SETUP TIME REDUCTION IN COMPONENT AND FINISHING SHOP

[1]Percyval Aman George, [2]Prashant Singh Tomar
[1]M.Tech Student in Production Engineering, [2]Assistant Professor in Mechanical Engineering Department
[1]Mechanical Engineering Department,
[1]Parul University, Vadodara, India

Abstract : To stand up in today's highly competitive world, manufacturers need to find a way to shorten production time. The removal of the waste can improve the productivity of the company. The current work aims to address the problem of the setup time reduction for the switchover. After a literature review of SMED techniques and expansion of the traditional SMED is proposed. In these expansions, we include additional steps to better characterize the whole process of SMED application. For each step, some tools are proposed and assessed with regard to their contribution to a fair analysis. The main goal of this project is to reduce the installation time of the Component and Finishing Shop via Single Minute Exchange or Die (SMED) technology and thus improve productivity. The work is being carried out in Electrical Company. Careful observation has been made during the switchover or setup and the maximum possible internal activities have been converted to the external activities and then some activities have been executed in parallel, saving a considerable amount of time. The results of the application on the field are shown in terms of reduction of installation time and rationalization of activities, competitive on an international market, is now a reality for all companies and consequently the impact of globalization is even more tangible. That is why companies need to regain their efforts and reduce their production costs through waste disposal and productivity growth. SMED (Single Minute Exchange or Die), a tool created by Shigeo Shingo, enables waste reduction in productive processes, making it more efficient and flexible. The main reason is that strict application of the Shingo SMED methodology is not the most efficient way to shorten set-up times in all situations.

IndexTerms **- SMED, Internal and External Activity, bottleneck, quick changeover.**

I. INTRODUCTION

The large variety and small quantities are important scenarios of the current production system. Because of the smaller production quantities and the large variety of parts, the set-up time often increases, which reduces productivity. Nowadays, companies are focusing on shortening the set-up time and to continue to compete. The importance of short changeover times has always been crucial for production companies. Nowadays customers demand a wide range of products that are delivered with high quality, faster response times and sold at reasonable prices. To survive in an increasingly competitive world, there is a need for continuous improvement in every type of industry. An answer to these challenges for production companies is the implementation of lean concepts and customer-oriented production in order to be able to meet all customer needs. The flexibility to change the production of different products or operations is the result of this SMED technique. SMED reduces non-productive time by streamlining and standardizing operations for exchange tools, using simple techniques and simple application.

II. SINGLE MINUTE EXCHANGE OF DIE (SMED) TECHNIQUE

SMED was developed by the Shiego Shingo in 1985 in Japan. Due to the increasing demand for smaller parties and to meet the required flexibility of the customer, shingo has proposed a method called Single Minute Exchange or Die which states that the switchover takes exactly one minute or more less than ten minutes. Van Die has to do with lowering the institutions and the main goal is to reduce the time to a value of one figure. This helps the organization to minimize the inventory level and the effective use of the equipment, since we can determine that the product life cycle of the products decreases and the demand for variable products increases, the need for SMED is mandatory in every organization. The analysis of the SMED must start with the details of the process and the time study. If an internal activity cannot be eliminated or converted, it must be combined or simplified or, if possible, replaced. Here the greatest concern is to identify the activities that are being carried out and then to separate them. There are two types of activities involved in the setup or changeover.

Internal activities: These are the activities that can be carried out after stopping the machine.
External activities: These are the activities that can be done when the machine is still in working mode.
Value-added activities: The time spent on activities that add value to an item from the customer's perspective.
Activities with no added value: The time spent on activities that add costs, but no value to an item from the customer's perspective.

III. OBJECTIVE OF THE PRESENT WORK

The goal of the project is to thoroughly study the existing setup operation and observe any activity performed by the operator. Single Minute Exchange or Dies (SMED) is the lean manufacturing tool and technique that is applied and applied in this area. This technique helps the company to eliminate the waste during the installation or conversion of the machine, which will help the company improve productivity.

IV. PROCEDURE AND DATA COLLECTION

For data collection I have selected three machines which was on the TPM (Total Productive Maintenance). In TPM we have to do the continues improvement activity.

