SETUP TIME REDUCTION OF SNAP FASTENER MACHINE BY IMPLEMENTING SINGLE MINUTE EXCHANGE OF DIE

This report is submitted in accordance with requirement of the University Teknikal Malaysia Melaka (UTeM) for Bachelor Degree of Manufacturing Engineering (Manufacturing Management) (Hons.)

by

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I hereby, declared this report entitled "Setup Time Reduction of Snap Fastener Machine by Implementing Single Minute Exchange of Die" is the result of my own research except as cited in references.

Signature : ……

Author's Name : NUR SYUHADA BINTI MAT ADAM

Date : 22 June 2017

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Manufacturing Management) (Hons).
The members of the supervisory committee are as follow:

…….....

(Dr. Effendi Bin Mohamad)

ABSTRAK

Masakini, kebanyakan syarikat, terutamanya dalam bidang pembuatan, sedang berusaha menghasilkan pelbagai produk dalam kos yang rendah dan masa penghantaran yang pendek. Ini boleh dilakukan dengan memastikan pertukaran pantas pada mesin supaya tindak balas fleksibiliti kepada permintaan tidak terjejas. Sebuah syarikat penghasilan barang untuk penjahitan pakaian di Melaka, Malaysia telah menerapkan *Single Minute Exchange of Die (SMED)* untuk menambah baik masa pertukaran mesin penghasilan logam yang kecil untuk mengetatkan pakaian. Ianya telah diberitahu bahawa isu adalah kekurangan pemikiran lean oleh pekerja, dimana telah menghasilkan pembaziran di dalam proses pertukaran dan masa pertukaran. Dengan menggunakan SMED, pertukaran semasa telah diteliti, aktiviti dalaman dan luaran telah diasingkan, aktiviti dalaman telah ditukar kepada aktiviti luaran, dan semua aktiviti pertukaran telah diselaraskan. Satu daripada aktiviti tersebut mempunyai potensi untuk dilakukan secara luaran, i.e. menyediakan mould / die yang baharu. Beberapa aktiviti di dalam proses pertukaran ini juga telah dihapuskan dengan menambah ramai pekerja dan memperbaiki hubung kait antara pengendali dan juruteknik yang bertanggungjawab untuk pertukaran. Aktiviti – aktiviti tersebut adalah penyediaan untuk pertukaran, membuang brass strip yang berlebihan dan lain-lain. Satu standard baru telah dibuat, yang bertujuan untuk menyamakan fungsi jenis blok dimana hanya boleh digunakan untuk satu jenis pemotong. Pemotong ini bertujuan untuk menyingkirkan keperluan membuat cutter yang baru daripada plate Alat lean yang lain juga telah dicadangkan. Satu pertukaran baru yang lebih mudah dan menjimatkan masa telah direka. Dengan proses tersebut, ia dapat dilihat dengan jumlah masa pertukaran yang diambil hanyalah 38 minit dibandingkan dengan 306 minit untuk pertukaran asal, (pengurangan 87 peratus). Kajian ini telah menunjukkan bahawa SMED masih lagi satu alat yang teguh dan berkesan yang boleh digunakan untuk mencapai pertukaran pantas yang mana sangat penting untuk syarikat.

