ISSN 2250-3153

Application of SMED Methodology- A Case Study in Small Scale Industry

Mr. Rahul.R.Joshi[*], Prof.G.R.Naik[**]

[*] Asst.Professor, Department of Mechanical Engineering,, Dr.J.J.Magdum College of Engineering, ,Jaysingpur, Shivaji University,Kolhapur(India)
[**] Asso.Professor, Department of Production Engineering,, KIT's College of Engineering,Kolhapur, Shivaji University,Kolhapur(India)

***Abstract*-** Perfection is not attainable. But if we chase perfection, we can catch Excellence. To stand up in todays Globalization world, Manufacturers need to find ways to reduce Production time and cost in order to improve operating performance and Product quality. It is normally possible to greatly reduce the setup times. Fantastic results are possible through better teamwork, good order, Planning and simple modifications. The main objective of this paper to reduce cycle time of a operation by using Single Minute Exchange of Dies (SMED). This Study is carried out in one of the automotive industry. The SMED system proved a track record in many types of industries. The results Shows that the this study has achieved more than 30% of Cost reduction, 97sec can be reduced which increases the productivity. Single Minute Exchange of Dies (SMED) is the approach to increase output and reduce quality losses

***Index Terms*-** SMED, Cycle Time, Internal and External Activity, bottleneck

I. INTRODUCTION

Due to the intricacy of market order and Competitiveness, many Manufacturing Organizations are unser Pressure to produce and dispatch products in shorter delivery times. In the past a lot of effort has been put to reducing the cycle time and speeding up the output rate whilst totally ignoring the change overtime from one product to another. This has lead to the Economic batch quantity Concept and has resulted in small batches appearing to be Uneconomical to run.[1] Reducing Setup times (Which we rarely Concentrate on) can give the Equivalent of huge increase in process speed (Which we almost and always concentrate on).This is all achieved without detriment to the quality of the Product. The idea of a setup time reduction Plan is move towards SMED (Single Minute Exchange Die) or OTED (one touch Exchange of dies). [1]

As shown in the [5] the Three main reasons for setup reduction are:-

a) Flexibility:- To be able to respond very quickly to changing market demands,you need to be able to produce small lot sizes in an a economical way.

b) Bottleneck Capacities:- Reducing setup times increases the availble capacity,Which can be interesting as an alternatives to buying new equipment or installing an extra shift in situations where the market demand increases.

c) Cost Reduction: - Since, especially on bottlenecks,the direct production cost is related to machine performance, an OEE(Overall Equipment Effectiveness) can easily shown the impact of setup reduction.

II. SMED

Working in any kind of manufacturing environment one of the unfortunate characteristics is waste. Waste can extend from unused raw material to damaged products, and it can carry quite of a financial loss for the company if not treated in an efficient manner. In order to reduce waste, there are several number of methods and strategies that companies can use depending on the desired results. One of the most popular methods is Single Minute Exchange of Die or SMED.[4]

SMED was developed by Shigeo Shingo in 1950s Japan in response to the emerging needs of increasingly smaller production lot sizes required to meet the required flexibility for customer demand. The SMED technique is used as an element of Total Productivity Maintenance (TPM) and "continuous improvement process"[4].It is one of the method of a reducing wastage in a manufacturing Process. The phrase "single minute" does not mean that all changeovers and startups should take only one minute, but that they should take less than 10 minutes (in other words, "single-digit minute").

Problem Statement:-

The machining production line with 2 VMC's and 2 HMC's handles five variants of the component. Each machine has an operator assigned to it. The cycle time for the bottle-neck operation is 8 minutes. There seems to be enough scope for reducing this cycle time. The output of about 50-55 pcs/shift and 168 pcs/day i.e.168 * 25=4200 pcs/month

III. METHODOLOGY

A. Data Collection

Statistical data collection methods for measuring machine setup time in assembly line A operation was used in this study to summaries and describe the data. Production process flow and standard operation procedure are reviewed briefly before setting up the data collection table is done. The next step is to create a data collection table prior to collecting data and the time taken was measured using a stopwatch. Based on the actual production, data was collected and recorded on a daily basis. Subsequently, a statistical bar chart was drawn to monitor and analyse the problems. These methods helps to identify the main contributor to high time loss and help to visualize and better understand the root causes and finding possible solutions to the problems..[6]

B. Application of SMED techniques

This study methodology describes on the project implementation in the battery assembly line by using SMED techniques. The SMED method consists of eight techniques:
separate internal from external setup operations;
convert internal to external setup;
standardise function, not shape;
use functional clamps or eliminate fasteners altogether
adopt parallel operations;
eliminate adjustments and
mechanisation.

C. Data Analysis

The analysis of data and information gathered led to significant improvement carried out in three categories such as mechanical improvement, electrical improvement and organizational improvement. Comparison result before and after SMED implementation was extensively reviewed. Total savings, other benefits are also discussed.

