PROPOSING A SINGLE MINUTE EXCHANGE OF DIES IN TEXTILE MANUFACTURING INDUSTRY

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

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisory is as follow:

……

(PROFESOR MADYA DR MOHD RIZAL BIN SALLEH)

ABSTRACT

Prym Industry is a textile manufacturing industry at Tanjung Keling, Melaka that manufactured and supply their products such as pins in domestic and also international marketing. One of the important departments in this company is the packaging department where it packaged all their products there. This study is about proposing Single Minute Exchange of Dies (SMED) at the packaging department. It focused on reducing the time taken for the changeover of the packaging machine in order to improve the productivity of the machine. The objectives of this study are to observe the base change process of the packaging machine, differentiate the internal and external activities of current base change procedure and propose a plan for SMED implementation. Observation of the current changeover was by videotaping the whole process involved. Some of the data also obtained by interviewing the operators and technician involved in this machine changeover process. All activities have been classified into internal and external activities. Then SMED methodology had been used to convert as much as possible internal into external activities and streamline all the activities involved. Other lean tools and technique also have been used including 5S and andon to support model change process. From all the data taken, a new changeover procedure had been proposed to the company. As the result of this study, the total time taken for the new changeover that had been reduced to 11.6 minutes compared to the current changeover which was 36 minutes. For the conclusion, SMED methodology is an effective tool in reducing the changeover of the packaging machine.

ABSTRAK

Prym Industry ialah sebuah industri pembuatan tekstil yang terletak di Tanjung Keling, Melaka yang membuat dan membekalkan produk-produk mereka seperti pin di pasaran domestic dan juga antarabangsa. Salah satu jabatan yang penting di dalam syarikat ini adalah jabatan pembungkusan dimana ia membungkus semua produk mereka disana. Kajian ini adalah untuk mencadangkan *Single Minute Exchange of Dies* (SMED) di Jabatan Pembungkusan. Ia menumpukan kepada pengurangan masa yang diambil untuk mesin pembungkusan itu mengalami proses pertukaran tapak bertujuan untuk meningkatkan produktiviti mesin tersebut. Objektif-objektif kajian ini adalah untuk memerhatikan proses pertukaran tapak mesin pembungkusan, membezakan antara aktiviti dalaman dan luaran pertukaran tapak dalam prosedur semasa dan akhir sekali mencadangkan satu plan untuk pelaksanaan SMED. Pemerhatian pertukaran semasa adalah dengan mengambil video proses pertukaran tersebut. Sebahagian daripada data juga diperoleh daripada temubual operator dan juruteknik yang terlibat dalam proses pertukaran. Semua aktiviti telah diklasifikasikan kepada dalaman dan juga luaran. Kemudian metodologi SMED digunakan untuk menukarkan seberapa banyak aktiviti dalaman kepada aktiviti luaran dan kesemua aktiviti tersebut diselaraskan. Beberapa teknik pembuatan *lean* telah digunakan seperti 5S dan Andon untuk menyokong proses pertukaran model. Daripada data yang telah diperoleh, prosedur pertukaran baru telah dicadangkan kepada syarikat. Keputusannya, jumlah masa untuk prosedur pertukaran baru adalah 11.6 minit dibandingkan dengan prosedur semasa yang mengambil masa selama 36 minit. Konklusinya, metodologi SMED merupakan alat yang sangat efektif untuk mengurangkan masa pertukaran mesin pembungkusan tersebut.

DEDICATION

Dedication to my beloved parents, family and everyone that involved in this project.

Thank you for the support and encouragement.

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LIST OF ABBREVIATIONS

JIT- Just In Time

SMED- Single Minute Exchange of Dies

TPM- Total Productive Maintenance

TPS- Toyota Production System

WIP- Work in Process

CHAPTER 1

INTRODUCTION

This chapter is discussing the background of study, problem statement, objectives and scopes of the project. In general, study is focusing on reducing changeover time in textile industry.

1.1 Background of Study

In lean manufacturing, the activities involved in the production stream can be grouped into two category that are value adding and non-value adding. Value means the satisfaction of client requirements. The value adding activity is a activity that change material or information into something that required by customers; Non value-adding activity also called waste is a activity that requires some investment, assets or space yet does not include to the customer requirements.

Non value-adding can be categorized into contributory activities and ineffective activities. Contributory activities are non-value added activities that indirectly required in fulfilling customers' needs. On the other hand, unproductive activities is an activities that is not necessary, and this could be wiped out from the production stream without lessen the estimation of the work.

This non value-adding or waste is one of the biggest problems that happen in industries that can affect the productivity of an organization. By reducing waste, it can maximize the productivity performance. One of the activities that can be called as waste that usually happen in manufacturing industry is changeover of a machine. Many industries have to perform changeover onto their machines in order to fulfil the variability of customer demands. This could affect the productivity of that company because too many times are wasting during these changeover activities. That is why implementation of Single Minutes Exchange Dies (SMED) in industry is important in order to reduce time during this changeover.

SMED is one of the tools in lean manufacturing that helps to facilitate model change process in the most effective way and the most important is in the shortest possible time. SMED is an approach where all the activities or changeovers involve must be completed in a single number of minutes (less than 10).