ABSTRACT

Nowadays, majority of companies, especially in manufacturing industry, are bounded to produce variety of products at a low cost and shorter delivery time. This can be carried out by ensuring a rapid changeover of the machinery in such a way that the flexibility of response to demand stays unaffected. A needlework and sewing company in Melaka, Malaysia has adopted *Single Minute Exchange of Die (SMED*) to shorten the changeover time of its snap fastener machine. It was noted that the problem in the company was poor lean thinking by the workers, which resulted in waste in changeover process, and changeover time. By using SMED, current changeover process was observed, internal and external activities were separated, internal activities were converted into external activities, and all changeover activities were streamlined. One of the changeover activities had the potential to be performed externally, and i.e. preparation of new mould / die. Some of the changeover activities were cancelled out by adding more workers and enhancing the correlation between operator and technician in charge of changeover. These activities were preparation for the changeover, removing the brass strips from the machine, setting the position of the brass strip and preparation for next run. A new standard was developed and implemented, aiming at standardizing the block types which can only be used by one type of cutter. This cutter is intended to get rid of the need to make or design the new cutter from the plate when the cutter is worn-off. To enhance the effectiveness of the improvements, other lean tools were recommended, including andon. Andon was recommended to enhance the correlation between the workers and inform the technicians about the changeover. A new changeover process which is much easier and time saving was created. With the new process, it was observed that the total changeover time was 38 minutes compared to 306 minutes with the current changeover time, (87 percent reduction). This study showed that SMED remains one of the most simple and effective tool which can be used to attain a rapid changeover that is essential for this company.

DEDICATION

Only

my beloved father, Mat Adam Bin Mohd Saed

my appreciated mother, Meriam Binti Yusoff

my adored sister, Nur Baizura, Nur Afzan and Nur Ain

my lovely brother, Muhammad Hafize Firdaus, Muhammad Abdullah Hakim and Muhammad Syukri Hanafi

my little sister, Nur Syahirah

for giving me moral support, money, cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

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TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURES

LIST OF ABBREVIATIONS

SMED	-	Single Minute Exchange of Die
TPS	-	Toyota Production System
LM	-	Lean Manufacturing
JIT	-	Just-In-Time
WIP	-	Work-In-Process
VSM	-	Value Stream Mapping
NVA	-	Non Value Added
VA	-	Value Added
TPM	-	Total Productive Maintenance
CNC	-	Computer Numerical Control
OEE	-	Overall Equipment Effectiveness
SOP	-	Standard operation procedure

CHAPTER 1
INTRODUCTION

In this introductory chapter, the background of the study and company background will be set out as a important information for better understanding. Problems are identified through interview and observation. This is followed by the objectives to be achieved throughout the study and scope which narrows down the area of the study. The important findings of other researchers are also stated in the problem statement as a rationale behind this survey. Besides that, the motivation of study is focused in reducing the changeover time in the manufacturing in industry. Finally, the impact of the study to the company is also revealed.

1.1 Background of Study

Due to the increasing competitors and high potential market demand, most companies have difficulties to produce and deliver products on time (Katsanos et al., 2009). Changeover time is the amount of time needed for changes to occur from one product to the other, from last to first good piece. The occurrence of changes in the products could cause an increase in the production downtime. So, it is very important for company to evaluate the option and action to cope with that issue by implementing the changeover or setup time reduction. The changeover or setup time reduction would lead to increasing the productivity of the company. According to Azizi (2015), productivity performance also can be improved by reducing the production lead time and also production waste.

Lingayat et al. (2015) stated that nowadays, to achieve the higher demand from the customer, the industries produce the variety of products and they are bound to produce the same in low cost, shorter delivery time and without affect to quality. To respond to these demands, Eriksson (2007) outlined that industries need to increase the productivity and efficiency and this can be achieved through setup time and lead time reduction.

This study is conducted in a needlework and sewing industry in Melaka which is a multinational manufacturing company with worldwide operations. This study also evaluates the changeover process or setup operation and propose an effective solution that can reduce the production downtime and thus reduce the production cost of the industry.