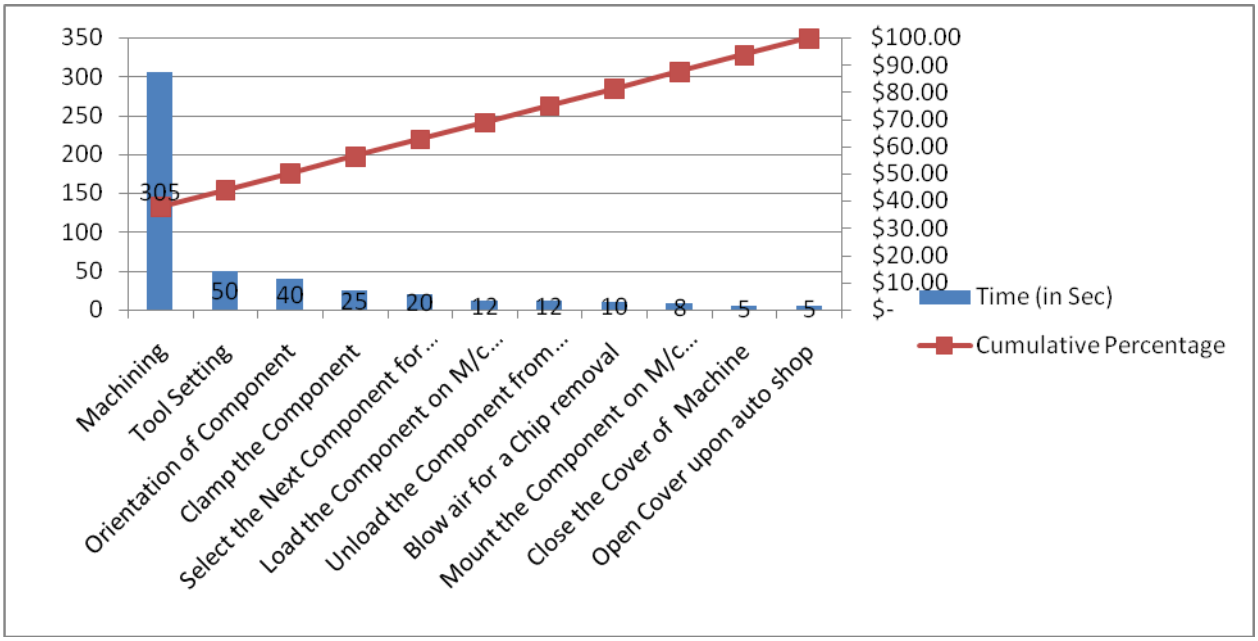
IV. Results and Discussion

Basically, the Entire Operation Procedure with detailed analysis is reviewed. Data was taken for entire 30 days . The cycle time data for each process performed was taken to ensure data accuracy and to observe data variation in each cycle time reading. The average readings of the data is shown in the following table.

Analysis of Operation:-

Operation Number	Description	Tools Required	Time (in Sec)
01	Mount the Component on M/c Bed	Jack	08
02	Load the Component on M/c on rough locator	Hoist	12
03	Orientation of Component	Manual	40
04	Clamp the Component	Spanner	25
05	Tool Setting	Manual	50
06	Close the Cover of Machine	Manual	05
07	Machining		293
08	Open Cover upon auto shop	Manual	05
09	Unload the Component from Machine	Spanner/Jack	12
10	Blow air for a Chip removal	Pneumatic Blower	10
11	Select the Next Component for loading	Manual	20

V. Pareto Analysis of a Operations



Application of SMED Methodology:-

SMED helps to reduce the cycle time by eliminating wastes and unwanted processes and also helps to improve current setup process and manufacturing flexibility. The following activities are carried out during application:-[3]

a) Distinguish Between Internal Activities and External Activities:-

Operation Number	Description	Activity	Time (in Sec)
01	Mount the Component on M/c Bed	Internal	08
02	Load the Component on M/c on rough locato locator	Internal	12
03	Orientation of Component	Internal	40
04	Clamp the Component	Internal	25
05	Tool Setting	Internal	50
06	Close the Cover of Machine	Internal	05
07	Machining	External	293
08	Open Cover upon auto shop	Internal	05
09	Unload the Component from Machine	Internal	12
10	Blow air for a Chip removal	Internal	10
11	Select the Next Component for loading	Internal	20

Internal Means:- Those carried out when the machine has Stopped.
External Means:- Those carried out when the machine is running.
Total Internal Activity Time:- 187Sec
Total External Activity Time:- 293 Sec

b) Converting Internal Activity to External Activity:-

In Order to convert internal activity to External activity, main focus is on the tasks related with material handling, information gathering, adjustment and control. In the Current State,we can see that the 64% are External Activities and 36% Internal Activities. Though External Activities are greater, our aim is to convert to more internal activities to External. One better suggestion for conversion is we can use the pallet change which gives the better result. On the other hand we can also use the some methods of orientation, tool setting provisions etc.

c) Streamlining all aspects of the Operation:-

In the final Step the improvements studies were done and checklists were formed. The causes for recursive activities were searched as possible and ideas implemented to eliminate them were provided. Finally, the tasks will no longer be unpredictable time delays by use of the precise time records.Therefore, better Planning activities will lead to customer stratification.

