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Cycle Time Reduction by Using Smed Tool

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Abstract :- In this work to optimize manpower data and implement more efficient processes, have conducted time study analysis and found out the time worked on the object, found the major NVA contributing operations and what type of NVA are majorly contributing in each operation and suggested best suitable, possible action plan for each waste, the results after their implementation were attached to this work. The after results will affect the overall wastage, thereby reducing the wastage and increase in production by using one of the major lean tool-Single-Minute-Exchange of-Die (SMED).

Keywords*: Optimize, Single-Minute-Exchange of-Die (SMED), NVA*

1. Introduction:

Sub assembly manufacturing is a critical part of the manufacturing process. It reduces the complexity of the assembly process by breaking it down into smaller tasks that can be completed more efficiently [1]. Sub-assemblies are also beneficial in terms of quality and cost control. By manufacturing sub-assemblies, manufacturers can ensure that their products meet the highest quality standards [2]. Additionally, sub-assemblies can be produced in different locations, allowing for greater flexibility in the production process. Sub-assembly manufacturing is the process of manufacturing individual parts or components of a larger assembly. Sub-assemblies are typically manufactured separately and then assembled together to form the final product. This type of manufacturing allows for greater customization and flexibility in the production of complex products. Sub-assembly manufacturing is often used when the parts of a product are too large or complex to be manufactured as a single unit [5]. In Main Assembly the process of combining individual components into a finished product takes place during manufacturing. An assembly may also refer to a single-level bill of material (BOM), a multilevel BOM, or a top-level BOM. Lean manufacturing is a production method primarily aimed at reducing times within the production system as well as response times from suppliers and customers. It's also called just-in-time manufacturing (JIT manufacturing), which tries to match production to demand by only supplying goods that have been ordered. The core principle in implementing lean manufacturing is to eliminate waste to continually improve a process. By reducing waste, lean manufacturing sustainably delivers value to the customer. The types of waste include processes, activities, products, or services that require time, money, or skills but do not create value for the customer.

2. Methodology:

Single Minute Exchange of Dies, SMED is the process of reducing changeover or setup time. It involves identifying and eliminating any unnecessary part of the changeover process. It provides a rapid and efficient way of converting a manufacturing process from running the current product to running the next product [10]. When a piece of manufacturing equipment needs to be replaced, the changeover time can lead to costly, unexpected downtime. SMED is an essential part of lean manufacturing that can lower waste, boost productivity, and reduce costs within a process

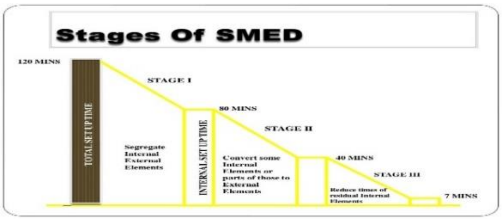


Fig: Stages of SMED

3. Experiment:

The experimentation is done by applying SMED tool in a cell where all the assembly loading takes place. In this cell the detailed parts directed from sub assembly [6]. Time study analysis has been conducted on the operations and the operator, and found the setup times, internal elements that are to be streamlined in order to increase productivity and reduce the wastes [7]. The time study involves recording the time taken by an operator to complete an operation (from start to end). The time study sheet includes name of operator, date on which the time recorded, start and end time for individual operation, shipset on which the operator is working, the activity performed, total working time on part (VA) and work done outside the part (NVA) and NVA categories [8].Finally, after dividing the operations to VA & NVA we consider VA time and compare it to the standard time and schedule for changes, in the direction of improving VA time thereby reducing NVA.Based on the time study analysis in the assembly cell, the operations which are contributing more NVA are to be figured out by the TIMWOODS method and the root cause is to be analyzed for them and the suitable best action plan is to be suggested and re-evaluating the process after successful implementation of action plan, showing the before and after results graphically to achieve better results, in turn increases overall efficiency[9].

	Ladder Assembly Loading	**power feed drill&inst**	**Support inst RDRQuad**	**Shim prep drill**	**FS Stiffener install**	**NutPlate install**	**Drilling &CSK**	**Panel Support Inst**	**Rib drill STA.63**
Transportation	3.91	2.09	1.19	2.29	0.88	1.36	1.17	0.96	1.2
Motion	2.07	2.31	1.77	2.67	0.79	1.99	1.33	1.23	1
Waiting	1.75	2.47	1.52	1.67	1.64	1.43	1.26	1.05	1.42
Defects	1.25	0.91	0.79	1.7	1.48	0.99	0.89	1	0.76
TOTAL	8.98	7.78	5.27	8.33	4.79	5.77	4.65	4.24	4.38