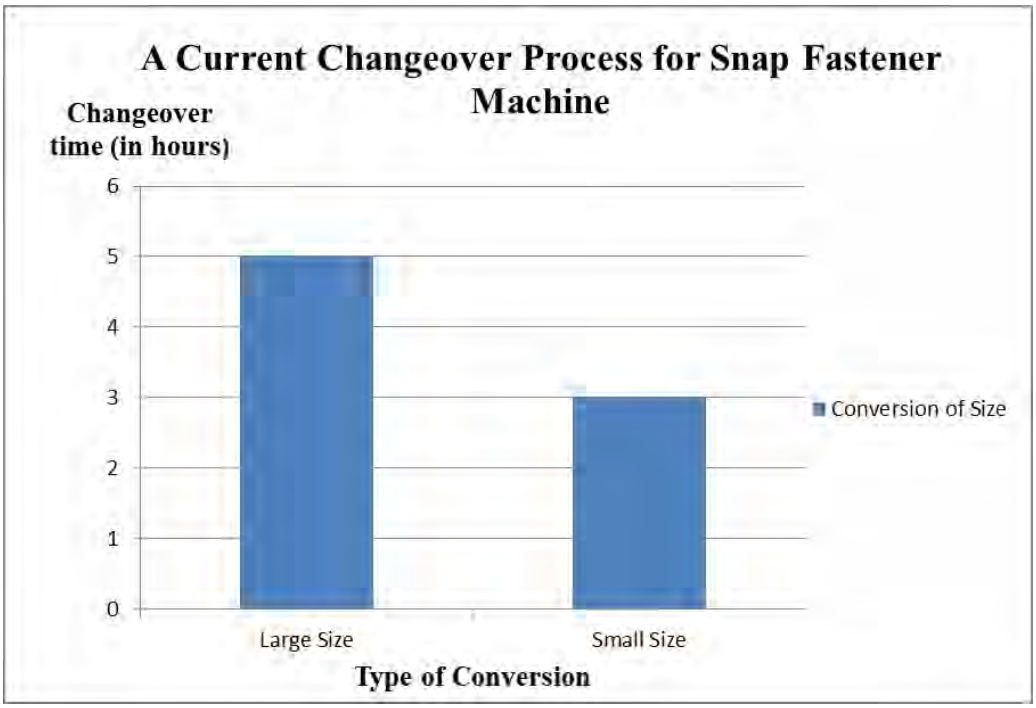
1.2 Problem Statement

This study was conducted in a needlework and sewing manufacturing industry in Melaka, Malaysia. In order to achieve the batch size reduction and the product variation demands, the snap fastener machine in this company as shown in Figure 1.1 have to undergo frequent changeovers and this machine need to shut down during the changeover.

Figure 1.1: Snap fastener machine

This machine is producing different types of snap fastener tape and each type uses different types of cutter. All Pre-Stamping and Stud machines have difficulties on loading the raw material to the machine. The changeover process for the snap fastener machine involves the conversion of different types of size which are large and small sizes. The current changeover for small size to large size takes about 4 – 5 hours and large size to small size takes about 3 – 4 hours and time for each conversions are shown in Figure 1.2.

