Implementation of Work Sharing Technique to Improve Line Efficiency in Sewing Section: A Case Study

Marzia Islam, Lecturer
Mst. Farzana Sultana, Lecturer
Md. Shafiqul Islam Chowdhury, Lecturer
Jaglul Hoque Mridha, Lecturer
Taposh Ranjan Sarker, Lecturer
Department of Textile Engineering, Northern University Bangladesh

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Abstract

This paper focuses on analyzing the garment processes and operation bulletin for a particular sewing line in Mahadi Fashion (PVT) Limited. The production rate of the existing layout was not close to the target. The target was 175 pieces per hour but actual production was 138 pieces per hour. So we analyzed the layout and found out the bottleneck area. Then we rearranged the workload by work sharing and reduced manpower. By doing so, actual production was 160 pieces per hour, which is near to the target, and line efficiency increased to 77%, where the existing sewing line layout was 55%. After reducing the bottleneck in sewing line capacity, we achieved 160 pieces per hour against the 138 pieces in the existing layout.

Keyword: Bottleneck, Layout, Line efficiency, Manpower, Work-sharing

Introduction

The world is becoming densely populated day by day and with the increase in population, the necessity of clothing is growing bigger. That is why the apparel industry is one of the most magnificent; besides, the garment industry is a section of central importance within the supply chain of the apparel industry. In Bangladesh, the garment industry has constructed itself as a single dominant industry within a single decade (Yunus et al., 2012). The production process of garments is individualized into four main phases: designing, fabric cutting, sewing, and ironing or packing. Of these, the more demanding phase is sewing because of entangling a greater number of operations. As the sewing line is composed of several operations, assembling apparel is a strenuous process. That is why the capacity of work continuously differs from person to person. To improve productivity and quality, the first step would be to identify the factors hampering productivity and to minimize them, which can easily gain quality as well as production in the sewing line. As it is known to all that the economic condition is changing very rapidly, it has become more important to focus on initial investment due to very high competition in the industrial area (Rajesh Bheda et al., 2003). As garment industries have been facing a challenging era, so are they keen on finding a process that can minimize the cost of manufacturing, can improve quality, etc. In apparel production, garments parts are assembled through a sub-assembly process, until the parts are composed into a finished product (Chan et al., 1998). The process of joining components together is the sewing process which is where labor is acute. For this reason, it makes a complex structure because some tasks need priority before assembling (Cooklin, 1991). As a result, good line balancing in the sewing line is needed to increase the efficiency and quality of production (Cooklin, 1991; Tyler, 1991; Chuter, 1988). The sewing line is composed of a set of workstations in which a certain task in a predetermined sequence is processed. Generally, one workstation is summed into one to several tasks (James Chen et al., 2012). In terms of productivity, the performance of the sewing section is very much important. To increase the performance, we need a balanced line which means designing a smooth production flow by allotting the processes to workers to allow each worker to finish their allotted workload within a certain time period (Amardeep et al., 2015). In the assembling line, balancing job allocation to the machine is dependent on the purpose of minimization of workflow among operators and the reduction of throughput time. Sharing the jobs of a work that is done by several people is called division of labor. It should be balanced in such a way that the time spent at each station is approximately the same, or equal operations should be carried out by each operator with proper and synchronized workflow, which is needed, such as short distance between stations, low volume of work in process, precise planning of time of production, and predictable production quantity (Eberle et al., 2004). Practically, the experience of sewing line managers can be used to attribute tasks to workstations based on the task sequence, standard time. For this reason, line balancing performance can vary from one manager to the other due to different work experiences (Olga Battaı et al., 2013). According to the labor skill level, operations are allocated to workers. Sequentially, several workstations are shaped like a sewing line and to balance the line efficiency, it is important to consider all the tasks to workstations to be equal as possible. In any case, if the unequal workload is assigned to workstations, this will eventually create a bottleneck that will increase WIP and hamper productivity, time, and cost (Pereira, 2013). So, finally, a planned line with an effective line sharing performance can facilitate the balancing of the workload of each operation to assure a smooth workflow in the sewing section so as to increase productivity.

2. Material and Methods

2.1 Material

Knit garments
Garments type: T-shirt
100% Cotton
GSM: 160

2.2 Methods

At first, a sewing line of t-shirts was chosen for balancing and required information was gathered from the line such as number of operator and helper, cycle time, target, and SMV. Then we took the time of each process needed for the completion of each worker. Then we found out the bottleneck area. At the numbers 6, 10, 12, and 17 operators, the capacity was higher than the previous operators, thus, work in process was high there. Two operators were reduced from the operation hem sleeve and attached sleeve to body and the number 6 operation was shared with number 5. Moreover, number 17 was removed and shared with the number 18 operator.

Therefore, the work process development of line balancing is done by this flow process.

