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Man Power Reduction in Moulding Operations through SWCT Study Technique

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Abstract

This paper discusses Standardized Work Combination Table technique which targets decreasing the non value added activity included exercises and thusly prompting decrease of Labor. This technique is carried out in a moulding process of an automobile manufacturing unit. SWCT is an effective tool which can help companies to reduce the manpower without automation and without affecting the work by complete utilization of Man hours. Standard work combination tables shows exactly how all the activities of work are performed. Standardization of work includes TAKT time calculation, U-shaped lines, Kaizen, visual management and time analysis. Basic information about man and machines are recorded and analyzed to arrive at an effective and efficient utilization of the facilities without stopping the production activity. Further, this paper discusses the use and application of Line balancing techniques to meet required creation rate with least or zero idle time. Finally, the paper reports an answer for improve the profitability in an assembling organization by improving the line balancing.

Keywords; *Line balancing, Material handling, SWCT, TAKT Time.*

I. INTRODUCTION

In manufacturing industries optimization of resource plays a vital role in improving the line. It has to be noted that improving productivity is a must to compete.

In order to achieve this, study on the methods of Material handling plays an important role during moulding process. It is observed that in most of the industry situations during Material Handling, Manpower will be usually deployed based on experience and there is no scientific method of deployment. However, the important aspect of indirect manpower is that they remain almost the same, irrespective of sales.

The standardized work combination table illustrates the combination of man work time, motion time, and machine operating time for each process in a production line. This is a more precise lean tool. It can be very useful to recognize the waiting time, over processing, and uneven distribution of work.

Line Balancing is balancing the workload among all the workers and in all processes by removing the bottlenecks and improves productivity. A well balanced lines results in reduced labour idleness and improves the efficiency of the workers

II. LITERATURE SURVEY

Many theories have been proposed to explain the Lean Tools to improve productivity in industries. This review will focus on major themes in the area

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of minimizing production cost by using Lean techniques in processing Industries. Sahebagowda et al [1] suggested Work standardization and lean manufacturing concepts helps in reducing number of line stoppages in the identified critical work stations. By adopting the concepts of lean manufacturing like 5S, kaizen and work standardization in LCV assembly shop the line Stoppages are reduced by 33% at identified critical station. Nurul Hayati Abdul Halim, Ahmed Jaffar et al [2] in paper focuses on the systematic application of SW in an automotive assembly production line which currently in the process of implementing TPS in order to sustain in the field of industry. Under this technique, parts are often produced much faster, leading to profits being collected during a shorter period of time. Concluded that the success of SW implementation is provided during a systematic manner with the assistance of effective data collection and analysis. Rishabh Mishra [3] suggested process are often improved supported by method study, working procedure and effective utilization of man, material and machine. It'll improve the present process by reducing the movements and labours fatigue. Dhruv Shah1 et al [4] in paper discussed about successful implementation of Lean Manufacturing is employed in small scale industries to enhance man, machine, method and environment, a core of producing industries. We will also suggest some change in steps of processes why using VSM through layout which might could also be efficient for workers to use it. By implementing Lean manufacturing techniques, excess inventory are often reduce, so we will manage to take care of inventory. R. Sundar et al [5] in their paper discussed that, any organization whether manufacturing or service oriented so as to survive may depend upon its ability to systematically and continuously answer the changes for enhancing the merchandise value. They're of the opinion that, value adding process is important to realize the perfection. The bulk of the study focuses on single aspect of lean element however for the successful implementation of lean, the organization has got to specialize in the aspects like U-line system, Value Stream Mapping, internal control, Cellular Manufacturing, Line Balancing, Pull System, Single Minute Exchange of Dies, Kanban.

III. PROBLEM STATEMENT

Based on the literature survey, it has been decided to identify solutions to reduce line delays, causes of unbalanced loads, issues with the change over and cycle time. There is a need to establish visual boards, line balancing techniques.

