= 63% (Without allowance)

CHAPTER 4: RESULT & DISCUSSION

4.1 Comparison of Day to Day Production & Efficiency

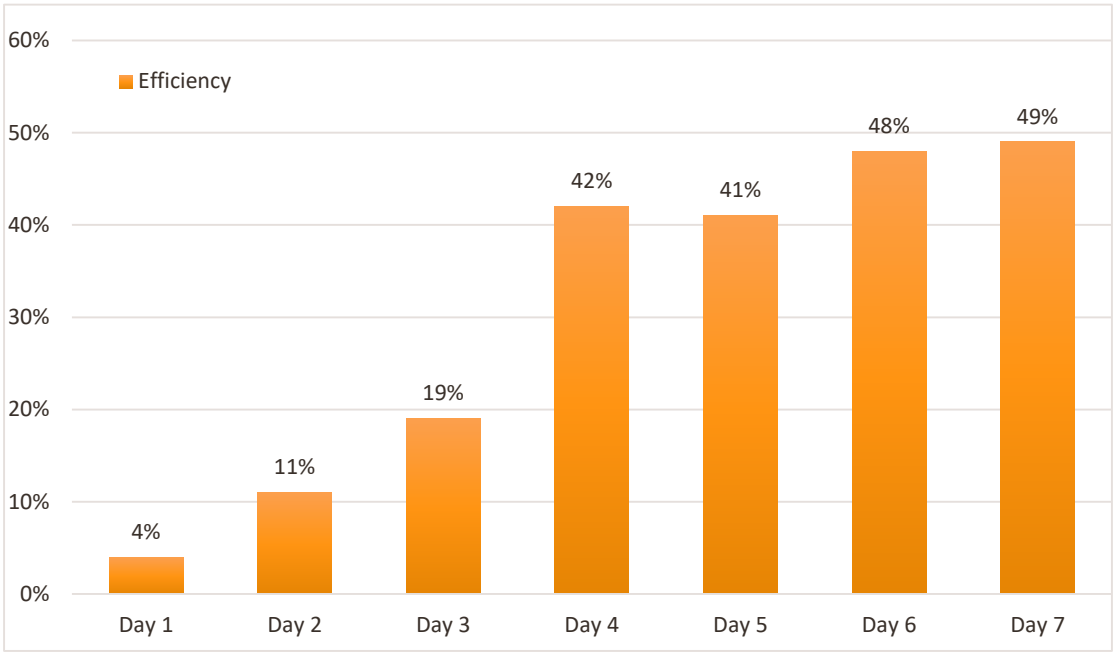
By analyzing the production of the line, the operators & their capacities, layout, motions & qualities, we have tried to implement some methods, motions & techniques to improve the productivity & efficiency. Here the productivity was calculated with following the formula,

Productivity = (Total Output/Total Input) x 100%

Efficiency = (QC pass x SMV x 100) / (Total MP x Working Hour x 60)