Operation breakdown
↓
Leveling workload
↓
Calculating target, SMV, line efficiency
↓
Find out bottleneck area and Relocate the workload
↓
Calculate the line efficiency after balancing
↓
Represent the result graphically

Basic Time = Cycle Time * Rating
= 6 *0.80
= 4.80 Min

SMV = Basic Time + (Basic time * Allowance)
=4.80 + (4.80 * 15%)
=4.80 + .72
= 5.52

Target Calculation

Manpower = 19
S.M.V. = 5.52
Working Hour = 10

Wanted Eff % = 85 %

$$\text{Target} = \frac{\text{Manpower* Working hour* 60 * Efficiency}}{\text{SMV}}$$

$$= \frac{19 * 10 * 60 * 0.85}{5.52}$$

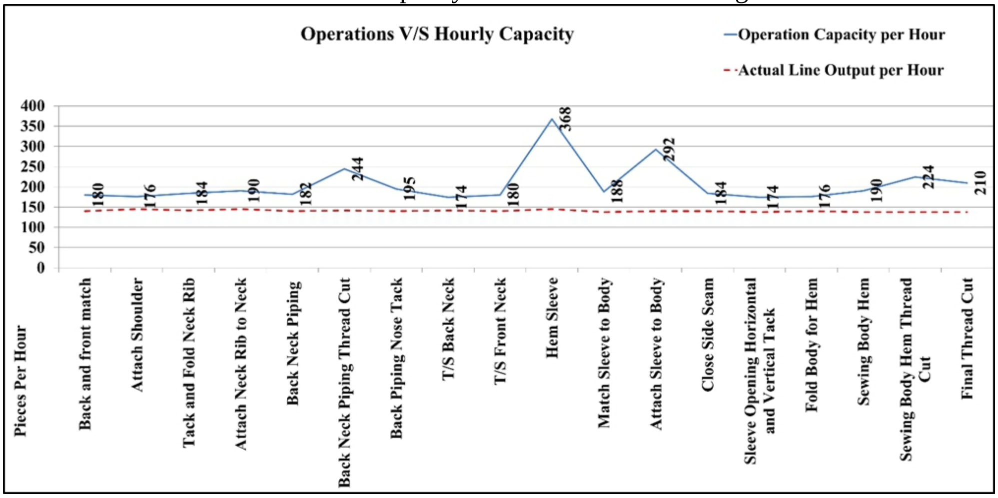
=1755 /10 Hour

3. Result and Discussion

Mahadi Fashion (Pvt) Ltd									
Capacity Study Based Pitch Diagram									
Buyer: Sisal		Sty # 6704	SMV	5.5					
S/L No	name	Operations	No. of Operators	Cycle Time With Allowance (In Minutes)	Operation Capacity per Hour	Line Capacity per Hour at 100%	Line Capacity per Hour at90 %	Actual Line Output per Hour	REMARKS
						100%	90%		
1	Moina	Back and front match	1	0.33	180	180	162	140	
2	Zorina	Attach Shoulder	1	0.34	176	176	158	145	
3	Sokina	Tack and Fold Neck Rib	1	0.33	184	184	165	142	
4	Aduri	Attach Neck Rib to Neck	1	0.32	190	190	171	145	
5	Karima	Back Neck Piping	1	0.33	182	182	164	140	
6	Rekha	Back Neck Piping Thread Cut	1	0.25	244	244	220	142	Bottleneck
7	Laizu	Back Piping Nose Tack	1	0.31	195	195	175	140	
8	Zosna	T/S Back Neck	1	0.34	174	174	157	142	
9	Hosna	T/S Front Neck	1	0.33	180	180	162	140	
10	Rabeya	Hem Sleeve	2	0.33	368	368	331	145	Bottleneck
11	Halima	Match Sleeve to Body	1	0.32	188	188	169	138	
12	Beauty	Attach Sleeve to Body	2	0.41	292	292	263	140	Bottleneck
13	Rehena	Close Side Seam	2	0.65	184	184	165	140	
14	Kolpona	Sleeve Opening Horizontal and Vertical Tack	2	0.69	174	174	157	138	
15	Sathi	Fold Body for Hem	1	0.34	176	176	158	140	
16	Bithi	Sewing Body Hem	1	0.32	190	190	171	138	
17	Rohima	Sewing Body Hem Thread Cut	1	0.27	224	224	202	138	Bottleneck
18	Sumi	Final Thread Cut	2	0.57	210	210	189	138	

3.1 Experimental Data (Before work-sharing)

Table 3.1. Capacity chart before work-sharing



Pre By IE	Floor Incharge	APM		IE Manager	GM

Figure 3.1. Control Chart of capacity before work-sharing

It is clear from the graph that in the 6, 10, 12, and 17 number operations, the bottleneck which occurred at those points capacity was higher than the previous operation.