1.2 Problem Statement

Prym industry has running a business of textile manufacturing and has many customers around the world. In order to living up to the expectation of their user, quality of their product is very important but delivering the product in time also play a big role in keeping their customers trust. The problem that could lead to the delaying of the delivery of the product is the changeover of packaging machine. This machine is used to pack different models of pin and each model used different types of base and receiver. Currently, the time taken for the changeover of this machine is 2165 seconds. Even though the time is not too long, but in order to fulfill the customer demand the changeover must be done frequently. This may lead in reducing the machine utilization and also will decrease the productivity of this company.

1.3 Objectives of the Study

The objectives of this study are as follows:

a) To observe the base change process of the packaging machine.
b) To differentiate the internal and external activities of current base change procedure.
c) To propose a plan for SMED implementation.

1.4 Scopes of the Study

The scopes of study are as follows:

i. This study focuses on a packaging machine which is operating at Prym Industries at Tanjung Keling, Melaka;
ii. This study is about to reduce dies setup time on the machine by implementing Single Minutes Exchange Dies (SMED);
iii. This study is based on a field experiment whereby a site observation is carried out to identify task require in exchanging base and receiver during model change;

CHAPTER 2

LITERATURE RIVIEW

2.1 Overview

This chapter is about the review of study from the previous research by other researchers. This study is about the implementation of SMED in order to reduce the changeover time while increasing the productivity. The objective of this chapter is to understand more about the previous study that related to this topic. It can be used to support this study in order to come out with the best solution. The sources of literature are taken from journals and books that related to this study.

2.2 Lean Manufacturing

Lean means creating more value for customers with fewer resources. Until now, lean has many definitions and according to Alukal and Manos (2006) lean is a systematic way in identifying and eliminating waste (non-value added activities) using the continuous improvement by flowing the product at the pull of the customer in inquiry of perfection.

A manufacturing will be lean when it uses less material, less investment, fewer inventories, less space and less people. An example of the best system that has shown

great success in implementing lean and one of the best lean systems around which is the best documented system is the Toyota Production System (TPS). According to Wilson (2010), TPS is a system that has a target on quality control to minimize cost by eliminating waste. It is built on a strong foundation of process and product quality and fully integrated. TPS is constantly expanding and is maintaining by a strong healthy culture that is managed consciously, continuously and consistently. Lean contain many techniques that contribute to the cost reduction by minimizing and eliminating of waste. Just in Time (JIT) and Jidoka had been used to minimize and eliminate waste.

JIT is a philosophy of operation that seeks to apply all resources in the most efficient manner by eliminates anything that does not add value to the customer as stated by White (2000). Resources included in this philosophy are not only limited to equipments, facilities, inventories, time and human. According to Cheng and Podolsky (1996), JIT contains of three main manufacturing objectives which are universal and homogenous in nature as follows:

i. Increase the organization ability in order to fight with another firms and remain ambitious over long period;
ii. Increase the efficiency in the production process;
iii. Reduce the total of materials, time and effort that have been wasted occurred in the production process

JIT focuses on reducing the waste in order to make the production process feature a continuous flow type of process which can operate very efficiently from raw material until finished product based on the objectives above.

According to Stevenson and Chuong (2010), there are seven aspects in process design that important for JIT system:

i. Small lot sizes
ii. Setup time reduction
iii. Manufacturing cells
iv. Quality improvement

v. Production flexibility
vi. A balanced system
vii. Little inventory storage
viii. Fail-safe methods

The other technique that has been used in Toyota Production System (TPS) is Jidoka. Jidoka is the principle of the work or process is stopped immediately if any problem occurs in order to prevent the production from making defective products as stated by Toyota Motor Corporation (1998). In TPS, Jidoka had been implemented by designing the equipment that can detect the abnormalities then automatically stop whenever the abnormalities detected. Train the operators to stop the production whenever the operator notices the abnormalities from the process is also one of the way used in TPS. This is known as mechanical and human Jidoka.

2.2.1 Seven Waste of Lean Manufacturing

The most important thing in lean thinking is to know what value mean and the activities and resources needed to construct and contribute to the value adding process. After the value has been fully understood, everything that not included in the value is considered waste. TPS has stated that there are seven type of waste in industry which is overproduction, waiting, transportation, over-processing, inventory, motion and defect but according to Gehin et al. (2008); Millet et al. (2007); Robert (2000) in Vinodth et al. (2010), utilization of creativity of employee and environmental waste are known as eighth and ninth waste respectively, which signify the resources that has been used with excessive also dangerous substances released to unsuitable places that could cause harm to human and environment.

Table 2.1 Types of manufacturing waste

(Source : Alukal and Manos ,2006)

WASTE	DESCRIPTION	EXAMPLE
Overproduction	Occurs when operation continues even they should stop. This can cause: • Production of product more than required • Product being made to early • Cost from excessive inventory	1. Production above target 2. Excessive lead time 3. Delivery to early
Waiting	• Materials or components are seen to be not moving • The periods of inactivity in a downstream process that occurs because an upstream activity does not deliver in time	1. Waiting for operation 2. Operators slower than production line 3. Late delivery 4. Machine breakdown
Transportation	• Transport any information, parts or material around the facility • Movement of material such as work-in-process (WIP) being transferred • Transportation of finished product to the customer	1. Conveyors 2. Material handling 3. External transportation
Over-processing	• Extra process such as rework, reprocessing, handling or storage that happen because of defects, overproduction or excess inventory • Process that add no value to the customer requirement	1. Variation between operators 2. Variation from standard