Figure 1.2: A current changeover process for snap fastener machine



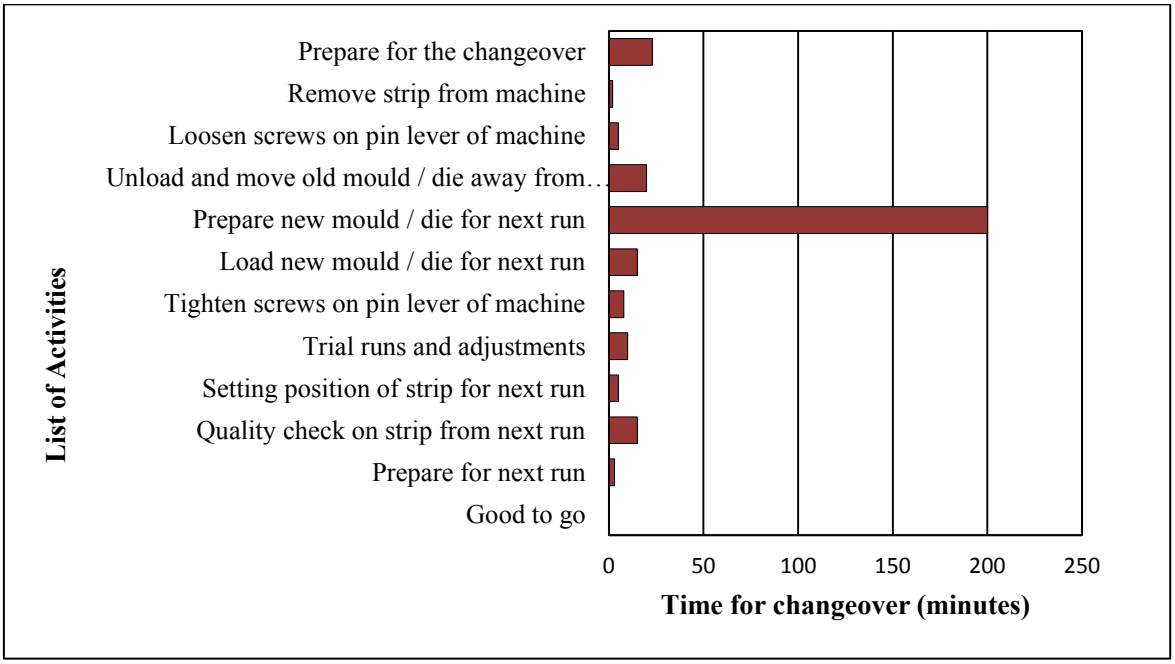
Besides that, the time for each activities are shown in Figure 1.3. The changeover time for this machine is long and more time will be wasted in the changeover procedure because the snap fastener machine usually need to undergo changeover at least 2 – 3 times per week. This problem will reduce the utilization of snap fastener machine and reducing the productivity of this industry. From the Figure 1.3 below, the activity whist is most time-consuming is preparing the new die for next run which is 200 minutes in this changeover process.

Current changeover operation/process did not have proper Standard Operating Procedures (SOPs) and any record of changeover time for changeover process of snap fastener machine. Changing heavy dies on a snap fastener machine, designing the

cutter from plate, setting on the snap fastener machine and mold and die repair were not adopted in current operation/process.

Machines such as large pressses machine frequently require processes at both the front of the machine and rear of the machine. In this case, for snap fastener machine require three operations which are the front of the machine, the die or mold set and the back of the machine. Furthermore, only one operator will involve for this setup operations. One worker that do the changeover process of the snap fastener machine means wasted time and movement. It is because the same worker is continuously doing the changeover process by walking back and forth from one end of the snap fastener machine to the other.

Figure 1.3: A current changeover chart for snap fastener machine



For the current changeover of the snap fastener machine, all the activities are performed internally, which means that can only be done when the machine is shut down. Last but not least, the snap fastener machine need to undergo frequent changeovers because of its cutter is always worn off and need to be replaced (Figure 1.4).

Figure 1.4: A cutter of snap fastener machine

In order to fulfill demand from customers and to reduce the setup time, the main approach that has been used for this study is Single Minute Exchange of Die (SMED). According to Shingo, S. (1985), Single Minute Exchange of Die (SMED) is a scientific technique for changeover time reduction that can be implemented in any company and to any machine. The changeover processes and machine setup can be reduced to less than ten minutes. Besides, by making setup times quicker and simpler, SMED help companies meet the customer demands with less waste by making it cost – effective to produce products in smaller batches, or lots. Moxham and Greatbanks (2001) stated that the usage in SMED allowing industries to understand where they currently stand in setting up a process.

1.3 Objectives of Study

The objectives of this study are as follows:

a) To study the existing changeover process of snap fastener machine.
b) To propose the new standard procedures by simplifying the steps in the existing changeover process.
c) To implement the new standard procedures in the changeover process for snap fastener machine.

1.4 Scopes of Study

This study aims to reduce changeover time on the snap fastener machine by implementing Single Minute Exchange of Dies (SMED). This study focuses at Line A. It involves only one Snap Fastener machine. This machine produces different types of snap fastener tape to suit all possible demand of customers in the snap fastening application. Due to the time constraint that could not be avoided, and thus to the large amount of different changeover operations, it is important to focus on one machine only. SMED is expected reduce complex, time-consuming, and non value added activities in this company, which should support the competitiveness of the company and make the work easier. The quality and the performance improvement is not considered in the scope of this study.

