Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

SETUP TIME REDUCTION USING SINGLE MINUTE EXCHANGE OF DIE IN TEXTILE INDUSTRY

RANO KHAN WASSAN,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

JANSHER ANSARI,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

ALI AKBAR,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

SHUAIB KAKA,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

UMAIR SARWAR,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

ZAHID HUSSAIN HULIO,
Department of Industrial Engineering and Management, Dawood university of Engineering and Technology, Karachi, Pakistan

Abstract

Nowadays to meet the production demand in textile industry, setup time reduction is a big challenge for the companies. Moreover, product customization has been increasing which negatively affects the setup time. Thus, there is need of an effective technique which can reduce the setup time. Therefore, Single Minute Exchange of Die (SMED) has been proposed in this study, it allows to optimize the changeover activity. Moreover it helps these industries to have maximum production flow. To show the practical applicability of SMED, a case study has been carried out of the changeover activity of printing rotaries in processing department of a textile industry. The results of the study showed that, 36% reduction in setup time has been achieved i-e 7 minutes 42sec were reduced per change over. It increased the production by 2.21% per day, which benefited the company to achieve higher production.

Keywords— SMED, Setup time, Textile industry.

1. INTRODUCTION

These days in textile industry, product is demanded by customer in shorter time than it really takes to manufacture it. It is impossible to achieve this target by using traditional methods of manufacturing. It can only be achieved through modern and latest techniques. Thus, to improve productivity of textile industry, SMED has been proposed in this study.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

SMED is one of the widely accepted methods to reduce the setup time during the changeover activity. The purpose of the SMED is to transform possible internal activities (accomplished when the equipment is stopped) to “external” activities (accomplished when the equipment is running), to perform the changeover activity in efficient manner. SMED targets to shorten the changeover times to the “single” digits (i.e. Less than 10 minutes). In this research importance of SMED method to benefit production flow is considered.

1.2 SMED ACTIVITIES

Initial phase: They have internal setup and External setup. Internal setup can be marked as the tasks that can be accomplished when the equipment is stopped during changeover activity while during external setup which can be marked as the tasks that can be accomplished while the equipment is in running.

1.2.1 Setup Time

The time required for setting up machine for the next process.

1.2.2 Change Over

The procedure of shuffling the production setup from one type of the product to other type in machines by exchanging the parts e.g: dies and molds.

2. LITERATURE REVIEW

Many literatures are available in which SMED has been used to reduce changeover setup time. Rodolfo Rodriguez-Mendez et al. discussed the concepts of aggregate planning and the synchronization of some lean manufacturing techniques tools like JIT, SMED to make the organization more reasonable in delivery lead time, improve customer satisfaction level and minimize inventory [1]. Jonalee D. Bajpai, used the SMED methodology as customized way for minimization of changeover time in garment industry to minimize the change over time [2]. Vipan Kumar et.al discussed that how SMED is useful to enhance the productivity by decreasing the setup time. The application of SMED used for three different mechanical press machines and measured the setup times before and after SMED [3]. Sivasankar et.al, used SMED and observed that it may be evaluated during design stage to observe the collective representation of improvement possibilities[4]. Ana Sofia Alves et.al, noted that the SMED technique may be merged with other traditional tools to bring some effective outcomes for organizations i.e. statistical analysis which added value to traditional SMED methodology [5]. Cakmakci gave the concept of interacting setup time and product design. Study also proved that improvement can be done by SMED proper adoption[6]. Michels, presented the idea to apply SMED to reduce changeover time and also discussed different the possibilities of reduction in setup time[7]. Kayis et.al, classified the outcomes of SMED technique in three different kinds of mechanical procedural and organizational improvements. To ensure its effectiveness, it should be considered at initial design phase and must continue at all stages of the

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

organization[8]. Trovinger et.al, performed SMED on chip shooter machines and minimized setting time by eliminating every actions which was done internally[9].

3. IMPLEMENTATION OF SMED

To show the practical application of SMED in textile sector, a case study has been conducted at Yunus Textile Mills Limited (YTM). It is one of the largest textile company in Karachi, Pakistan. The company, produces 100 Million meters per annum, it is also the Pakistan's largest textile exporter. YTM distribution services are spread out in USA, France, Spain, United Kingdom and Canada. Company was facing problem in fulfilling customer demand on time due to larger change over times. A lot of time was wasted due to changeover of printing rotaries. In order to reduce setup time to an acceptable limit, SMED was adopted for the changeover of printing rotaries.