IV. OBJECTIVE

The objective is to reduce the Manpower through Standardized Work Combination Table (SWCT) analysis and to improve the productivity and efficiency of assembly line by implementing line balancing technique and to reduce machine cycle time variations and to reduce down time during processing of component

V. METHODOLOGY

The study involves the selection of mould for the component and to carry Gemba Walk to understand the process mapping and carry out time, motion study along with the spaghetti diagram. Further, to categorize the elementary operations to be performed with the help of Standardized Work Combination Table. The charts will be prepared to analyze the elements like value added time, non-value added time, set up time, number of workers etc. To analyze the lean tools, which may be applied to enhance the efficiency of the process.

VI. RESULTS AND DISCUSSION

A case study was conducted in an industry where assembly line faces the matter of fulfilling the targeted production plan. To satisfy the assembly plan, overtime work is carried out. This increases the production costs and reduces profit. The time taken for exchange of dies is extremely large and therefore the machine cycle time variation is erratic in nature. The assembly process involves a group of

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moulds, each mould has set of operators completing a selected task or tasks in a restricted sequence. It's important that tasks allocated to every operator as evenly as possible to avoid bottlenecks and excessive idle time. Line balancing involves assigning and balancing tasks between workstations of the production line so as to attenuate balance delay, labor pool and ultimately minimizing the production cost. The work mainly focuses on improving overall efficiency of assembly line by reducing the cycle time, non-value-added activities and distribution of labor load at each work station by line balancing.

Fig 1: Cover Fuel Tank Outer U129

The SWCT analysis is carried out for the automobile part Fuel Tank outer U129 shown in Fig 1 and the description is shown in Table 1.

Table 1: CFT Outer description

Part Name	**Cover Fuel Tank Outer U129 H2**
Machine Name	J550-AD-I
Standard Cycle Time	60
No of Operators Used	3 / Shift
Processes Involved	De flashing, De gating, Marking date & shift,Packing.
Total Man Time	77 seconds

Problem Analysis Through 4w-1h And Fish Bone Diagram

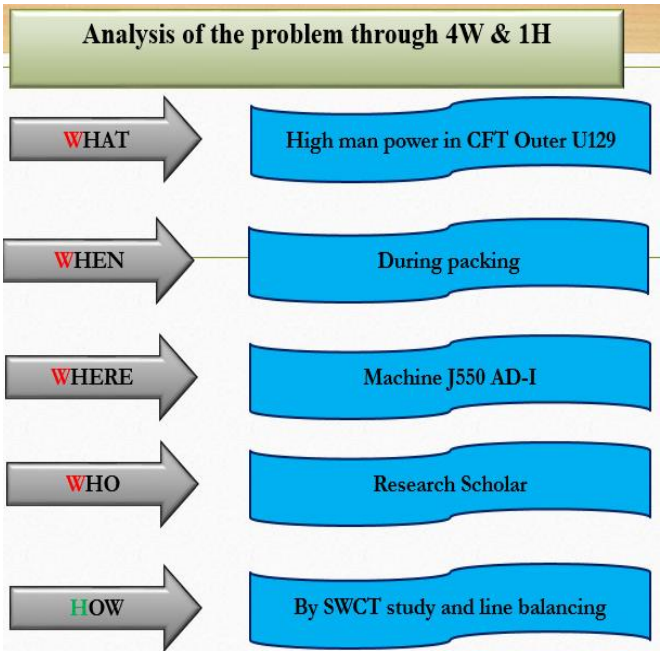

Fig 2: Problem analysis through 4W-1H

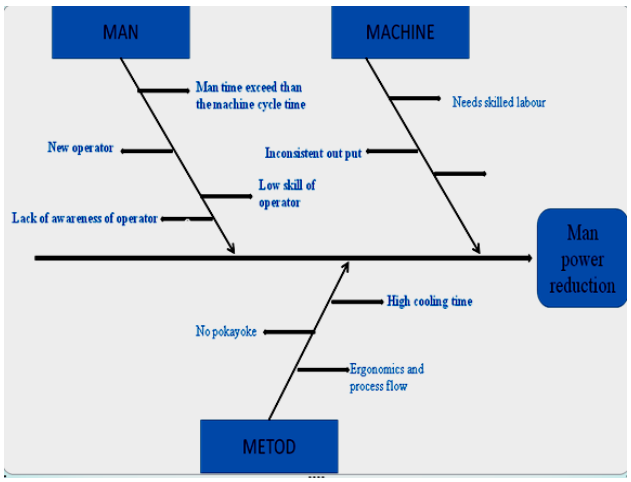

Fig 3: Cause and Effect Diagram

Fig 2 & Fig3 shows the 5 Why and 1 How methodology and the cause and effect diagram to address the issue.