1.5 Project Summary

To get the better understanding, this report has been written according to the arrangement of the chapter which have been decided by the researcher. This report is classified into five main chapters, which is each of the chapters contain the different explanation.

Chapter 1: Introduction

This chapter states about the background of the study, the problem statement, the objectives and the scope of this study which plays as the main to the whole research.

Chapter 2: Literature Review

This chapter covers on the previous research and findings about the topics that related to the study through the research of all published work types.

Chapter 3: Methodology

It explains the method that have been chosen and used by the researcher to complete this study. It contains of fundamental approach and techniques that to be taken to achieve the objectives of the study.

Chapter 4: Result and Discussion

This chapter shows the results and the discussion of the study. Data was obtained from the method that have been used for this study followed by the discussions related to the results.

Chapter 5: Conclusion and Recommendation

This chapter describes the summary on this project findings and research. It concludes the improvements and recommendations of this study based on the results and discussions obtained from all previous chapters

CHAPTER 2
LITERATURE REVIEW

This chapter covers the research topic and the previous studies from articles and internet sources by other researchers. This study is about Single Minute Exchange of Die (SMED) implementation in order to cut the changeover time. The purposes of this chapter is to understand about the changeover operations from the earlier researchers that can be used as the reference. Besides, the basic methods in the changeover procedure, the changeover procedure for analyzing the current setup operation and the three stages of SMED are also comprised. Lastly, the concepts, methods and tools for implementing the each stage of SMED are described.

2.1 Concept of Waste in Changeover of Machine

Andreia and Alexandra (2010) stated that changing of products processes, replacement or modifying of the tools, are called as setup or changeover processes. From that, the waste has been considered in the productive system during the performance of changeover processes, since there is production cost and time used are added to the finished goods without direct creation of value. Ohno (1998) described the waste concept as non value added activity and concludes seven wastes which are overproduction, defects, over-processing, inventory, waiting, motion and transportation.

When the setup or changeover operations occur, the setup times will become too high and it becomes necessary for company to produce the larger size lots. Thus, the company will make the stock, which can increase the production costs. So the time spent in

setups is considered as a waste and it should be minimized or if possible, eliminated. (Shingo, 1998)

Waste must be minimized or eliminated as much as possible in order to reduce the changeover time. Waste of changeover is usually found in motion such as; searching, selecting, arranging a tool and transporting the tool and dies to the machine. According to Arai and Sekine (1992), wastes of setup that always discovered are:

Table 2.1: Wastes of setup

No.	Wastes of Setup
1.	Waste in searching for, finding, lining up, and transporting the seven changeover tools
2.	Standby waste related to materials, especially missing items
3.	Searching waste related to bolts, nuts, and washers for attaching dies
4.	Searching for carts and waiting for an available crane
5.	Searching for dies
6.	Finding chutes and searching for their bolts
7.	Searching for block gauges, inspection tools, and clean rags
8.	Checking the technical drawing or manufacturing specifications
9.	Checking personal notes on gauges' values
10.	Searching for pallets, product containers, and conveyor

2.1.1 Waste elimination

Bicheno (2000) showed in an empirical study that there are two kinds of wastes in any manufacturing industry which are material waste and time waste. It is important to reduce all the types of wastes in order to increase the profit. In order to get the ambitious benefit, it is crucial to achieve the shorter setup time and possible through the waste of time reduction or non value added activities elimination.

According to Varghese and T. (2015), the steps explanation such as value added and non-value added is the one of the key things in TPS and Lean. All the process tasks must be divided into these two categories to eliminate the waste. It is then possible to start actions for eliminating the non-value adding activities and enhancing the value adding ones.