4. METHODOLOGY

There are different types of methodologies available in different sources to apply SMED, this adopted a methodology it begins with identifying and classifying the internal and external set up to shift internal to external setup and carryout all phases of setup activities as shown in Figure.1.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

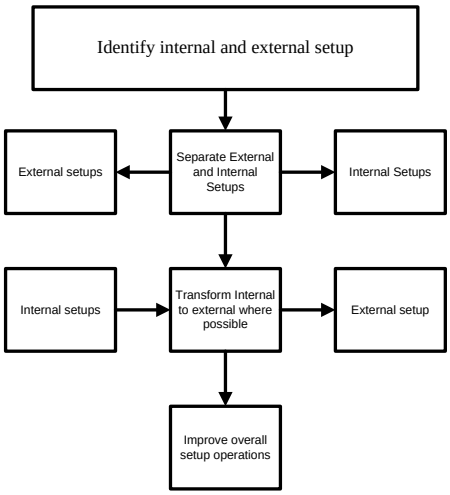


Figure. 1. SMED process

4.1 Identifying Internal and External Setup

Initially the Internal and External activities have been recognized via the Internal and External Setup sheet as shown in the below Figure.2, which indicates the name and nature of setup.

4.2 Separate External and Internal Setup

In this step segregate the internal and external setup activities to differentiate the setup process.

4.3 Transforming Internal to External Setup

In this step elements were converted from internal to external setup activities as shown in Figure.3. It aimed to minimize the downtime of the machine.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

ROTARY MACHINE NO

NO. of screen removed:

No of screen to be set:

No of workers available:

S.NO	ACTIVITY	INTERNAL/EXTERNAL
1.		
2.		
3.		
4.		
5.		

Figure. 2. Setup sheet

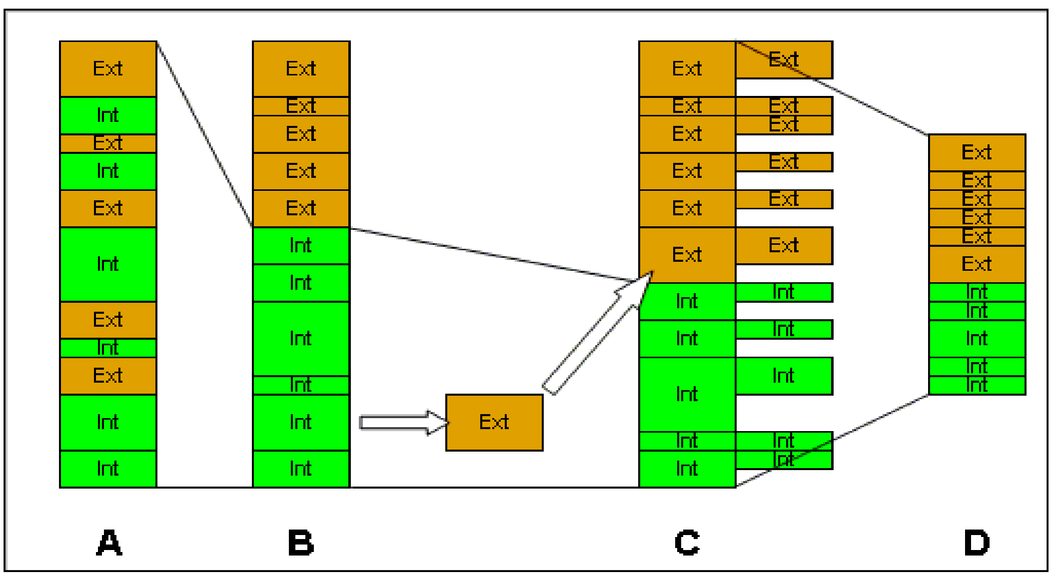


Figure. 3. Transformation of Internal to External Setup

4.4 Improve All Setup Operations

In the end, look after remaining components towards improvement so setup time can be lesser. Preference should be given to internal components to fulfill the primary goal of minimizing the changeover time.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

5. RESULTS AND DISCUSSIONS

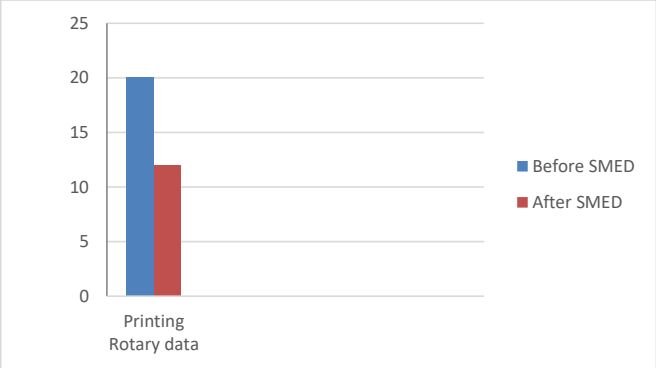
Data of printing rotaries have been collected, analyzed and reviewed for the purpose of conversion of internal setup activities to external setup activities wherever possible.