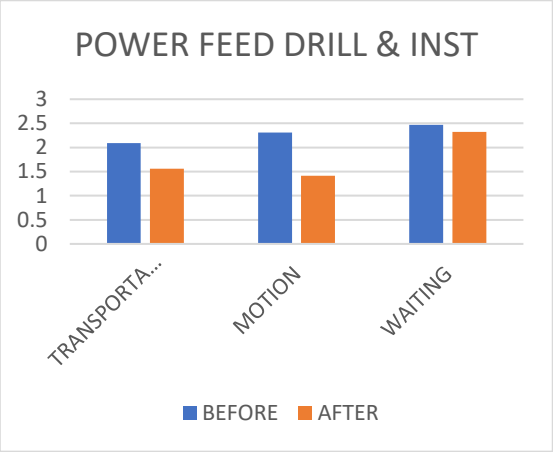
Table: Timwood

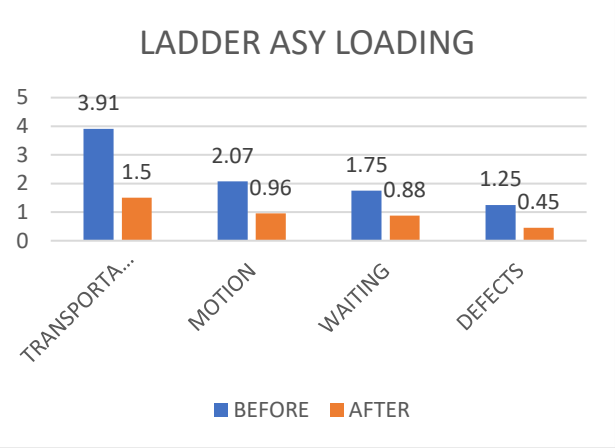
S.No	**Operations**	**MOST (hrs.)**	**Time study (hrs.)**	**Delta**
1	Ladder Assy Load	12.7	21.68	8.98
2	Power feed drill& inst	1.5	9.28	7.78
3	Support install RDR Quad	1.3	6.57	5.27
4	Shim prepare& drill	2.18	10.51	8.33
5	FS Stiffener install	1.4	6.19	4.79
6	Nut plate install	1.86	7.63	5.77
7	Drilling&CSK	2.15	6.8	4.65
8	Panel Support install	6.25	10.49	4.24
9	Rib drill STA.63	18.1	22.48	4.38

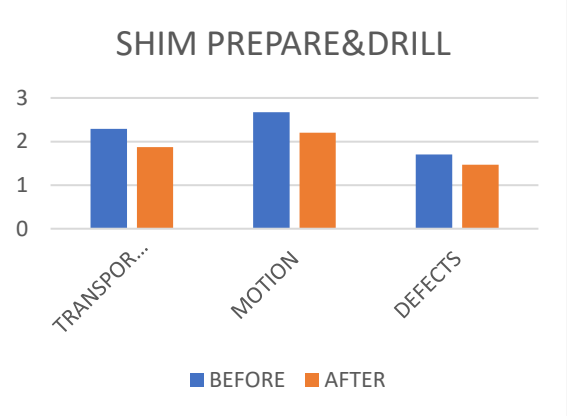
Table: Delta values

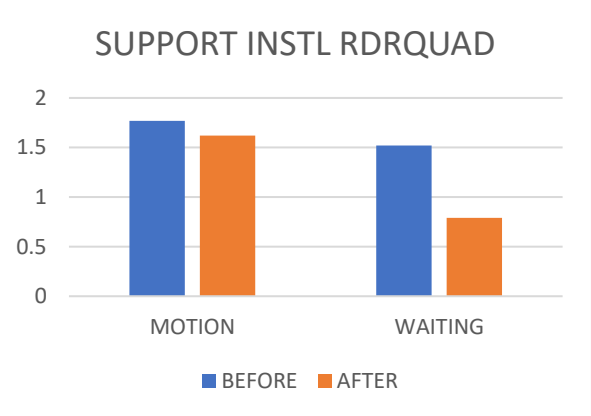
4. Results & discussions:

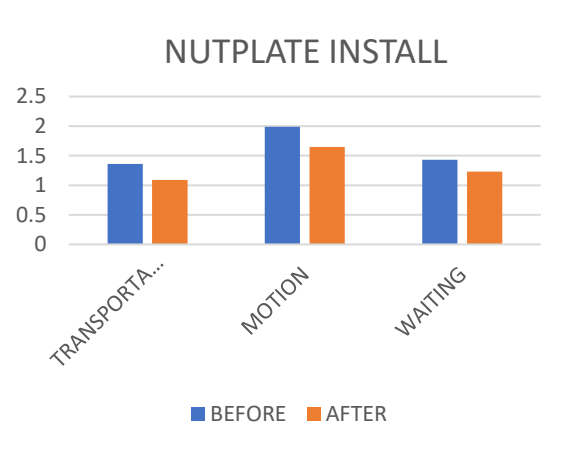
The 80/20 rule, also known as the Pareto Principle, is a concept that suggests that 80% of outcomes (or outputs) result from 20% of all causes (or inputs) for any given event. In business, a goal of the 80/20 rule is to identify inputs that are potentially the most productive and make them the priority. Key points of the 80/20 rule include: The 80-20 rule maintains that 80% of outcomes come from 20% of causes. The 80-20 rule prioritizes the 20% of factors that will produce the best results.

