



## Productivity Improvement in a Sewing Line Through Line Balancing in a Garment Manufacturing Company in the Philippines

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### ABSTRACT

In any manufacturing company, productivity in terms of quality and cost required in doing the operation is the topmost priority to be considered. Productivity improvement was studied through the use of time and motion study and line balancing concept in one of the clusters of a sewing line in a garment manufacturing company. Series of observations in the line and direct interviews among the regular personnel involved in the operation were done including the sewers, pressers, and supervisors in charge of the assembly line. It was noted that the average productivity rate of the selected assembly line was only seventy-one (71) percent way down below from their target output. Based on the findings of the study, plant layout was one of the contributing factors that causes bottleneck in the assembly line particularly in the pairing and aligning of cut goods. Task time involved in each process was studied and computed based on optimal number of manpower and expected productivity rate. In effect, combining the processes of pairing and aligning of cut goods in one line contributes great impact in reduction of machine requirements per process to improve the productivity rate of the company.

**Keywords:** *Productivity, Time and Motion Study, Line Balancing*

### I. INTRODUCTION

Productivity pertained to the effectiveness of a certain individual or an organization to produce goods or to render certain service over a period of time. Different approaches of productivity improvement were done from previous citations of Propster, Marz, Reinhart

and Intra (2015), where dynamic balancing is done for a high productivity mixed -model assembly line to handle the different assembly times of the variants. According to Chowdury MD. Luthfur Rahman (2010), the greatest problems the operation department is facing today are the high level of boredom, absenteeism, personnel turnover, and dissatisfaction among assembly-line workers. Luthfur Rahman (2010) worked in providing flexibility in assembly system wherein existing assembly line was redesigned considering possible alternatives while Bhagirath (2015) focused on the assessment of manpower efficiency to increase workers productivity for higher workers efficiency rate and performance. Commonly, previous studies focus on the worker or human factor improving productivity in a production line. The researchers of previous studies broke down the human factors and rearrange the processes in each line in order to balance the assembly line.

This study aims to produce higher productivity in one of the clusters of a sewing line in a garment manufacturing company. Analysis with the existing conditions were done such as human factors, state of the process, nature of the work, design of the process, requirement of the products and other more unseen factors within the line that contribute as a problem. All these factors were studied through an extensive application of time and motion study and line balancing technique to assess the assembly line.

### II. MATERIALS AND METHODS

In order to meet a more efficient productive line, the three pillars shown in the figure was considered such

as improving the cycle time, balance the line, and allocate optimal headcount to increase profitability of the company.

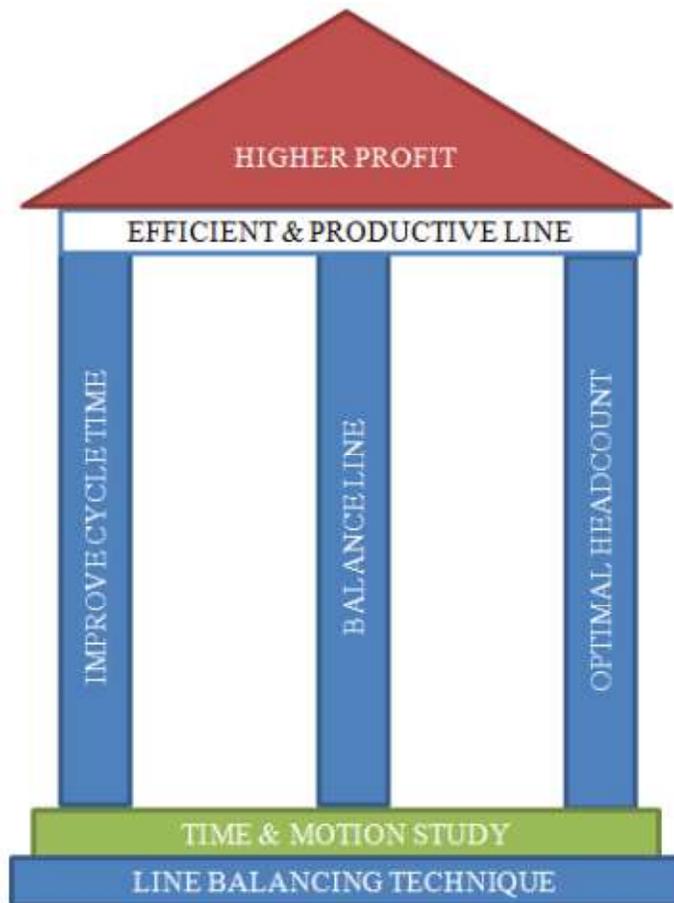


Figure1. Conceptual Framework of the study

This study uses descriptive method of research wherein data were gathered through actual observations and interview questionnaires regarding the operations within the assembly line were administered to the operators of the line including the Line Leader, Supervisors, Production Engineers and