1) CNC Machine.
2) Moulding Machine 60 Tons.
3) Press Machine 40 Tons.

4.1 CNC Machine

Table 1: data collection of cnc machine

Sr. No.	Activity	Time in sec.	Cumulative percentage
1	Setting & Trial	2340	56.76
2	Fixture Loading	1902	84.09
3	Fixture unloading	930	97.46
4	Fixture movement	177	100.00
	Total time in sec.	**5349**	
	Total time in min.	**90 m**	

This is the data of CNC machine which is collected after the time study of the whole setup changeover. The whole time study is divided into four major activities.

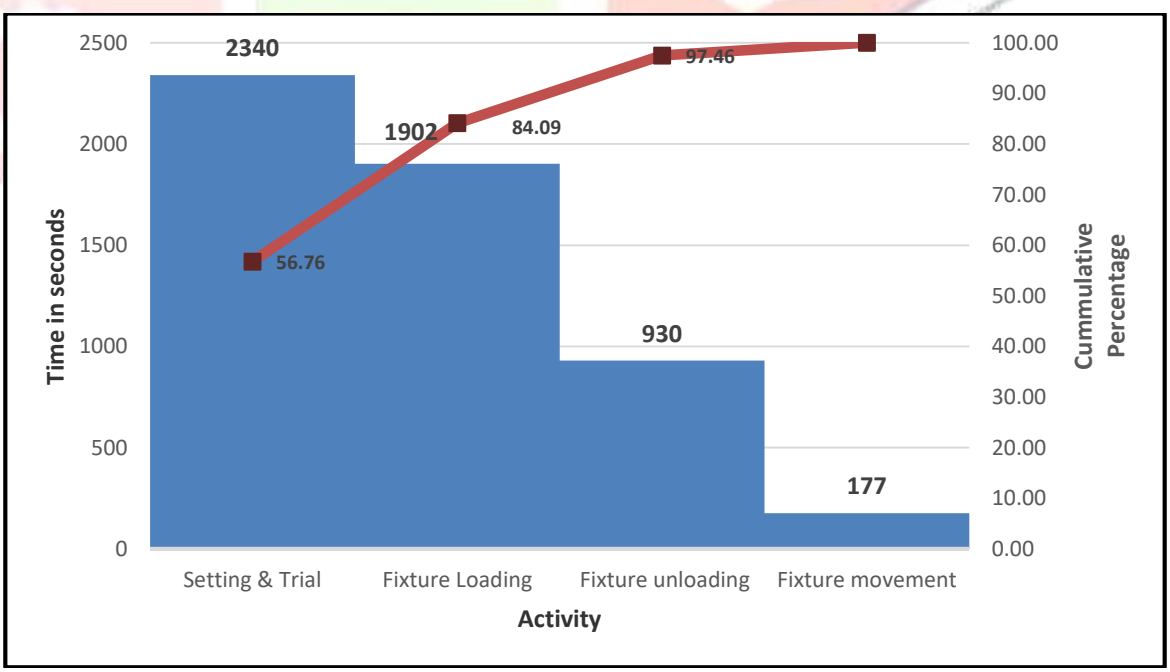

Figure 1: pareto analysis of cnc machine

The Pareto chart is drawn from the four major activities which are divided on the basis of the time study of the whole setup changeover. Pareto chart is used to see that which process is taking a lot of time in the whole changeover and it also shows the cumulative percentage of that activity. So from the chart it is cleared that setting& trial activity is taking a lot of time in the whole changeover.