3.2 Efficiency Calculation before Work-Sharing

Given,

Manpower = 23

Working Hour = 10

Actual Line Output = 1380 / 10 Hour

S.M.V. = 5.50

$$\text{Efficiency \%} = \frac{\text{Line Output} * \text{S.M.V.}}{\text{Manpower} * \text{Working Hour}}$$

$$= \frac{1380 * 5.5}{23 * 10 * 60} * 100$$

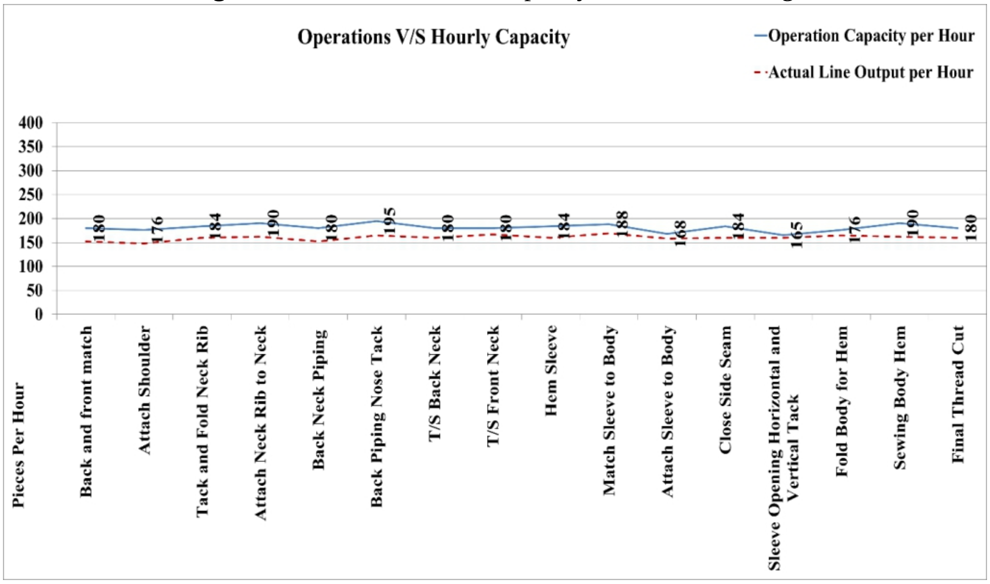
= 55 %

3.3 Experimental Data (After work-sharing):

Mahadi Fashion (Pvt) Ltd									
Capacity Study Based Pitch Diagram									
Buyer: Sisal		Sty # 6704	SMV	5.5					
S/L No	name	Operations	No. of Operators	Cycle Time With Allowance (In Minutes)	Operation Capacity per Hour	Line Capacity per Hour at 100%	Line Capacity per Hour at 90 %	Actual Line Output per Hour	REMARKS
						100%	90%		
1	Moina	Back and front match	1	0.33	180	180	162	152	
2	Zorina	Attach Shoulder	1	0.34	176	176	158	148	
3	Sokina	Tack and Fold Neck Rib	1	0.33	184	184	165	160	
4	Aduri	Attach Neck Rib to Neck	1	0.32	190	190	171	162	
5	Karima	Back Neck Piping	1	0.35	180	180	162	152	Back neck piping thread cut was done by Karima
6	Laizu	Back Piping Nose Tack	1	0.31	195	195	175	165	
7	Zosna	T/S Back Neck	1	0.34	180	180	162	160	
8	Hosna	T/S Front Neck	1	0.33	180	180	162	167	
9	Rabeya	Hem Sleeve	1	0.33	184	184	165	160	Reduce one worker
10	Halima	Match Sleeve to Body	1	0.32	188	188	169	169	
11	Beauty	Attach Sleeve to Body	1	0.39	168	168	162	158	Reduce one worker
12	Rehena	Close Side Seam	2	0.65	184	184	165	160	
13	Kolpona	Sleeve Opening Horizontal and Vertical Tack	2	0.73	165	165	149	160	
14	Sathi	Fold Body for Hem	1	0.34	176	176	158	165	
15	Bithi	Sewing Body Hem	1	0.32	190	190	171	162	
16	Sumi	Final Thread Cut	2	0.60	180	180	162	160	Sewing body hem thread cut was done by Sumi

Table 3.2. Capacity chart after work-sharing

Figure 3.2. Control Chart of capacity after work-sharing



From the graph, it has been seen that the capacity fluctuation was removed by removing the bottleneck. To do that, four manpower was reduced and some of the work was shared with other workers as shown in the table.

3.4 Efficiency Calculation after Work-Sharing

Manpower = 19
Working Hour = 10
Actual Line Output = 1600 / 10 Hour
S.M.V. = 5.50

$$\text{Efficiency\%} = \frac{\text{Line Output} * \text{S.M.V.}}{\text{Manpower} * \text{Working Hour}}$$

$$= \frac{1600 * 5.5}{19 * 10 * 60} *100$$

$$= 77\ \%$$

Conclusion

It can be concluded that the work-sharing technique is very effective in balancing the production lines without changing the product layout nor adding or subtracting any manpower. In this study, efficiency increase to 77% from 55% and capacity increase from 138 to 160 by work-sharing, also thereby increasing production.

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