Manager. Furthermore, the following tools were used as instrumentation of the study: Fishbone diagram to deeply analyze the root causes of the problems and relationships on how they contribute in affecting the assembly line; Pareto Diagram to graphically understand the occurrence of problems in each processes by ranking them into the most frequent and in order to find out which is the most contributing factor to problem within the sewing line; Time and Motion study to measure and record the existing cycle time of the operation and analyze the deficiencies in the existing cycle time of the operation and compute and set alternative standard time for the line; and Work Sampling Method to determine the amount of work, and delay, through work observation at random time.

### III. DISCUSSION AND RESULTS

For three (3) months of observation, some factors that affect the productivity of a sewing line were noted such as manpower, material or product, process and method of operation. Historical data of the previous weeks of operation of the line regarding their output per regular eight working hours per day were also looked into. Variation of garments being processed in the line was also considered as basis of assessing the present operation of the line. The results of time study done was assessed based on the current standards and actual observations in the line.

Current set up of one of the cluster in a sewing line of the garment company in terms of distance and transportation time between operations was shown in the table below.

Table1. Actual distance and time consumed in a line

NVA's per Operation	Movement Description	Current Distance (Meter)	Average Observed Time (sec)	Total Time Consumed (sec)
1	Going to Cut Goods Storage	4.82	17.969	148.62
	Getting & searching for Cut Goods		112.805	
	Going back to the Table		17.848	
2	Going to Cut Goods Storage	4.82	17.361	113.25
	Getting & searching for Cut Goods		99.497	
	Going back to the Table		16.39	
3	Going to Operator 5	5.115	12.882	28.961
	Getting Supply		4.501	
	Going back to the machine		11578	

Table 2: Current Task Time of Operation in a Sewing Line

Process no.	Process Description	Task Time (Min)
1	Press fuse back neck + Shoulder x2	0.476
2	Press fuse at sleeve Arm x2	1.155
3	Join Shoulder x2	0.404
4	Attach Sleeve at Arm Hole x2	1.144
5	Close Sleeves & sides x2	1.105
6	1" Fold Bottom x1	0.784
7	1" Fold Sleeve Opening Arm x2	0.683
8	Attach Piping to bottom front Center x2	0.601
9	Basting + Insert Piping End at Bottom x2	0.667
10	Bend back Piping Bottom front Center x2	0.758
11	Attach front-neck Piping cont. x1	0.672
12	Make Label	0.189
13	Attach main label to back neckline	0.497
14	Basting + Insert Piping End at front neck x2	0.667
15	Bend back front-neck Piping cont x1	0.918
16	Stitch lock Bend back End 4x	0.417
17	Attach Side Label	0.436
<b>TOTAL TIME</b>		<b>11.573</b>

The table above showed the current task time of each process in one of the clusters of sewing line of which was 11.573 minutes per garment, and currently used as the basis of computing the target output and productivity level of the line. The standard time of operation was measured plus the allowance factor of Twenty percent (20%) which was set by the GSD (General Sewing Development) Department.

Table 3: Current Task Time of Operation &amp; Average Time of Ten Trials of Observation of Time Study

Process no.	Process Description	Task Time (Min)	Time study: Task Time (Min)
1	Press fuse back neck + Shoulder x2	0.476	0.46
2	Press fuse at sleeve Arm x2	1.155	0.29
3	Join Shoulder x2	0.404	0.87
4	Attach Sleeve at Arm Hole x2	1.144	1.14
5	Close Sleeves & sides x2	1.105	1.96
6	1" Fold Bottom x1	0.784	1.33
7	1" Fold Sleeve Opening Arm x2	0.683	1.12
8	Attach Piping to bottom front Center x2	0.601	0.59
9	Basting + Insert Piping End at Bottom x2	0.667	0.64
10	Bend back Piping Bottom front Center x2	0.758	0.67
11	Attach front-neck Piping cont. x1	0.672	0.93
12	Make Label	0.189	0.70
13	Attach main label to back neckline	0.497	0.23
14	Basting + Insert Piping End at front neck x2	0.667	0.62
15	Bend back front-neck Piping cont x1	0.918	0.85
16	Stitch lock Bend back End 4x	0.417	0.91
17	Attach Side Label	0.436	0.42
<b>TOTAL TIME</b>		<b>11.573</b>	<b>13.91</b>

According to the result of the ten (10) trials of observation of time study, it was found out that the current and existing task time of operation of a Sewing Line which was 11.573 minutes did not match the observed time of 13.91 minutes. The current and existing task time of operation of a sewing Line was not updated and did not fit to the actual processing time of operation in the line.