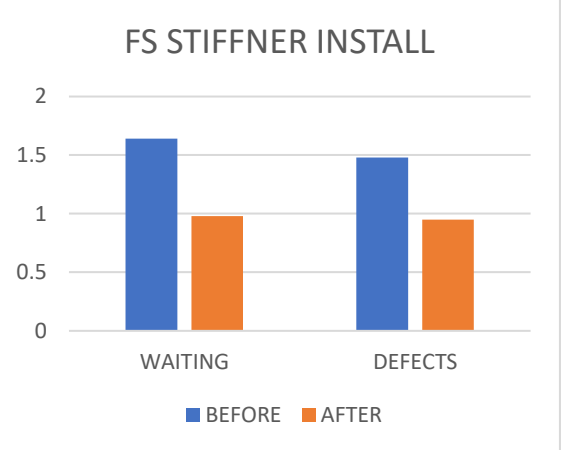












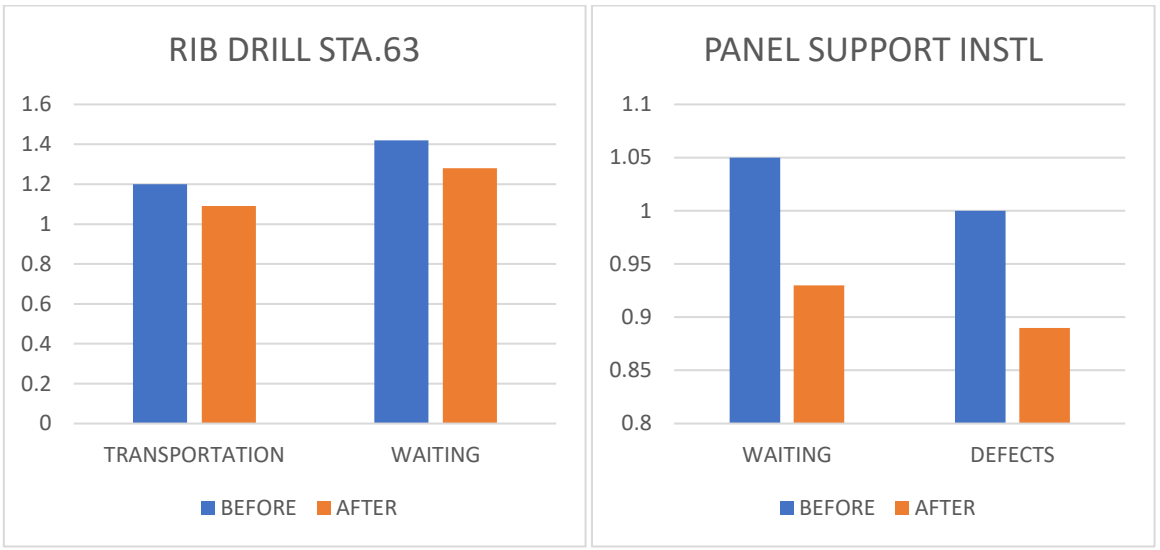


Fig: Graphs shows the detailed picture of before and after implementing the action plan

Conclusion:

From the data provided and discussed above, I can conclude that finding pivotal operations and streamlining them is necessary for an industry in order to reduce stock outs, reduce wastes, improve setup and changeover times' thereby increasing overall production. SMED tool is one of the most widely used guaranteed solution, though it does not involve any mathematical calculations, but when implemented carefully we can find the best results through it. Classifying the time study data into TIMWOOD is the first step of SMED and finding the element which can be streamlined by possible ways, the data is tabulated as TIMWOOD for every operation individually. Later the top NVA contributors are analyzed individually for all the operations. After analyzing individually, the after results are tabulated and compared with before. An overall difference graph is attached for the individual operations, and the top contributors are reduced by SMED tool. For every individual operation the root cause is been identified for major contributors, the action plan was suggested individually in every operation like introducing parallel working in cell, providing work spaces nearer to cell, purchasing required hand tools, appointing supervisor and quality checking officer to each cell, hassle free work assigning to the operators, conducting training and awareness programs to the operators frequently, etc.The activities suggested are successfully implemented and shown the best results in operation. All these activities gain the confidence to the operator in turn reduces the wastage and increases the production efficiency.

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