SWCT Analysis:

Working Process flow of part CFT OUTER before Kaizen and Line Balancing is shown in the Fig 4. It has been identified through the study that there is a need to apply kaizen and line balancing techniques to address the issue.

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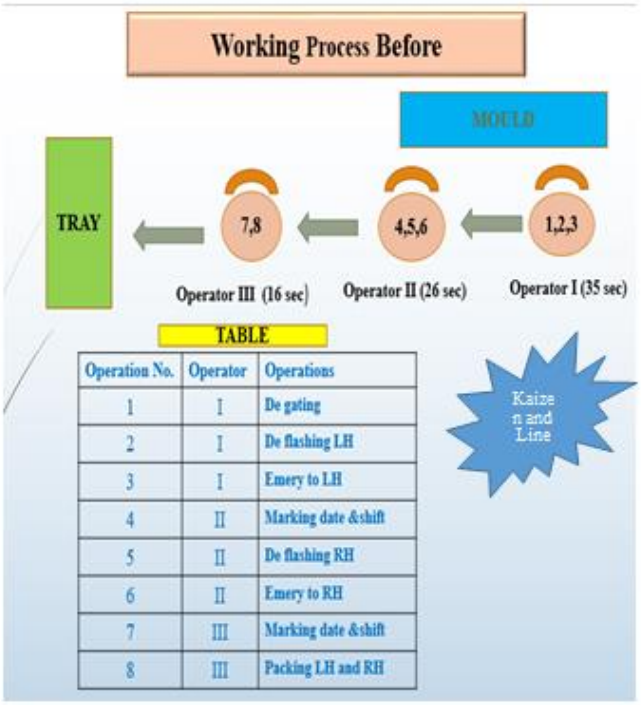

Fig 4: Working Process flow of part CFT OUTER before Kaizen and Line Balancing.

Fig 4 shows the working process flow of manufacturing part CFT outer before the implementation Kaizen and line balancing. The number of operations were 8 and number of operators working on the process were 3 and there were uneven work distribution among the operators.

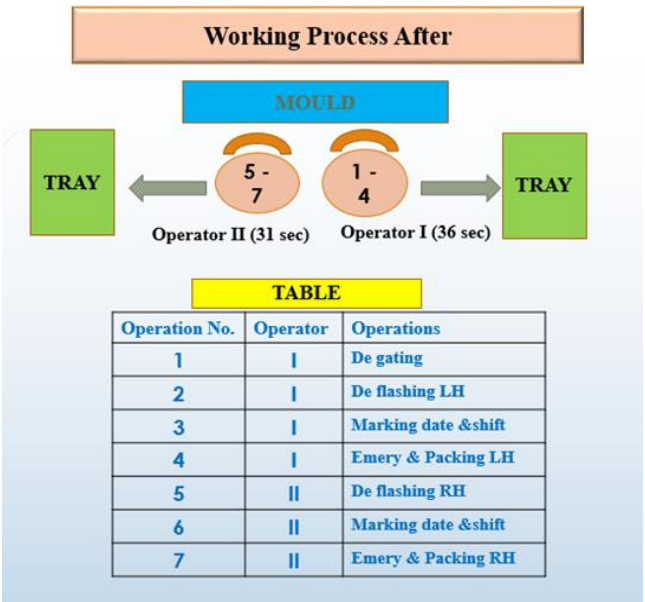

Fig 5: Working Process flow of part CFT OUTER after Kaizen and Line Balancing

Fig 5 shows the working process flow of manufacturing part CFT outer after the implementation Kaizen and line balancing. The number of operations were reduced to 7 from 8 and number of operators working on the process were reduced to 2 from 3 and the work was equally distributed among the operators.

Standardized Work Combination Table (SWCT)

The Standardized Work Combination Table is a combination of human movement and machine movement supported by takt time and is adopted as a tool to reduce labor and standardize the work sequence. SWCT is the basis for standardizing the process by analyzing the man hours and machine hours.