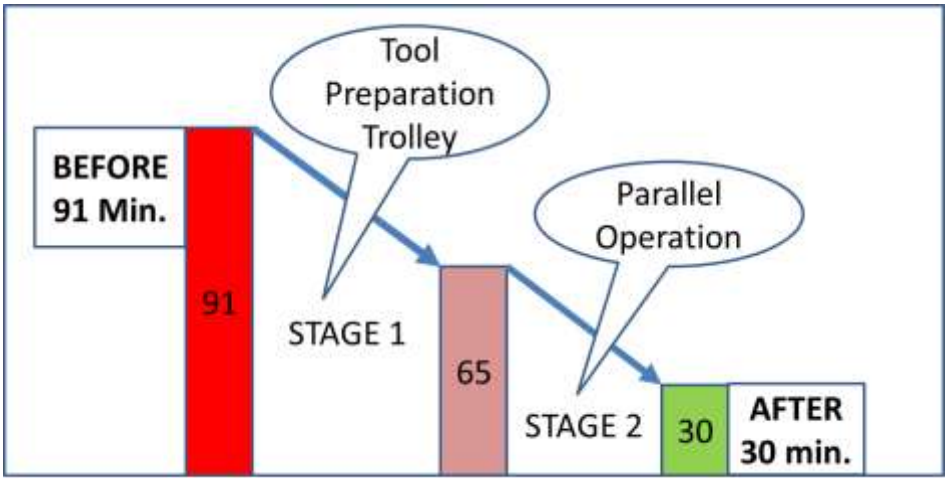

Figure 2: setup time reduction stages

The figure 2 shows that how the setup time is reduced from a high to low it shows what actions are taken in the project. In stage 1 the tool trolley is provided which has reduced some time and after that in stage 2 a parallel operation technique is used which has reduced some more time and finally the time reaches from high to low.

4.2 Moulding Machine

Table 2: data collection of moulding machine

Sr. No.	Activity	Time in sec.	Cumulative percentage
1	Mould movement	1150	34.86
2	Unloading Mould	816	59.59
3	Loading Mould	784	83.36
4	Setting & Trial	549	100.00
	Total time in sec.	**3299**	
	Total time in min.	**54m 59s**	

This is the data of Moulding machine which is collected after the time study of the whole setup changeover. The whole time study is divided into four major activities.

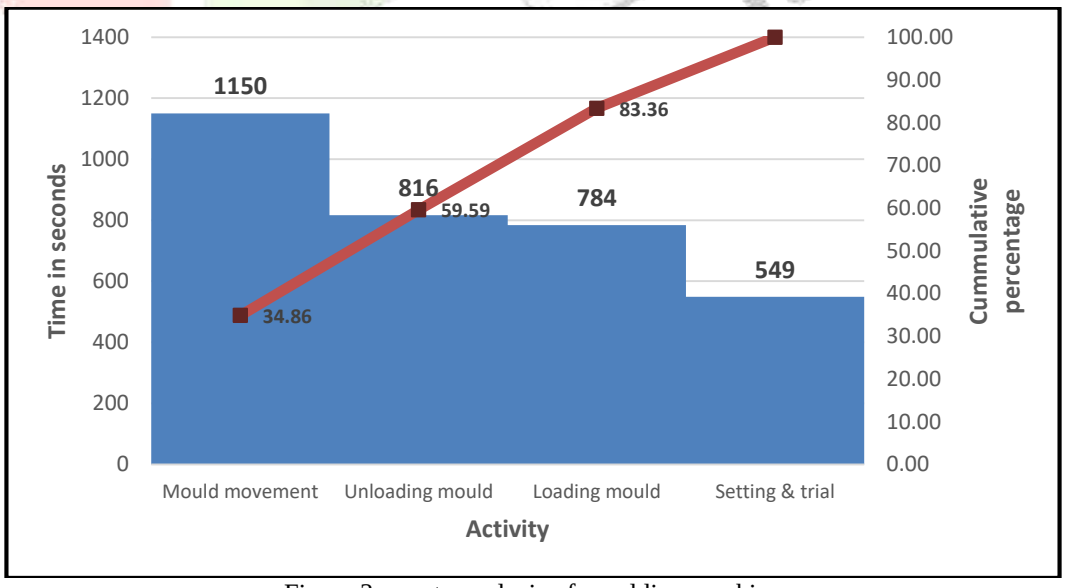

Figure 3: pareto analysis of moulding machine

The Pareto chart is drawn from the four major activities which are divided on the basis of the time study of the whole setup changeover. Pareto chart is used to see that which process is taking a lot of time in the whole changeover and it also shows the cumulative percentage of that activity. So from the chart it is cleared that Mould movement activity is taking a lot of time in the whole changeover.