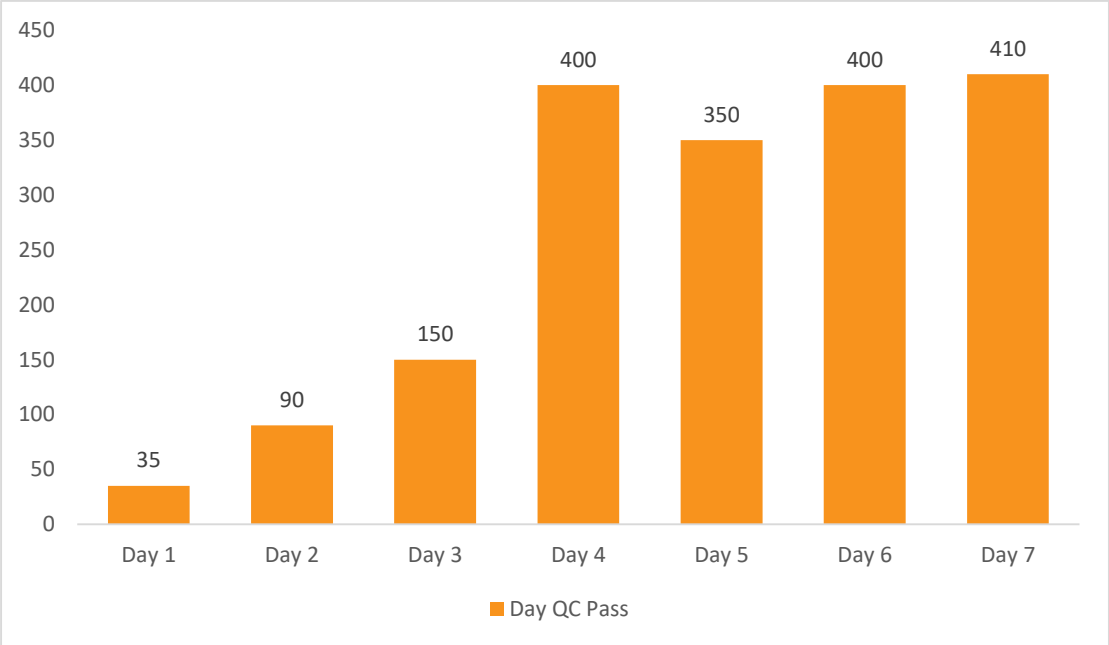
From day 1 to day 7 the efficiency has been increased gradually. The following chart shows the improvement of daily efficiency.

Table 17 Daily Efficiency Comparison of 7 Days



Here, the graph shows that the efficiency was gradually increasing. But in Day 5, the efficiency decrease 1% than the previous day. Because this day, we allocated so many operators in OT hour. But, the expected production was not reached. If we see the following chart about the daily qc pass of that line, it will be more visual. We can also understand the improvement situation of 7 days of that item.

Table 18 Comparison of Daily Production of Those 7 Days



4.2 Improvement & Replacement of Bottleneck Process

Bottleneck process is not fixed in a sewing line. Day to day, it improves & by improving the capacity of manpower, it replaces also. We have observed a sewing line for 7 days & there also bottleneck process was not fixed. We have found two process as bottleneck at those 7 days. From day 1 to day 3, it was **"Join Collar to Body"**. After improving the capacity of this process by adding extra manpower & removing their excess motions, we got the another bottleneck process that is, **"Top Stitch at Neck Join"**. If we see the details of bottleneck process of each observe day, we will be able to analyze the real situation of that sewing line.

4.3 Bottleneck Process Scenario

Bottleneck process capacity is also known as the line capacity. Because, to complete a whole garment, all the process need to complete. But if one process is giving the lowest production, then obviously the output will be low because of that particular bottleneck process. That's why the bottleneck process capacity is called line capacity & it is the most important job of an IE to increase the capacity of bottleneck process & make the line balance.

Here the table shows the details of bottleneck process of the observed days.

Table 19 Details of Bottleneck Process

Days	Bottleneck Process	BNP MP	Avg. Cycle Time	Capacity	LBR%	Line Efficiency
Day 1	Join Collar to Body	3	738	12	15%	4%
Day 2	Join Collar to Body	3	716	13	15%	11%
Day 3	Join Collar to Body	3	460	21	24%	19%
Day 4	Top Stitch at Neck Join	1	83	37	43%	42%
Day 5	Top Stitch at Neck Join	1	80	38	44%	41%
Day 6	Top Stitch at Neck Join	2	111.5	60	62%	48%
Day 7	Top Stitch at Neck Join	2	109.5	61	63%	49%