SWCT Before (Operator I)

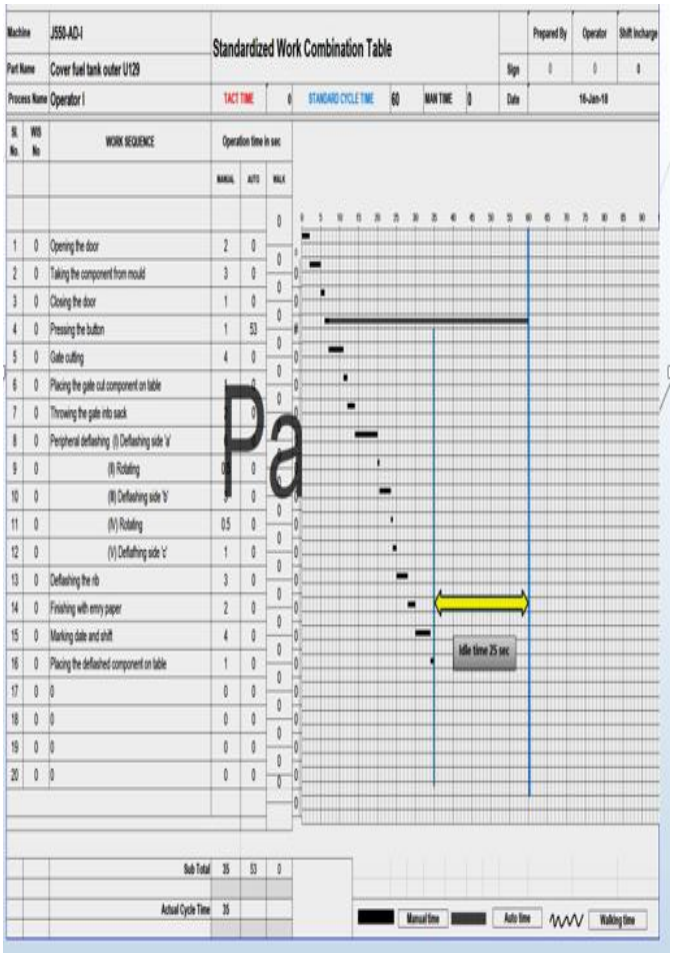

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Fig 6: SWCT analysis for Operator I before Kaizen and Line Balancing

The above SWCT chart shown in fig 6 illustrate the elementary work done by the operator I during moulding process of the part CFT OUTER before Kaizen and line balancing. The Machine cycle time is 60 sec and the idle time of Operator I during the moulding operation is 25 sec.

SWCT After (Operator I)

The SWCT chart shown in fig 7 illustrate the work done by the operator I during moulding process of the part CFT OUTER after the implementation of Kaizen and line balancing.

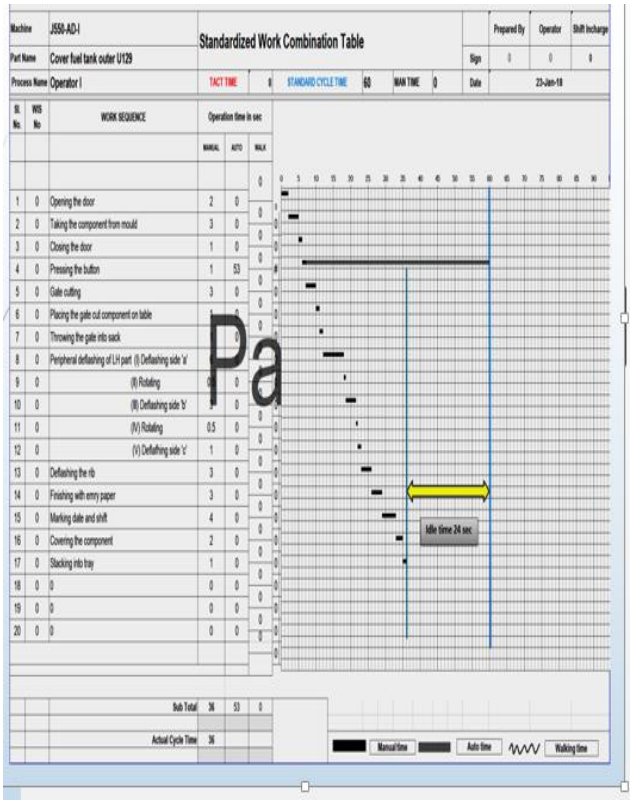

Fig 7: SWCT analysis for Operator I after man power reduction by Kaizen and Line Balancing.