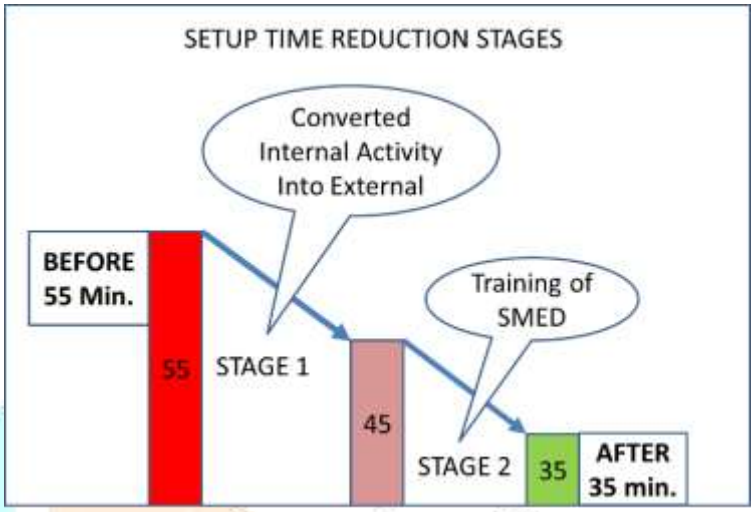

Figure 4: setup time reduction stages

The figure 4 shows that how the setup time is reduced from a high to low it shows what actions are taken in the project. In stage 1 internal is activity is converted into external activity which has reduced some time and after that in stage 2 training of SMED is given which has reduced some more time and finally the time reaches from high to low.

4.3 Press Machine

Table 3: data collection of press machine

Sr. No.	Activity	Time in sec.	Cumulative percentage
1	Setting & Trial	2458	56.72
2	Loading die & new coil	1066	77.30
3	Unloading die	578	88.46
4	Die movement	632	100.00
	Total time in sec.	**4734**	
	Total time in min.	**78m 58s**	

This is the data of Press machine which is collected after the time study of the whole setup changeover. The whole time study is divided into four major activities.

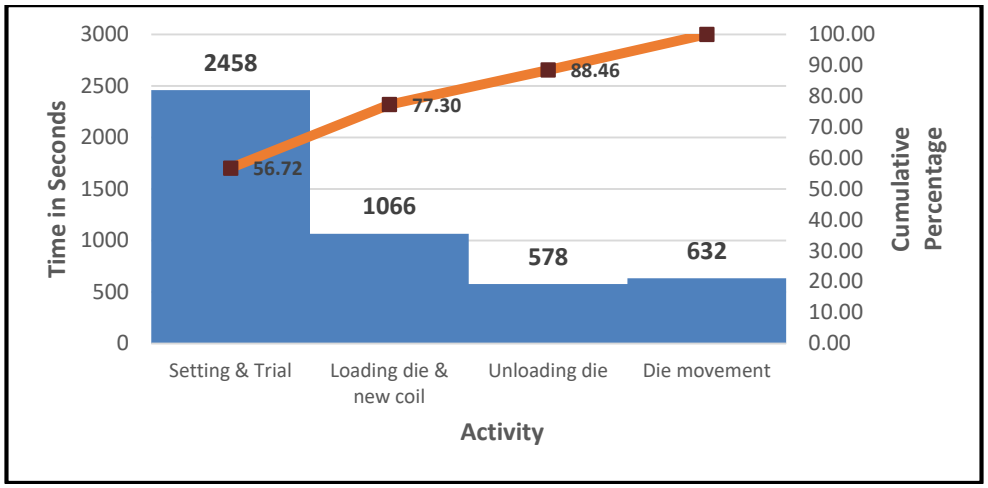

Figure 5: pareto analysis of press machine

The Pareto chart is drawn from the four major activities which are divided on the basis of the time study of the whole setup changeover. Pareto chart is used to see that which process is taking a lot of time in the whole changeover and it also shows the cumulative percentage of that activity. So from the chart it is cleared that setting trial activity is taking a lot of time in the whole changeover.