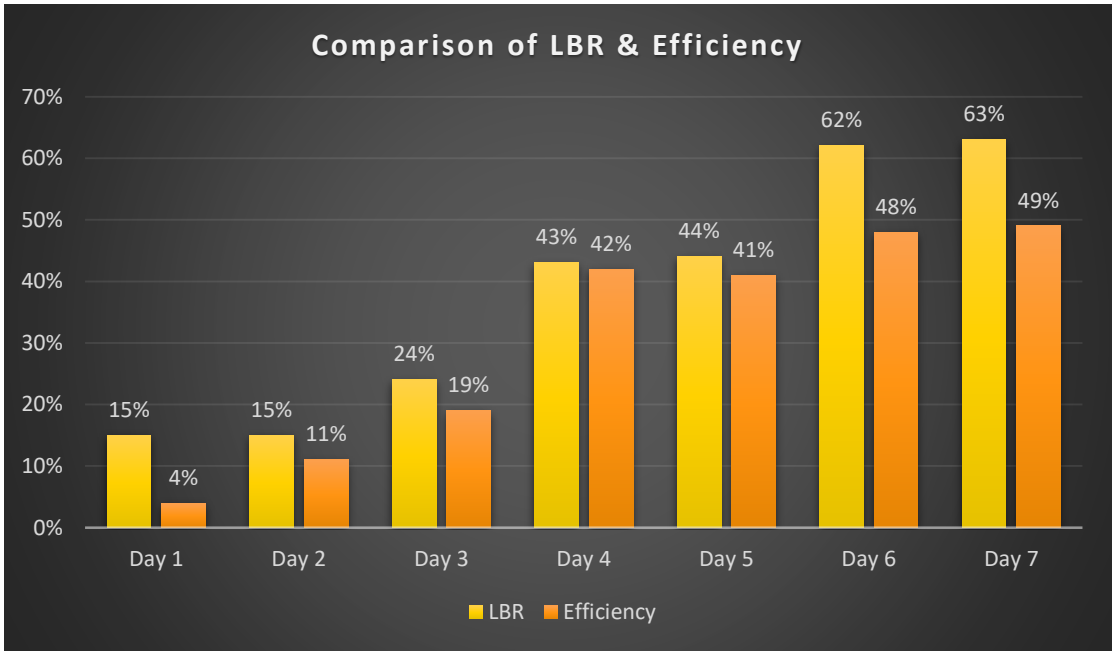
For first 3 days, bottleneck process was "Join Collar to Body" & for last 4 days it was "Top Stitch at Neck Join". As we mentioned in **"Day 2 of Chapter 3"** that, on first 2 days, average cycle time of the bottleneck process was too high & capacity was very low. So, in 2rd day, we removed so many unnecessary motions of 3 operators for that particular process. After removing those unnecessary motions, the average cycle time of that process has been increased & in Day-3, it was 460 seconds where in previous it was respectively 738 & 716 seconds. The capacity was increased. But still that process remains bottleneck. Then we decided to add an extra manpower in 4th day. The capacity increased so much & in 4th day, we got a new bottleneck process that is "Top Stitch at Neck Join".

In 4th Day, the average cycle time was 83 seconds for a single manpower. Her capacity was only 37 pcs. But the Line Target was 68 pcs/hour. We tried to increase her capacity by removing excess motions. But it didn't work enough. So, in 5th days, the capacity was not increased enough. Then we realized that we need to add one more manpower to this process. Otherwise line will not balance properly. So, from 6 days, there was 2 manpower for this process & and their capacity was 61 pcs in combine.

4.4 Comparison of Daily LBR% & Efficiency

LBR (Line Balancing Rate) is calculated by the capacity study. It indicates, how much balance the line is. That means, if we give the proper effort, we can achieve that label of efficiency. LBR% must be equal or higher than the efficiency. Because, LBR% gives the target. But whatever we achieve, those are the efficiency. So, efficiency will be always equal or, lower than the Line Balancing Rate. If we compare the graphical view of both of them in a graph it will be more easy to understand the difference between LBR% & Efficiency.

Table 20 Comparison of Daily LBR & Efficiency of the Line.



CONCLUSION

In sewing section of a garment industry, it is very important to develop the sewing lines to achieve the highest efficiency. Generally, we always try to improve capacity, method, motions etc. after completing the layout. But if we take the step to improve all of them during the layout, then the production will be much better from 1st day of layout. During the layout, technicians instructs the operators & helpers, how to do the work. But they don't know, how a work can be done in a better way. It's the job of IE. So, if IE can do this during layout, the line capacity, production & efficiency will definitely increase from the 1st day of the layout.

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