The Machine cycle time is 60 sec and the idle time of Operator I during the moulding operation is 24 sec even after reducing one operator.

SWCT Before (Operator Ii)

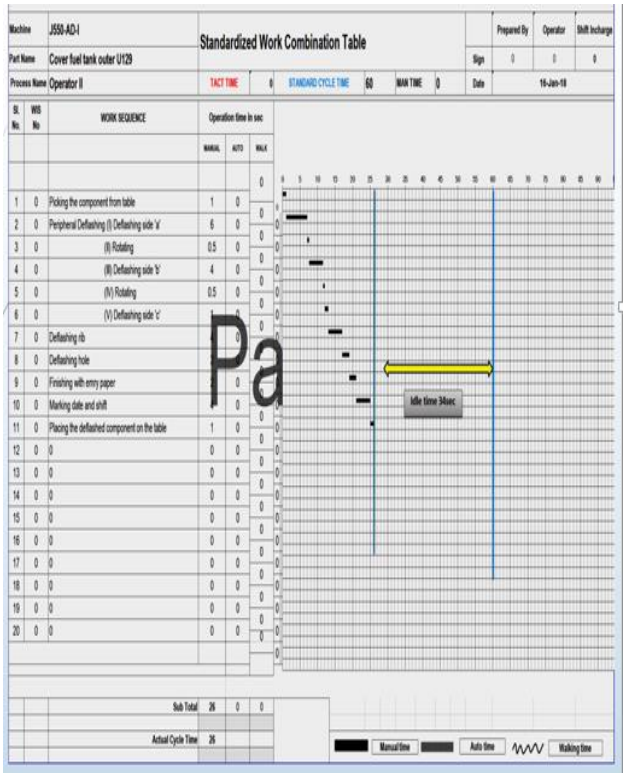

Fig 8: SWCT analysis for Operator II before Kaizen and Line Balancing.

The above SWCT chart shown in fig 8 illustrate the elementary work done by the operator II during moulding process of the part CFT OUTER before Kaizen and line balancing. The Machine cycle time is 60 sec and the idle time of Operator I during the moulding operation is 34 sec.

SWCT After (Operator II)

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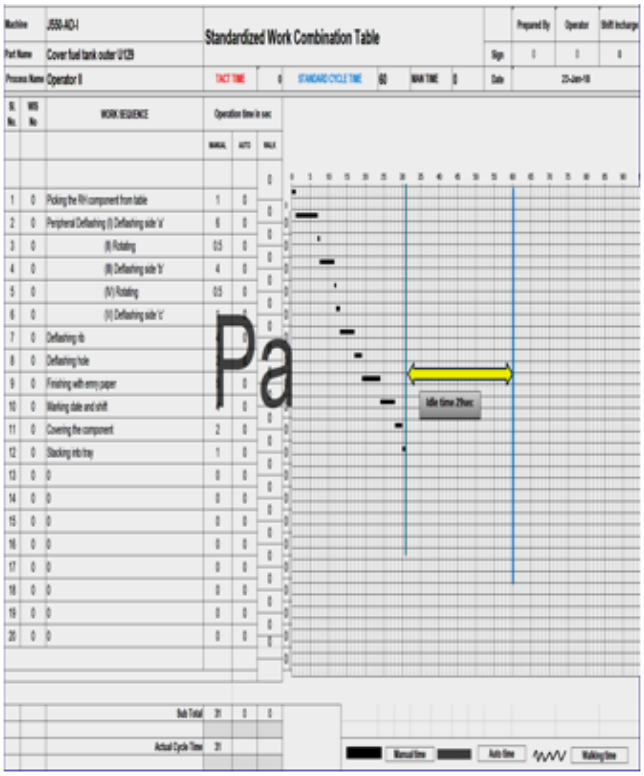

Fig 9: SWCT analysis for Operator II after man power reduction by Kaizen and Line Balancing.