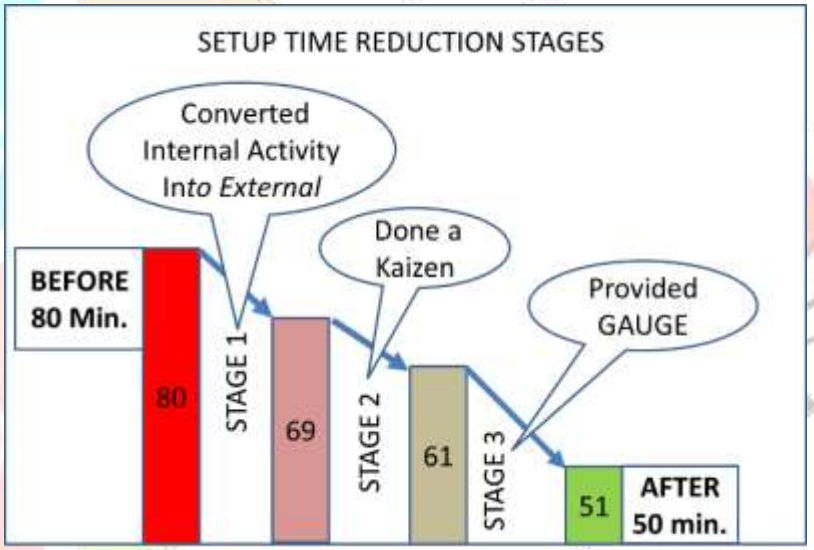

Figure 6: setup time reduction stages

The figure 6 shows that how the setup time is reduced from a high to low it shows what actions are taken in the project. In stage 1 internal is activity is converted into external activity which has reduced some time and after that in stage 2 a kaizen has been done which has reduced some more time in 3 stage a gauge is provided and finally the time reaches from high to low.

V. CONCLUSION

Implementation of the lean principles in each process will yield good results for each sector. Huge results can be achieved by eliminating non-value adding activities. If these principles are applied in all departments of the organization, they will produce significantly good results. SMED methodology is used to prepare a standard operating procedure for the switching operation on certain machines. A comparison has been made of the results achieved before and after the SMED implementation.

- CNC Machine – Time Reduced from 90 Minutes to 30 minutes. Time saved is 60 minutes/changeover
- Moulding Machine- Time Reduced from 55 Minutes to 35 minutes. Time saved is 20 minutes/changeover
- Press Machine- Time Reduced from 80 Minutes to 51 minutes. Time saved is 29 minutes/changeover

VI. ACKNOWLEDGMENT

I would like to express my gratitude to Parul University and the private Electrical & Automation Company for providing me opportunity to work on this project.

REFERENCES

[1] Mohammed Viqar Nadaf Pinjar, Dr. Shivakumar S, Dr. G V Patil "Productivity Improvement through Single Minute Exchange of Die (SMED) Technique", International Journal of Scientific and Research Publications 2015 1-9**.**

[2] Prof. Nagaraj A Raikar, "Reduction in Setup Time by SMED Methodology", International Journal of Latest Trends in Engineering and Technology (IJLTET) 2015, 56-60.

[3] Mohammed Ali Almomani, Mohammed Aladeem, Abdelhakim Abdelhad, Ahmad Mumani, "A proposed approach for setup time reduction through integrating conventional SMED method with multiple criteria decision-making techniques", Computers & Industrial Engineering 66 (2013) 461–469.

[4] Deros B.M., Mohamad D., Idris M.H.M., Rahman M.N.A., Ghani J.A., Ismail A.R, "Setup Time Reduction in an Automotive battery assembly Line", international journal of systems applications, engineering & development (2011) 618–625.

[5] Jonalee D. Bajpai, "SMED (Single-Minute Exchange of Die) methodology in Garment Manufacturing Industry", All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014) 61–67.

[6] Filla Jan, "The Single Minute Exchange of Die Methodology in a High-Mix Processing Line", Journal of Competitiveness 2016 59–69.

[7] M.S. Desai "Productivity Enhancement by Reducing Setup Time", Global Journal of Researches in Engineering Mechanical and Mechanics Engineering 2012 15-20.

[8] Silvia Pellegrini, Devdas Shetty and Louis Manzione "Study and Implementation of Single Minute Exchange of Die(SMED) Methodology in a Setup Reduction Kaizen", International Conference on Industrial Engineering and Operations Management 2012 2353-2363.