Table. 1. Change over activities and setup time before and after SME

S.NO	ACTIVITY	TIME	Before SMED	After SMED	Time saved
1.	Operator Goes to Engraving	1min35sec	External	External	00
2.	Engraving Supervisor Handed Over Screens to Operator	35sec/screen	External	External	00
3.	Operator Collect Screens from Engraving	1min21sec/screen	External	External	00
4.	Screen Sequencing as Per Design	10sec/screen	External	External	00
5.	As Per Program Quantity Fabric Material Availability to M/C	2min 12sec/ batcher	Internal	External	**2min12sec**
6.	Squeegee Preparation	1min41sec/ squeegee	Internal	External	**1min41sec**
7.	Lead Clothes Trolley to Fabric	56sec	Internal	External	56sec
8.	Fabric Stitched to Lead Clothes	55sec	Internal	External	55sec
9.	Temperature Maintaining	4min54sec	Internal	Internal	00
10.	Sensor wire removed	3sec	Internal	Internal	00
11.	Sensor removed	6sec	Internal	Internal	00
12.	screen removed	32sec	Internal	Internal	00
13.	Squeeze removed	25sec	Internal	Internal	00
14.	removed colour pump	4sec	Internal	Internal	00
15.	Clean of head	1min18sec	Internal	Internal	00
16.	screen took in to machine and fit	57sec	Internal	Internal	00
17.	squeeze took into screen	24sec	Internal	Internal	00
18.	Squeeze levelling	1min17sec	Internal	Internal	00
19.	cleaning of pump	46sec	Internal	Parallel to 16,17,18	**46sec**
20.	sensor took and sensor wire	1min12sec	Internal	Parallel to 18.	**1min12sec**
21.	colour pump insert	9sec	Internal	Internal	
TOTAL		**20mints**			**7min42sec**

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

After the SMED implementation in printing rotaries the setup time was calculated before and after SMED implementation. Table.1 represents the setup times and setup activities status before and after SMED implementation. Figure.4 shows Graphical representation of setup time before and after SMED.



7. CONCLUSION

Favorable outcomes have been achieved through SMED application in Yunus Textile Company. The SMED study helped in minimizing setup time by removing those activities which doesn't add any value. SMED has been implemented in printing rotaries. The setup time has been calculated of screen's changeover of the machine before and after implementing the SMED technique. After collection and analysis of data, it was observed that total down time of Rotary printing machine before applying SMED was 20 minutes for single screen changeover and after SMED time reduced to 12 minutes 18sec. The total time reduction achieved was 7 minutes 42sec, which means removed all non-value added items and also lowered overall manufacturing cost as well. That will help to be more responsive towards customer demands which leads to increases our production growth rate.

REFERENCES

1. Rodríguez-Méndez, R., et al., A case study: SMED & JIT methodologies to develop continuous flow of stamped parts into AC disconnect assembly line in Schneider Electric Tlaxcala Plant. 2015. **48**(3): p. 1399-1404.
2. Bajpai, J.D. SMED (single-minute exchange of die) methodology in garment manufacturing industry: Case study in reducing style change over time. in Proceedings of the 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014), Guwahati, India. 2014. Citeseer.
3. Rao, S., et al., Application of SMED in Rim Manufacturing Plant for Light Motor Vehicle. 2016. **2**(11).
4. Wani, M., R.J.I.R.J.o.E. Pant, and Technology, Implementation of Single Minute Exchange of Die in Motor Manufacturing Unit. 2017. **4**(11): p. 1300-1310.
5. Chowdhury, S., et al., Implementation of lean strategies in a furniture manufacturing factory. 2015.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online): 0493-2137
E-Publication: Online Open Access
Vol:55 Issue:07:2022
DOI10.17605/OSF.IO/3GRQX

12(1): p. 45-50.
6. Cakmakci, M.J.T.I.J.o.A.M.T., Process improvement: performance analysis of the setup time reduction-SMED in the automobile industry. 2009. **41**(1): p. 168-179.
7. Michels, B.T., Application of Shingo's Single Minute Exchange of Dies (SMED) methodology to reduce punch press changeover times at Krueger International. 2007.
8. Sayem, A., et al., Productivity enhancement through reduction of changeover time by implementing SMED technique–in furniture industry. 2014. **17**(1): p. 15-33.
9. Trovinger, S.C., R.E.J.P. Bohn, and o. management, Setup time reduction for electronics assembly: Combining simple (SMED) and IT-based methods. 2005. **14**(2): p. 205-217.