The SWCT chart shown in fig 9 illustrate the work done by the operator II during moulding process of the part CFT OUTER after the implementation of Kaizen and line balancing. The Machine cycle time is 60 sec and the idle time of Operator II during the moulding operation is 29 sec even after reducing one operator.

SWCT Before (Operator III)

The SWCT chart shown in fig 10 illustrate the elementary work done by the operator III during moulding process of the part CFT OUTER before Kaizen and line balancing. The Machine cycle time is 60 sec and the idle time of Operator I during the moulding operation is 44 sec.

After the Kaizen and line balancing the work was evenly distributed and the operator III was eliminated without effecting the process, operations by redistributing the work among the operators.

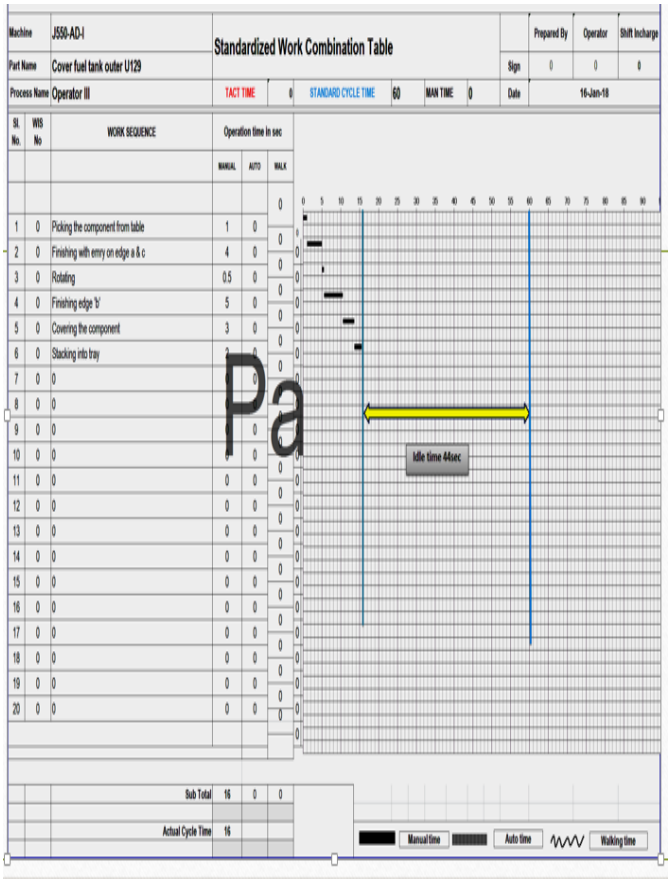

Fig 10: SWCT analysis for Operator I before Kaizen and Line Balancing.

Man Power Calculation

Total Man time = Operator I + Operator II + Operator III

= 35+26+16

= 77 sec

Machine cycle time = 60 sec

Number of workers required = Total man hour/ Machine cycle time = 77 / 60 = 1.28 Hence, Man power required = 1.28 (approximately 2)

Yamazumi Before

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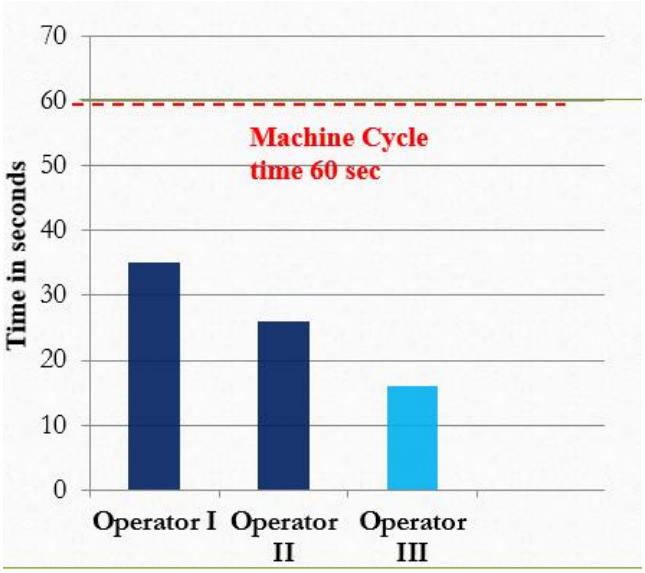

Fig 11: Yamazumi before man power reduction.