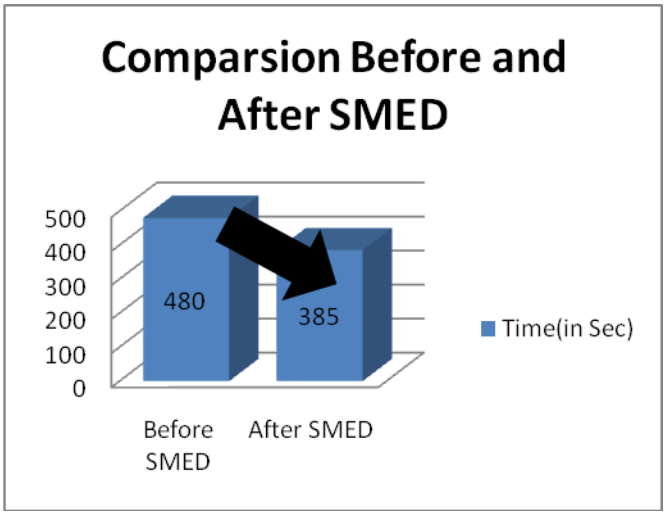
Tables I:-shows the detailed avtivities before SMED, after SMED and improvement ideas are given:-

Sr. No.	Activity.	Before SMED	Improvement ideas	After SMED	Time Saving (in sec)
01	Mount the Component on M/c Bed	08	Pallet Change	00	08
02	Load the Component on M/c on rough locator	12	Pallet Change	00	12
03	Orientation of Component	40	Poka Yoke	28	12
04	Clamp the Component	25	Pneumatic Spanner	12	13
05	Tool Setting	50	Provision for setting block	20	30
06	Close the Cover of Machine	05	-	05	00
07	Machining	293	-	293	00
08	Open Cover upon auto shop	05	-	05	00
09	Unload the Component from Machine	12	Pallet Change	00	12
10	Blow air for a Chip removal	10	Pallet Change	00	10
11	Select the Next Component for loading	20	Rack size increased from 24 Nos to 50	10	10

			Nos.		
	Total	480		385	95

Comparison between before SMED and After SMED:-

After the SMED technique was applied to the bottle neck Operation, the total time taken to perform the operation was decreased by 20 percent from 480 sec to 385 sec. The Company Started producing the Number of Components increased from 168 to 176 per day and Number of Components per month increased from 4200 to 4400. The Cost reduction about 30% is achieved by application of SMED. Following graph Shows the Comparison:-



VI. CONCLUSION

SMED principles. However, for small batch manufacturers the issues that led to the change in focus for long run producers have not been present to the same degree.SMED methodology applied to prepare an optimal standard procedure for changeover operations on defined machine. A Comparison of results and achievements before and after SMED implementation were made to measure the effectiveness of SMED to reduce cycle time. Hence, not only is it imperative to focus on reducing the amount of productive time that is lost when a machine is being set, but also to eliminate errors, with the application of poka yoke principles to the setting equipment and procedures.

REFERENCES

Journal:-

[1] Antonio Carrizo Moreira,Gil Campos Silva Pais (2011) "Single Minute Exchange of Die:-A Case Study Implementation Journal of Technology Management and Innoviation pp29-46

[2] Ali Allahverdi H.M. Soroush (2008) " The Significance of reducing setup times /setup costs" Euporean Journal of Operation Research pp978-984.

[3] Dr.Warkhedkar R.M,Desai.M.S., (2011) "Productivity Enhancement by reducing adjustment time and setup change" International Journal of Mechanical Engineering & Industrial Engineering) pp37-42

Conference:-

[4] Goubergen Dirk V, Landeghem Hendrik v (2001)"An Intergated Methodology for More Effective Set Up Reduction" IIE Solutions 2001 Conference

[5] Ulutas Berna(2011) " An Application of SMED Methodology" World Academy of Science, Engineering and Technology pp100-103

Book:-

[6] Maynards Industrial Engineering Handbook.(2004) Tata Mcgrawhill.pp4.81-4.85

AUTHORS

First Author – Mr. Rahul.R.Joshi, Asst.Professor, Department of Mechanical Engineering,, Dr.J.J.Magdum College of Engineering, ,Jaysingpur, Shivaji University,Kolhapur(India), Email: rahul.joshi719@gmail.com

Second Author – Prof.G.R.Naik, Asso.Professor, Department of Production Engineering,, KIT's College of Engineering, Kolhapur, Shivaji University, Kolhapur(India)