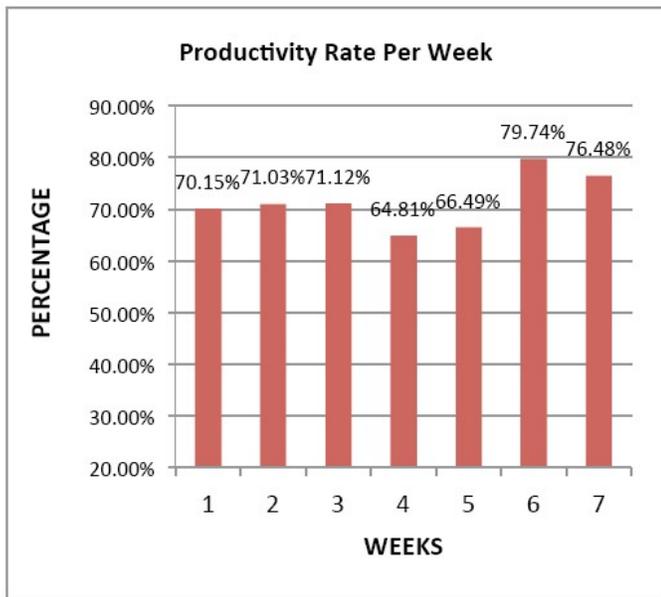


Figure 2: Productivity Rate per Week of a Sewing Line

per day was four hundred ninety-nine (499) units wherein an average of five (5) hours overtime per day was allocated in order to meet the desired output and an average of seventeen units (17) units per hour were lost due to inefficiency of the line.

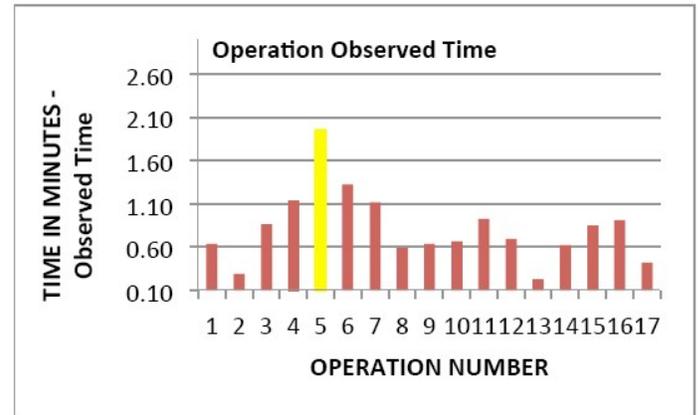


Figure 3: Bottleneck Operation of a Sewing Line

Figure 2 showed the inconsistency of productivity level of a Sewing Line which productivity level averages to only seventy-one percent (71%) and the highest productivity rate of the line per week was eighty percent (80) as reflected in the output per day which was the set target output of four hundred thirty-five (435) units per day. The average output produced

Figure 3 showed the time per process, the longest processing time of the line which was in operation 5 (close sleeves and sides) and the shortest was process 13 (attach main label to back neckline).