Yamazumi After

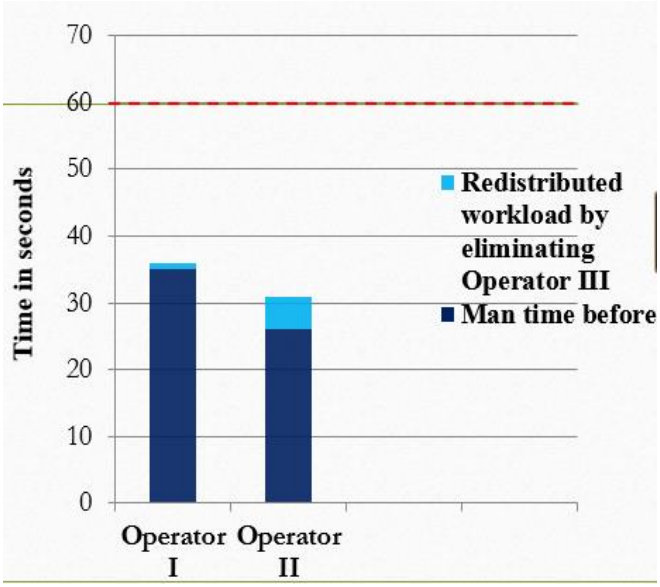

Fig 12: Yamazumi after man power reduction.

The graphs in fig 11 and fig 12 shows the line balancing before and after SWCT analysis. Before analysis there was uneven work distribution among three operators. Operator I has more work when compared to operator II and III. So the time study for the given machine was carried out to minimize the non-value added activities, so that work can be equally shared. After reduction of manpower from 2 to 1 the operators has more work and less of idle time. The worker idle time is reduced after implementation. After SWCT analysis non value added activities were minimized and the operator III's work was redistributed among the operator I and operator II by eliminating Operator III.

SWCT Analysis For Few Parts

Table 2: Result of SWCT analysis for few parts

SL. No	Part Name	No. of Operators Before SWCT	No. of Operators After SWCT
1.	CFT Outer U129	3	2
2.	Tail Cover U129	3	2
3.	Cover Frame LH-RH U129	2	1
4.	Alpha Case Top	3	2
5.	Visor Head	3	2
6.	CFT Outer N58	2	1

The Table 2 shows the result of SWCT analysis for few parts. Initially the time study was conducted to study the existing process and operations done by the workers. After conducting time study it was identified that the sequence of operation and its method were responsible for the loss of time during its work. Hence the sequence of operation was changed based on the requirement. Line balancing techniques were adopted and the process new mapping was suggested which was responsible to reduce the operator from 3 to 2 and a better synchronization of operation was possible. Before its implementation the workers were made to work with the changed process plan and there was no ambiguity in the modified process mapping. In the same way the process was repeated for the other parts and operations and prepared SWCT model for better control of process mapping and reduction of number of workers without causing any inconvenience to the worker.

Summary

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Table 3: Summary of Results of SWCT analysis.

Part Name	MCT In sec	OP I Time In sec	OP II Time In sec	OP III Time In sec	OP I + OP II + OPIII	No. of operators required	No. of operators reduced
CFT outer U129	60	35	26	16	77 / 60	1.28	1
Alpha case top	34	22	20	19	61 / 34	1.79	1
Tail cover U129	70	41	22	28	91 / 70	1.3	1
Visor head U129	48	21	26	41	88 / 48	1.83	1
Cover frame U129	50	44	22	-----	66 / 50	1.32	1
CFT Outer N58	60	27	12	------	39 / 60	0.65	1

VII. CONCLUSION

It is concluded that, there was a reduction in manpower in moulding operation thereby reducing the production cost.

The use of automation in production lines increased productivity by improving quality and efficiency.

Less labour costs could be achieved due to the incorporation of automated machines and less employees were required to handle these machines. Further, higher volume production could be achieved due to procurement of automated machines and large production volumes could be achieved.

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VIII. AUTHORS PROFILE

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