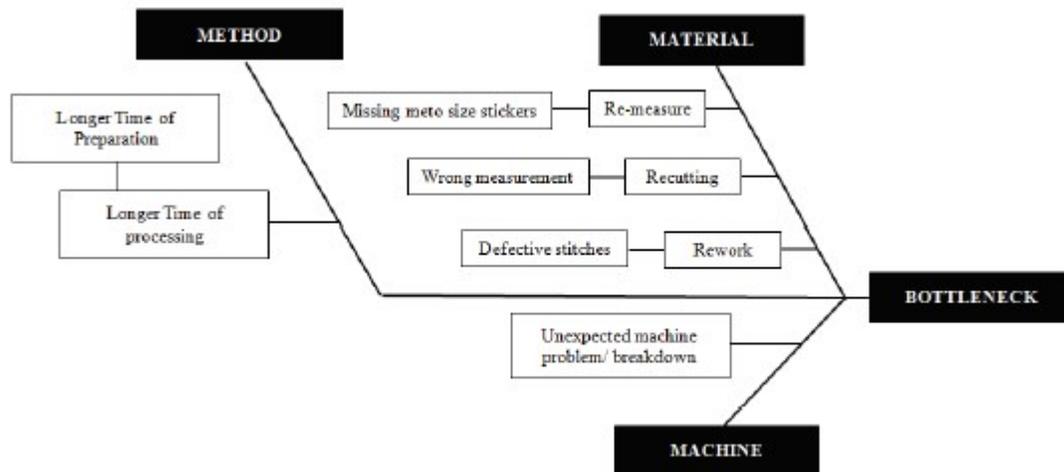


Figure4. Factors Affecting Bottleneck

Figure 4 showed the factors contributing to bottleneck based on the observation and interview conducted by the researchers in the line. Under this method, longer time of processing was rooted to the longer time of preparation of parts of the garment which was considered as non-value adding activity. For material, re-measuring due to missing meto-size stickers, re-cutting due to wrong measurement of the cut-goods and rework due to defective stitches was observed.

For machine, unexpected machine problem or breakdown was observed. There was no problem in manpower because all operators were regular workers and been working for almost ten (10) to twenty (20) years in the company which meant that they were already professional sewers and pressers. The factor over environment was disregarded since the facility was sufficiently ventilated and supplied with enough lighting.

Using work sampling technique for 5 days observation, it was identified that the most frequently occurring problem in the line among all the observed factors causing bottleneck in a sewing line was the time of preparation of cut goods such as pairing and aligning of parts during sewing operations which averages to 126 times per day and averagely consumes 44.09 minutes per day.

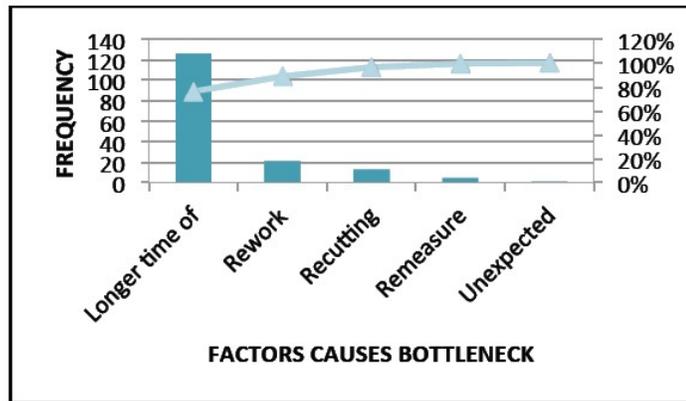


Figure 5: Occurrence of Factors Causing Bottleneck

Using Pareto Analysis, it was identified that the most contributing factor that caused bottleneck was the longer time of preparation of cut goods supply in the line.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the study, it can be concluded that the current standard time used in the Sewing Line was not updated and did not fit the current processing time of the line base on the 10 trial time study observation. An improper line layout of the line was not appropriate for cut goods storage, sewing machines and pressing machines due to distance travelled caused travel distance and improper process flow. Longer process time in pairing and aligning of cut goods was the most contributing factor that causes bottleneck which did not add value to the operation.

Also, since the normal time of operation of the line was outdated according to time study results, it would be better to update it to new standard time where proper setting of target output would be obtained. After assessing the possible alternatives in treating the root cause of bottleneck of the line which was the longer time of preparation such as pairing and aligning of the cut goods, it can be concluded that one possible solution was to combine processes that have same machine requirements in order to reduce the

preparatory time of pairing and aligning. Since balancing of the line through distribution of workload in each process was impossible due to different machine requirements per process, right manpower alignment and distribution would balance the operation of the line.

Updated standard time of operation in a Sewing Line gave it a proper baseline of computing for the target output. The existing twenty (21) operators could also be reduced into optimal eighteen (18) workers. Also, combination of process 4 and 5 was effective in reducing the time consumed by pairing and aligning parts of garments which was considered as non-value adding activity of the process, thus making the combined process more productive than the uncombined process. The new layout of the Sewing Line, where cut goods storage sewing machines and pressing machines were rearranged according to process sequence made the processing and product flow more smooth, thus helped eliminate and reduce travel distance consuming time. The current standard time and the proposed standard time of operation set in a Sewing Line was significantly different, thus the proposed standard time helped set a proper baseline in measuring the target output for the line and set optimal manpower allocation for the line to meet higher productivity.

For the next phase of improvement, it is recommended to to adopt 5's (Sort, Standardized, Set in order, Shine, Sustain) to properly control the flow of materials in the line by proper sorting of cut goods and to reduce the non-value adding activity such as preparation of cut goods due to unorganized flow of materials.

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